Comprehensive Healthcare Simulation

Series Editors: Adam I. Levine · Samuel DeMaria Jr.

Patricia K. Carstens · Paul Paulman
Audrey Paulman · Marissa J. Stanton
Brian M. Monaghan
Douglas Dekker *Editors*

Comprehensive Healthcare Simulation: Mobile Medical Simulation

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Preface

Medical science is advancing at an ever accelerating pace. New knowledge, new medications, and new diagnostic and therapeutic procedures become available to healthcare practitioners on almost a daily basis. Because of a traditional long timeframe between new medical discoveries and the application of those discoveries to patient care, both federal and state governments and industry have programs in place to reduce the "bench-to-bedside" time lag in order to bring new knowledge, products, and procedures to direct patient care faster. These programs will increase the amount of new information and procedures available for patient care and will speed up the pace of these new materials coming to the market.

The United States faces shortages of doctors, mid-level providers, nurses, pharmacists, healthcare technicians, and other healthcare personnel. This shortage is most acute in rural and frontier areas of the United States. In several states with large rural areas, large segments of those states have been designated as health provider shortage areas. These shortages are predicted to persist and worsen over the next several years [1].

These trends have created a unique set of problems for healthcare practitioners in rural and frontier areas. For instance, in many rural and frontier areas, Emergency Medical Services (EMS) providers may be the first and only medically trained personnel available to patients for many miles and minutes. In several states, trial programs involving EMS providers performing tasks such as home visits, to monitor the status of homebound patients with severe chronic illnesses, and medication availability and compliance checks for select patient populations have shown beneficial outcomes for patients [2]. These tasks are performed in addition to the traditional stabilization and transfer duties of EMS providers. Because of the ongoing healthcare personnel shortage, programs which expand the scope of practice of available medical personnel, especially in rural and frontier areas of the United States, in order to help minimize the impact of the healthcare personnel shortage will likely increase.

In addition to maintaining their knowledge, skills, and proficiencies associated with their traditional tasks, healthcare personnel practicing in shortage areas will be asked to obtain new knowledge and master new skills. Travel to distant sites to attend continuing educational events can remove scarce key personnel from practice sites where their skills are needed to help manage medical problems and emergencies. In addition, since virtually all healthcare is delivered by a team, often in a unique clinical context, team training in the team's environment, managing simulated frequently encountered (or less frequent but critical) medical conditions, is recognized as optimal training. Several studies have shown that training a team as a unit in their operating environment (or a high-fidelity facsimile venue) improves the performance of that team [3]. Because patients have to transition between various venues to achieve care (e.g., home to ambulance to emergency department to hospital room), and since medical transitions are associated with high levels of patient morbidity and mortality, it is essential to train medical teams to work through communications and other issues associated with a patient transition [4].

For these and other reasons, mobile medical simulation programs using state-of-the art, high-fidelity mannequins and other equipment have been developed. These programs allow the use of high technology simulation training equipment and techniques for team training in the providers' operating environment and minimize the need for members of the team to travel to distant sites for continuing education and training. These mobile simulation programs vary in scope and complexity from "mailing" a mannequin or another piece of simulation training equipment to a training site to fully equipped mobile simulation facilities complete with simulation mannequins, simulated healthcare venues, recording facilities for debriefing and performance review, and supporting technical staff to provide training and operate equipment [5].

In order to foster the growth, development, and effective use of mobile medical simulation training, the production team of this book hopes to provide concise and useful information both to those involved in designing mobile simulation programs and processes and to those who design, conduct, and assess the effectiveness of training sessions for providers who care for patients. The team has recruited authors with real-world experience in all areas of mobile healthcare simulation training, and it is our sincere hope that the information provided in this book will be useful for administrators and educators as they provide mobile medical simulation training.

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Part I

Mobile Simulation Program Development

Staff and Equipment

1

Benjamin King

"Simulation is a social experience"
Dr. Zach Sturges, Simulation Medical Director, Best Practice Medicine

Key Points

1. Mobile simulation teams must be highly knowledgeable in a broad range of technical, pedagogical, and clinical theory, methods, models, and applications.
2. Recognize that mobile simulation environments are considerably different than brick and mortar operations.
3. Intentional recruiting, training, retaining, and succession planning will lead to program success and sustainability.
4. No amount of technology, money, or resources can compensate for the wrong humans beings in simulation.

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Definition of Terms

- High Fidelity Simulation (HFS): the use of lifelike realism capable simulators to create immersive learning environments for clinical education.
- Mobile simulation: simulation conducted in a transient environment, not in a fixed location. This can be either in a mobile lab (truck, bus, van, etc.) or in situ, within a facility or clinical care setting (emergency department, ambulance, and critical access hospital).
- Simulationists: clinical, pedagogical, and technical experts in simulation.
- Static simulations: simulations that occur in a brick and mortar operation and rarely, if ever, are performed outside an established simulation education space.
- Pedagogy: derived from the Greek word, paidagogos. (meaning “teaching”) [1].
- Mobile lab:: a catchall description of a physical space that can be moved for the purposes of simulation. Often, these labs are described by the type of vehicle, such as a bus, van, truck, or trailer. We recommend using the terminology mobile lab or mobile learning lab, as it describes the purpose of the vehicle rather than the vehicle itself.
- Simulation team leaders (STLs): specialized simulationists with expertise in simulation education and operations.
- Simulation in Motion Montana (SIM-MT), Inc.: a Montana-based, volunteer led, nonprofit organization (www.mobilesimmontana.org).
- Best Practice Medicine LLC (BPM): a clinician-owned and founded medical education company based in Montana. BPM is the project partner of SIM-MT, responsible for the daily operations of SIM-MT (www.bestpracticemedicine.com).

Find Your Humans

Simulation is fundamentally a social experience. The greatest asset of any simulation program is its people. This is especially true for mobile simulation, which is inherently more challenging than static simulation centers. To be successful, mobile simulation leaders must focus on four human objectives while building, leading, or growing a team:

1. Recruiting
2. Team training
3. Retention
4. Succession planning

Recruiting

As with establishing clinical objectives, the first practical step in recruiting mobile simulationists is an internal needs and gap assessment. Leaders must align the recruiting objectives with mission, vision, and purpose of the mobile simulation program. For example, a new mobile program focused on providing training for rural nursing education with in situ simulations will likely have different staffing needs than one whose mission is to serve urban hospital systems using a mobile learning lab (truck, van, bus). It is essential that simulation leadership have a clear understanding of expectations and mutually agreed-upon measures of programmatic success.

The good news is, as an emerging subspecialty of medicine, simulation tends to attract early adopters who are often highly motivated and lifelong learners. The bad news is that mobile simulation requires such a broad, multidimensional scope of knowledge and skill set, it may feel as if you are searching for a unicorn. This is a major difference between static simulation and mobile simulation. Typically, brick and mortar simulation centers enjoy a larger budget, staff, and more controlled and predictable learning environments. This leads to a greater degree of skill, knowledge segregation, and specialization. As a profession, these larger static centers and their staffing models dominate simulation theory and practice. The Society for Simulation in Healthcare (SSH) [2] certification and accreditation committees reflect this in the certifications of Certified Healthcare Simulation Educators (CHSE) and Certified Healthcare Simulation Operations Specialists (CHOS) [3]. Mobile simulation operations rarely have the budget, space, or capability of narrowly defined roles for simulationists. Recruiting efforts must focus on people capable of more than a specific task. Mobile simulationists need to be excellent educators (CHSE) and exceptional operators (CHOS).

It is helpful to consider your recruitment efforts through the lenses of small team dynamics. Within SIM-MT, after conducting our needs and gap assessments, and extensive evaluation of the programs mission, vision, and purpose, we chose to consider our mobile simulation teams as air ambulance clinical teams. We found a number of useful parallels from our experience in air medical transport and mobile simulation. Based on the leadership's relevant experience, mobile simulation programs should consider past high-performing professional teams and adapt the behaviors and characteristics that led to their program success into the recruiting of the mobile team.

Mobile simulation programs should establish two sets of criteria for simulationists before beginning recruitment efforts. The first criterion sets the ideal qualifications for the mobile simulation program (Table 1.1). The second criterion establishes the minimum qualifications acceptable for candidates (Table 1.2). The minimum criteria are directly correlated to the training and education available to new members of a mobile simulation team. The greater and more robust the onboarding and initial training program, the lower the initial requirements may be. In addition, leaders should be willing to consider exceptions to the minimum requirements in the initial growth of a mobile program. In our experience, we found occasionally our minimum requirements eliminated excellent candidates that displayed unusual aptitude and motivation to grow.

Table 1.1 The simulation unicorn: "ideal" core background, traits, behaviors, and characteristics

15 years of clinical experience relevant to the mobile simulation mission
In at least two different subspecialties of medicine
10 years of clinical multidiscipline education experience
5 years as peer trainer, field training officer, nurse educator, etc.
Specific training and mentorship in adult pedagogy
Committed to technical hobbies/interests outside of medicine
Welding
Music, song writing
Photography
Cooking
Travel
Gaming
Etc.
Previous career(s) outside of medicine
Examples of high flexibility, exceptional critical thinking, and leadership experience
Stellar professional and personal reputation and well connected in the existing clinical and education community
Experience with complex technology
Implementation of electronic health record systems
Data management responsibilities
Quality assurance/peer review responsibilities

Table 1.2 The simulation unicorn: "minimum" core background, traits, behaviors, and characteristics

5 years clinical experience relevant to the mobile simulation mission
2 years education experience
Demonstrated technical aptitude
Willingness to take a risk
Recent examples of new learning. Are they coachable and trainable?
Above average maturity and interpersonal skills

Lessons Learned

The classic paradigm "those who can't do, teach" regrettably has some merit. As a general rule, the humans you are looking for are overemployed and highly sought after. Beware of the applicant who is not currently employed in medicine or whose primary motivation appears to be a departure from a current position. Mobile simulation programs get to make a first impression once. If you hire a candidate with a poor reputation as a clinician or educator, the entire program will assume that reputation in the eyes of regional learners. This can be catastrophic.

In recruiting a team, well-developed job descriptions are an important first step for screening the best candidates and set clear expectations for potential staff (Table 1.3). Descriptions need to reflect program priorities and a loose description of qualifications. This is especially true in new mobile simulation programs. Internally, a program needs a minimum requirements list, but as mentioned leaders must exercise their best judgment for candidates that may not quite meet the entry requirements but may be an exceptional fit in other areas on the team.

Table 1.3 Example job descriptions for Simulation Team Leader (STL)

Job description	
Position:	STL, Best Practice Medicine
Classification:	Full-time
Reports to:	Operations Director
Locations:	Bozeman, Kalispell, Missoula, Havre, Glasgow
Duties and responsibilities:	
Under supervision of the Operations Director, STL is generally responsible to the program leadership for the day-to-day operation of the MobileSim vehicle, individual simulation events/sessions, and the assigned simulation specialists. The general duties and responsibilities of the STL include:	
Administrative duties	
Immediate supervision and direction of the simulation specialists to include simulation staff scheduling and coordination, administering probation and annual formal evaluations, and maintaining program policies and standards in accordance with the SIM-MT policies and procedures.	
Regularly evaluate simulation specialists in vehicle operations, simulation system operations, and teaching performance and provide constructive feedback to improve the simulation specialist's knowledge and performance.	
Develop and maintain relationships with regional clients and serve as primary point of contact for regional client's simulation program communications.	
Meet with clients to develop client needs assessment and individual simulation event objectives.	
Implement regional program marketing campaigns and conduct individual regional marketing events as directed.	
Participate in professional and educational activities to maintain professional competencies and current knowledge base.	
Other duties as assigned.	
Support duties	
Oversee and perform vehicle, systems, and equipment setup, breakdown, and storage.	
Oversee and perform routine vehicle maintenance activities	
Oversee and perform maintenance and cleaning of manikin, systems, and hardware.	
Troubleshoot and report system and manikin malfunctions, damage, and errors.	
Participate in simulation program and curriculum development activities.	
Obtain Class B CDL and function as the primary sim truck driver.	
Other support duties as assigned.	
Education duties	
Schedule, attend, and conduct simulation events/sessions to meet client objectives.	
Supports learners to maintain a safe learning environment.	
Provide student, client, and system verbal and formal debriefing/feedback as required by program policies.	
Provide and implement solutions to enhance the delivery of simulation-based education through technological developments and creation of artifacts, such as moulage.	
Assist with the piloting and delivery of simulation-based training and other educational activities undertaken during the simulation project, commissioning, and operational phases.	
Other education duties as assigned.	
Preferred qualifications	
5–10 years clinical practice experience	
2–5 years clinical educational experience	
3–5 years leadership experience	

(continued)

Table 1.3 (continued)

Job description
Multidiscipline instructor ratings
Prehospital and hospital-based experience
Experience with Google-based technology
Strong technical knowledge and experience within project management

Lessons Learned

SIM-MT periodically receives applications for positions on the simulation teams from underqualified candidates. In our experience, candidates who understand the desired minimum requirements and who, despite not meeting the requirements, apply anyway demonstrate a self-starter attitude that can be an excellent fit for the team. This is not always the case, but we give these applicants serious consideration.

Your mobile simulation program's reputation and success is directly linked to the credibility and authenticity of your least experienced team member.

Where Are Your Humans?

With the recruiting parameters established, the search for the mobile team begins. Where do you look for these highly specialized people? It is helpful to consider that the candidates you are recruiting are likely not actively looking for a new job and are typically overemployed. That is, they are working multiple jobs and/or have substantial "other duties as assigned" by their primary employer. These are the people you are recruiting. Using the criteria list developed for recruiting requirements, simulation leaders should consider where the specific candidates will be reached with the recruiting information. By customizing this, programs will have a higher rate of qualified applications and reduce the time required to evaluate those that are not a good fit for the program. For SIM-MT criteria, we successfully advertised in the following ways:

- Professional networks/organizations
  - EMS and nursing associations
  - State listservers – DPHHS
  - State hospital associations
- Social networks of colleagues and professional contacts
- Word of mouth
- Social media, specifically Facebook
- Website standard application form
- Stakeholders in mobile simulation

Lessons Learned:

High-performing clinicians and educators are a sought-after asset for nearly every facet of healthcare. To successfully recruit them to your mobile simulation, leaders need a compelling story as to why mobile simulation is the place for your candidate to continue *their career. We found that nurses with 15–20 years of clinical practice and paramedics with 10–15 years of clinical practice were the most likely to be interested in a nonpatient career path that will allow them to continue their passion for patient care on a large scale.*

Interviewing

If an applicant cannot connect to your Wi-Fi, don't bother.

The art of interviewing is well researched and documented. Leaders not trained or those unfamiliar with best practices in interviewing will do well to become familiar with any number of resources available on this topic. The specifics of interviewing candidates for mobile simulation are similar to the principals of recruitment. The primary objective of the interview is to assess the candidate's alignment and potential to meet the mobile programs specific mission, vision, and purpose. In addition, the small team dynamics of mobile simulation combined with the broad scope of knowledge required for interviewing teams should deeply consider the personality and fit of every candidate with current team members. Building a mobile simulation team is similar to building a championship sports team. Leaders need to consider not just the individual strengths and weaknesses, but how well each member of the team will complement the roster and contribute to the overall success of the program.

Best Practice Medicine conducts interviews in two phases. The first phase is a phone interview with a single, senior member of our leadership team. We recommend this member be directly connected to the performance of the mobile team and intimately familiar with the recruiting goals. The purpose of the phone interview is to act as a gate keeper, to quickly identify unqualified candidates or invite the applicant to an in-person team interview.

The value of an in-person interview cannot be overestimated. This is especially true in programs where mobile simulation staff may be working remotely or live many hours away. The composition of the interview team is an important consideration for leaders. While many resources also exist on this subject, practically, the interview team should have a clear understanding of the kind of candidate the program wishes to recruit and include a standardized set of questions, basic training on interview techniques, and the ability to deviate from the questions as necessary to understand the candidate as completely as possible. A potential peer of the candidate should participate in interviews. By empowering your small mobile teams to influence the hiring of their colleagues, your team is playing an active role in the creation of the team culture, which is the building block of all team dynamics and behaviors.

Requiring candidates to teach a short topic to the interview team is a powerful tool to assess a future educator. Much like simulation, the process of presenting information in a brief small group setting can often expose truths about a person otherwise well concealed. When evaluating a presentation, contemplate on the following:

General:

- How nervous are they?
- How prepared is the content?
- Did you learn something?

Warning signs:

- I, me, mine statements in teaching
- War stories
- Ego

Positive signs:

- Verbal assessment of the learners (interviewers)
- Content that reflects the stated objectives (defined in the phone interview)
- Humility and self-reflection
- Confident, calm, and cheerful
- Humor
- Curiosity and inquiry

Lastly, it is important to remember that applicants are interviewing the program and the team just as they are being interviewed. Be prepared for tough questions and insist that the interview teams share a consistent, positive vision for the project and the candidates' potential role in it. Avoid scaring good candidates off with poorly developed plans for the overall project.

Lessons Learned: Competitive Pay

Because your candidates are likely overemployed, competing with their current pay can be a challenge. It's best to consider the entirety of benefits of working for a mobile simulation team when making an offer. It is highly unlikely that what you can pay a simulationist will be competitive with clinical pay, especially when considering differentials (i.e., night shifts). It is more accurate to assess the compensation of other high-performing education professions in the programs regions. Universities and technical schools are good market rate benchmarks. A flexible schedule, defined autonomy, meaningful work, and paid time off are all force multipliers for attracting the right staff.

Recruiting the right people to your mobile simulation team is a key factor in the success of your program. It is also directly linked with other important factors of successful mobile simulation programs such as a clear mission, an inspiring vision, and an achievable purpose. The most advanced simulation systems in the world will never be able to compensate for a poorly recruited team.

Lessons Learned: Full-Time or Part-Time Mobile Simulation Teams?

Many factors must be considered in the decision to hire a few full-time mobile simulationists or a larger cohort of part-time people. The practice of simulation requires regular commitment. This can be achieved in specific circumstances with part-time staff, but the *logistics challenges alone can be substantial. Part-time staff work best in the mobile simulation environment when regularly engaged in mobile simulation and when partnered with full-time simulationists.*

Train Your Team

Train your team well enough so they can leave.
Treat them well enough so they want to stay.
Sir Richard Branson

Currently, there are not any known formal mobile simulation-specific trainings or certifications. A small portion of the modestly growing HFS subspecialty of medicine, mobile simulation training is highly program specific with few guidelines for reference. Best practices in simulation pedagogy, theory, and application are well established. They may however need to be significantly modified to fit the specific operational parameters of a mobile program. Chances are very high that new team members to your organization will simultaneously be new to high-fidelity and mobile simulations. Initial and continuing education programs for mobile simulation staff should be well constructed and regularly updated.

There are four distinct phases of training for mobile simulation staff:

1. Initial immersion training
2. Apprentice learning
3. Continuing education and quality improvement
4. Professional certifications

If your mobile program is getting started, the initial training is well done in a group training setting. One of the challenges with mobile simulation program growth is that staff will likely be hired as individuals rather than as large cohorts, making regular academy style training significantly more expensive and less effective. We will address best practices in both the large cohort and individual simulation academy models.

Large Cohort Academy

Based on the mission, vision, and purpose of the program, leaders should construct a standardized initial academy curriculum to best meet the average experience level of the learners. Best practices in conducting learner needs and gap assessments are addressed in this book. They are applicable for both external and internal clients and learners. Table 1.4 is an example of the Best Practice Medicine large cohort simulation academy.

Table 1.4 Example simulation academy curriculum

Day 1
12:00–12:45 Introductions and BPM History
12:45–14:00 Simulation Exercise
14:15–15:45 CAE Manikin Orientation
15:45–16:15 EMT Simulation Learning Goals
16:30–17:30 Adult Learning Review
17:30–18:00 Homework and Daily Evaluations
18:00–tbd Team Dinner
Day 2
08:00–10:00 Case Design Lecture and Exercises
10:15–12:00 Debriefing Lecture and Exercises
12:00–12:30 Lunch with Regional STLs
12:30–14:00 Simulation Creation
14:15–15:15 Simulation Dry Runs
15:15–16:30 EMT Case Refinement
16:30–17:30 Dinner Break
18:00–22:00 Simulation Performance for EMT Class
Day 3
08:00–08:05 Evaluations of Yesterday
08:05–08:45 Debrief EMT Simulations
09:00–09:45 Simulation Case Resources
09:45–10:45 Lab/Truck Setup and Takedown
11:00–11:45 Operations
11:45–12:15 Lunch
12:15–13:00 Administration and Applications
13:00–13:30 Expenses Tracking and Collecting
13:30–14:00 Evaluations and Wrap-up Q&A

For established programs that will onboard and train individuals rather than teams, the aforementioned curriculum requires modifications. Training individuals is best done with an assigned mentor responsible for the customization of the training to meet the learner's current knowledge and experience gaps and an established apprentice program to guide the learning. Table 1.5 is the BPM simulation apprenticeship curriculum.

Lessons Learned: Checklists in Simulationist Education

Another easy adoption from high-risk medicine is the use of checklists as initial training aids and to ensure safe consistent mobile simulation operations. Electronic checklists that can be updated as needed by leadership are superior to paper which tends to outdate regularly as a program is growing. SIM-MT uses an iPad-based checklist system which can be automatically updated for all teams and syncs with the operations team to report problems with the labs or equipment [4, 5].

Continuing Education and Quality Improvement

High-performance teams have a universal commitment to continued learning and quality improvement. Mobile simulation teams require innovative approaches to continuing education, specifically because as a subspecialty of simulation few resources designed for mobile simulation training exist.

Table 1.5 Example of individual training academy with learning objectives

Best Practice Medicine Simulation Apprentice Program

Gap and needs assessment:
The assigned mentor will appraise the learners experience with simulation and adult learning theory. This inventory will include the following;

- Review of resume and interview notes
- Inquiry of the learner in self-identified areas of simulation strengths and weaknesses
- Discover the learner's working knowledge of simulation methods and models
- Elicit learner's experience in curriculum development and objective exploration
- Determine the preferred method of debriefing and depth of knowledge

Apprentice		*Initials*		*Start Date*	
Mentor		*Initials*		*Start Date*	

Apprentice curriculum.

Instructions: In addition to the standardized curriculum listed, the apprentice and the mentor will identify additional areas of learning and mentoring based on the gap and needs analysis beyond the core curriculum. This additional curriculum will include a minimum of 5 objectives

1.

2.

3.

4.

5.

Instructions: The mentor and the apprentice will each initial under their assigned columns when the stated objectives and actions are completed. The mentor does not need to be the sole signer; other qualified mentors may sign when appropriate. Qualified mentors include all STL's senior simulation staff and members of the leadership team.

Introductions and Program History 2–3 hours:
The learner will define the organizational structure of Best Practice Medicine and articulate the specific organizational structure of SIM-MT. The learner will describe the opportunity wheel and practice its use throughout the academy. In addition, the learner will acquire a working knowledge of the origins of Best Practice Medicine, SIM-MT Inc., the board of directors, and the history of the simulation project to date.

Actions	Apprentice	Mentor	Date
Initial orientation to program history			
Articulates history accurately internally			
Demonstrates public facing knowledge of program history			

Safety and Risk Mitigation 1–1.5 hours:
Learners will review all safety and risk mitigation procedures and policies found in the procedures manual and employee handbook. Learners will be oriented to the mobile lab and will identify key risk and approved methods for mitigation.

(continued)

Table 1.5 (continued)

Actions	Apprentice	Mentor	Date
Orientation to safety and risk mitigation procedures			
Orientation to lab safety and risk mitigation			
Demonstrates knowledge of safety procedures and practices			

The Simulation Learner's Experience 2–2.5 hours:
The learner will recognize the importance of the pre-briefing. Specifically, the learner will identify the key components of psychological safety, the basis assumption, fiction contract, vegas clause, instructor code of conduct and purpose of the pre-briefing. In addition, the learner will be oriented to the expectations of simulation educators and learners.

Actions	Apprentice	Mentor	Date
Orientation to the stated objectives			
Demonstration of the stated objectives			
Capable of meeting the objectives without assistance			

Introduction to Debriefing 2–3 hours:
The learner will describe four current debriefing models and compare them. The learner will practice debriefing for good judgment and, plus/delta methods of debriefing, describe the benefits of these methods and their use in mobile simulation.

Actions	Apprentice	Mentor	Date
Orientation to the stated objectives			
Demonstration of the stated objectives			
Capable of meeting the objectives without assistance			

Course Development and Learning Objective 4–6 hours:
The learner will review the BPM methods, models, and procedures of course development. The learner will articulate the key BPM philosophies and purpose of the high–fidelity learning experience process. The learner will demonstrate a working knowledge of SMART objectives and interpret Blooms taxonomy in both the cognitive and psychomotor domains. The learner will identify the workflow process of course development and learning objectives, from the initial client contact to the simulation learners evaluation of the experience.

Actions	Apprentice	Mentor	Date
Orientation to the stated objectives			
Demonstration of the stated objectives			
Capable of meeting the objectives without assistance			

Mobile Simulation Systems 8–16 hours:
The learner will acquire a novice working knowledge of all essential mobile simulation systems. This is an initial exposure, and with the conclusion the learner will demonstrate a basic practical understanding of the systems in the mobile simulation lab. Further, advanced training will be necessary to achieve mastery of the systems. The mobile simulation lab setup checklist located on the onboard iPad will serve as a guide for the systems orientations

Actions	Apprentice	Mentor	Date
Orientation to the stated objectives			
Demonstration of the stated objectives			
Capable of meeting the objectives without assistance			

Difficult Debriefings 2–3 hours:
The learner will define difficult debriefing and their contributing factors. The learner will articulate human factors that influence difficulty debriefers, from the perspective of the simulation learner and the debriefer. The learner will translate the best practices in good judgment and plus/delta methods, to difficult debriefings and psychological safety.

Table 1.5 (continued)

Actions	Apprentice	Mentor	Date
Orientation to the stated objectives			
Demonstration of the stated objectives			
Capable of meeting the objectives without assistance			

Simulator Orientation 8–16 hours:
The learner will apply established best practice in the utilization of each simulator in the mobile sim lab. The learner will articulate resources available for troubleshooting and continuing education. The learner will power on and operate each simulators specific functions and describe the purpose of each major function of both the simulation hardware and software

Actions	Apprentice	Mentor	Date
Orientation to the stated objectives			
Demonstration of the stated objectives			
Capable of meeting the objectives without assistance			

Confederates and Standardized Patients 0.5–1 hour:
The learner will show a working knowledge of best practices as defined by the procedures of the use of confederates and standardized patients in the mobile simulation. The learner will articulate the common pitfalls of confederates and standardized patients and the associated remedies.

Actions	Apprentice	Mentor	Date
Orientation to the stated objectives			
Demonstration of the stated objectives			
Capable of meeting the objectives without assistance			

Evaluations and Feedback 0.5–1 hour:
The learner will explain the purpose of 100% student evaluation and feedback review in the mobile simulation environment. The learner will identify the steps required to solicit meaningful feedback and its role in ongoing program improvement.

Actions	Apprentice	Mentor	Date
Orientation to the stated objectives			
Demonstration of the stated objectives			
Capable of meeting the objectives without assistance			

Debriefing Quality Improvement 2–5 hours:
The learner will participate in a recorded debriefing and review the debriefing CQI procedure. The learner will repeat the CQI debriefing expectations and locate examples of other recorded debriefings. Using the debriefing CQI tool, the learner will provide peer review on ten previously recorded CQI debriefs and will compare the tool to the existing reviews of those debriefings.

Actions	Apprentice	Mentor	Date
Orientation to the stated objectives			
Demonstration of the stated objectives			
Capable of meeting the objectives without assistance			

Apprentice Event Tracking

In the first year the apprentice will participate as an educator in a minimum of 30 events:

- 5 pre–hospital BLS events
- 5 prehospital ALS events
- 10 hospital events
- 2 conference events
- 5 promotional events
- 3 company-wide trainings

Pre–hospital BLS events (5)

(continued)

Table 1.5 (continued)

Location	*Hours*	*Mentor*	*Date*

Pre–hospital ALS events (5)

Location	*Hours*	*Mentor*	*Date*

Hospital events (10)

Location	*Hours*	*Mentor*	*Date*

Conferences (2)

Location	*Hours*	*Mentor*	*Date*

BPM–sponsored internal trainings (3)

Location	*Hours*	*Mentor*	*Date*

Promotional events (5)

Location	*Hours*	*Mentor*	*Date*

Company-wide trainings (3)

Location	*Hours*	*Mentor*	*Date*

Apprentice		*Initials*		*Completion Date*	
Mentor		*Initials*		*Completion Date*	

The mobile environment can easily lead to communication challenges across the organization. A primary purpose of regular trainings is the communication of lessons learned and solutions needed for high-performance simulations. In the case of SIM-MT, three simulation teams separated by hundreds of miles face the substantial obstacle of communicating learning experiences across the entire mobile team. To address this, the operations director hosts a weekly meeting run by the STLs, where the mobile teams share and work together to address the problems or successes of the previous week.

Mobile simulation teams regularly face unique and time-sensitive challenges for which they must create solutions with limited resources and time. As a real-life example, a tetherless simulator internal air compressor overheats and fails in the middle of the day of simulation. No backup simulator is available in the mobile lab. The mobile team must be trained to quickly identify the primary problem, empowered to source a work around solution, and expected to keep the learner's experience central at all times. Leaders must consider the specific categories of challenges their mobile teams will face during development of the recruiting, initial training, and continuing education plan.

Leaders should consider other professional high-performance teams and their lifelong learning habits. However, it is important to only adopt the best practices that fit the operational tempo, team demographic, and mission of your mobile sim program. Too often, programs will "copy and paste" another organizations educational plans, policies, and procedures, without assessing the specific implications and applications on their programs intricacies.

SIM-MT conducts large-scale continuing education retreats following the initial simulation academy on a triennial basis (Table 1.6). These two- to three-day events are invaluable to the professional development of individual sim team members and the overall cohesion and success of the program. They are mandatory for all mobile sim staff, are planned a year in advance, and have living agendas. Mobile simulation leaders must prioritize ongoing team-oriented training and learning opportunities in budgets and operational planning. An essential component of these retreats is the participation of mobile simulation staff in a simulation experience. If not experiencing simulations from a leaners perspective, intentional educators can quickly lose the ability to empathize with a learner's experience. By constructing a program where mobile simulation staff are required to regularly participate as learners in simulation, leaders will encourage educators to remain humble, understanding, and connected to their learners. Lastly, mobile simulation teams, like many small high-performance teams, benefit from team building and community experiences together. The importance of a group meal, event, or other nonclinical interpersonal interactions is not to be undervalued.

Quality improvement in simulation is required for the same reasons it is in clinical medicine. Stakeholders in mobile simulation need to see that the program is reflective and proactive in its growth, and value is added to the clients and learners. A purposefully designed quality improvement program will increase mobile sim staff confidence, competence, and sense of self. Of all the skills, mobile simulationists must master the art of debriefing, which is likely the most anxiety producing and least

Table 1.6 Example of triennial meeting agenda

Day 0	
19:00–22:00	*STL Meeting*
Day 1	
08:00–08:15	*Welcoming by the Hi-Line Team and Agendas*
08:15–09:00	*SIM-OPS Conference Highlights*
09:00–10:00	*Advanced Concepts in Simulation Education*
10:15–11:15	*Lessons Learned Roundtable and Debrief*
11:30–12:30	*Operations Safety Culture*
12:30–13:00	*Lunch On-site*
13:00–15:00	*Central and Western Team Simulation and Debrief*
	On-deck team, Technology Training Stations
	1. Hubspot
	2. ASANA
	3. Travel vouchers and T-sheets
15:15–16:00	*Moulage Helpful Tips, Hints, and Tricks*
16:00–18:00	*Business Summary*
18:00	*Team Dinner*
Day 3	
08:00–08:30	*Buddy to Boss, Book Review*
08:30–09:00	*Culture by Design, Book Review*
10:00–11:00	*Sexual Harassment Presentation*
11:00–12:00	*Customer Relationship and Difficult Clients*
12:15–12:45	*Lunch On-site*
12:45–15:30	*Teambuilding Exercise*
15:30–16:30	*Messaging, Social media, and Strategy*
16:30–17:00	*Closing Remarks*
17:00	*Team Dinner*
19:00–20:30	*STL and Drivers Bonus Round*
	Tire Chains
	Lab Standards
	Weather Standards
	Knowledge Sharing

common skill on your team. The continuous quality improvement (CQI) program at SIM-MT is designed from the ground up around debriefing, based on our team's feedback and gap analysis. In our program, every simulationist conducting a debriefing is recorded on video once a month. This film is sent to a review team, comprised of peers, leaders, and the simulation medical director. We have built a debriefing CQI tool based on beta test feedback from the simulation team, leadership expectations, and best practices noted in simulation debriefing literature. This tool is used monthly to evaluate the debriefing performance of all simulation staff. The archived videos and reviews are additionally integrated into new staff training (Table 1.7).

Evaluations from learners have a demonstrated impact on simulationists. Primarily, written feedback creates opportunities for self-reflection and program analysis. By providing learners with paper single-page feedback tools immediately following the simulation and specifically asking for written narrative feedback, in addition to a brief Likert scale, both the simulation teams and leaders can see a practical snapshot of the simulation experience of the learners. SIM-MT collects 100% written feedback immediately following every simulation experience. This feedback

Table 1.7 Sample form for CQI debrief

Debrief - Continuous Quality Improvement

Form for Debrief CQI - To be completed monthly upon review of Debrief CQI Videos

* Required

Email address *

Your email

Debriefer Name *

Choose

Month of Debrief *

Choose

Paste link for Debrief video Here *

Your answer

Presents professional appearance *

- ◯ Yes
- ◯ No

Explain (optional)

Your answer

(continued)

Table 1.7 (continued)

Assumes approachable position in room*

○ Yes

○ No

Explain (optional)

Your answer

Debrief is structured in a purposeful way*

○ Yes

○ No

Explain (optional)

Your answer

Utilized reactions to identify performance gaps*

○ Yes

○ No

Explain (optional)

Your answer

Uses open-ended questions with inquiry and advocacy model*

○ Yes

○ No

Explain (optional)

Your answer

Table 1.7 (continued)

Uses silence effectively *

- ○ Yes
- ○ No

Explain (optional)

Your answer

Debriefer is prepared to debrief with relevant resources *

- ○ Yes
- ○ No

Explain (optional)

Your answer

Made an effort to engage all learners *

- ○ Yes
- ○ No

Explain (optional)

Your answer

Respectfully and effectively managed angry or upset learners if present. *

- ○ Yes
- ○ No
- ○ N/A

(continued)

Table 1.7 (continued)

Explain (optional)

Your answer

Utilized specific examples about participant behaviors when providing feedback on clinical objectives *

◯ Yes

◯ No

Explain (optional)

Your answer

Helped explore what participants were thinking or trying to accomplish at key moments. *

◯ Yes

◯ No

Concluded debriefing with summary phase where learning objectives were reinforced. *

◯ Yes

◯ No

Explain (optional)

Your answer

Table 1.7 (continued)

Effectively addressed participants concerns about the fidelity and content of the simulation*

- ○ Yes
- ○ No

Explain (optional)

Your answer

Debriefer was personally knowledgeable or used content expert to improve participants performance. *

- ○ Yes
- ○ No

Explain (optional)

Your answer

If no for any question, provide a suggestion for improvements. Mark N/A if all answers are yes. *

Your answer

The debriefer excels in... *

Your answer

The debriefer could improve by... *

Your answer

I learned this from the debriefer... *

Your answer

A copy of your responses will be emailed to the address you provided.

is reviewed and discussed by the mobile team prior to departure from the simulation site. All evaluations are uploaded to a company drive and reviewed by the simulation development team and designated leaders for quantitative and qualitative data. These learner feedback tools, in conjunction with filmed reviewed debriefing, comprise the core of our quality improvement program (Tables 1.8 and 1.9).

Table 1.8 Simulation learner evaluation tool

Instructor Names: ____**Date:** ________________

Course: ____

Indicate on a scale of 1 to 5 your opinions. Also, include any comments (your comments are strongly encouraged) you feel are appropriate. This is our chance to improve!

Evaluation Scale

Unsatisfactory	Poor	Adequate	Good	Excellent
1	**2**	**3**	**4**	**5**

1.	The simulation increased my clinical confidence:	1 2 3 4 5
2.	The simulation increased my clinical competence:	1 2 3 4 5
3.	The simulation environment was open and allowed for learning:	1 2 3 4 5
4.	The simulation experience is valuable to my clinical practice:	1 2 3 4 5
5.	Overall opinion of the simulation:	1 2 3 4 5
6.	Would you recommend this course to colleagues?	Yes No

Comments (Use the back of the form if needed):

____
____
____
____

What could we do to make simulation education better?

____
____
____
____
____

May we publish your comment on our website at www.bestpracticemedicine.com?

YES __________ No__________

If yes, would you like to include your name? Name: ________________________________

List your contact info if you would like BPM to contact you if you wish to provide direct feedback about your experience with us. ____

Table 1.9 Simulation learner debriefing evaluation tool

Debriefer Name: ____Date: ________________

Course: ____

Your feedback matters very much to us. This document will be peer-reviewed by our simulation team and leadership. Please be as specific as possible in your feedback.

Strongly Disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly Agree 5

The debriefer facilitated a psychologically safe environment:	1 2 3 4 5
I was encouraged to express my feelings about the simulation:	1 2 3 4 5
The debriefer was genuinely curious about my choices in the simulation:	1 2 3 4 5
The debriefer listened to me:	1 2 3 4 5
The debriefer was knowledgeable and clinically prepared to the simulation:	1 2 3 4 5
I noticed the debriefer was comfortable with silence in the debriefing:	1 2 3 4 5
I understood the learning objectives:	1 2 3 4 5
I perceived the debriefer to be credible:	1 2 3 4 5

Circle the most accurate feeling you have leaving this debriefing.

Delighted	Angry	Happy	Encouraged
Frustrated	Embarrassed	Excited	Satisfied
Enthusiastic	Confident	Sad	Discouraged

100% of your feedback is reviewed by our team.

Learner Name (Required)	
Learner Preferred Contact (Required)	

The final step in training your team is the process of professional certifications and programmatic accreditation. The two primary simulation certifications, and the ones most likely to be recognized in the world of clinical education, are the CHSE and the CHOS.

The team you start with might not be the team you grow with, and that's okay.

Table 1.10 Estimated cost of onboarding per employee

Recruiting staff payroll	$1000–$3000
Recruiting/advertising Costs	$100–$300
Interview staff payroll	$650–$1150
Initial training	$8000–$12,000
Continuing education	$5000–$10,000
Projected first year of employment/onboarding cost	$14,750–$264,509

Retention

Small teams by their very nature are highly interconnected. The investment in recruiting, interviewing, hiring, and initial and continuous training represents the largest portion of most organizational budgets. Therefore, building a culture and a program that retains your greatest assets is of the utmost importance to the simulation leader. It is helpful for programs to have a reasonably accurate understanding of what it costs to successfully onboard a new team member and what the continuing education of that member costs annually. This becomes an important consideration when evaluating attrition and retention of staff and programmatic budgets (Table 1.10).

The science and art of creating a positive culture and work environment that retains your best staff is well documented and discussed in the business lexicon. The role of simulation leaders in retention is critical and should be a focus on continued learning and growth.

The specifics of every mobile simulation program are unique, and therefore the strategy for retention will be custom to each organization. In his book, *Culture by Design* [6], David Freidman describes that in the absence of an intentional team culture, as defined by the leadership, the company (team) will define its own culture, which is not likely to be wholly in alignment with the mission, vision, value, and purpose of the organization. Best Practice Medicine leadership with the guidance of this, other texts, and through leadership training on culture defined our organization's core behaviors. Behaviors are verbs, which are teachable, coachable, and observable. We ritualize these behaviors regularly and use them as measures of individual and team performance. As a result, a team of nearly 50 high-performing people working in the fourth largest state and the largest mobile simulation program in the nation are united and consistent in our behaviors with our clients, learners, and colleagues. By setting clear expectations and demonstrating them in daily interactions, programs can greatly increase retention of quality staff (Table 1.11).

Succession Planning

A hallmark of organizations committed to longevity and sustainability is clearly defined succession pathways for every person on the team. Shortly after recruiting,

Table 1.11 Sample mission and value statement for mobile simulation training

How we work with external clients and learners

Look through the lens of clients and learners in all we do
- We consider the impact, meaning, and influence of our work from the vantage point of the learners
- We care about the parking lot meetings

Build a connection between our CURRENT experience and THEIR current experience
- We will swear, occasionally, and in good taste
- We show your humanity will maintaining our credibility
- We laugh at ourselves and use humor as a disarming tool
- We know that learners connect with the human condition, in most circumstances we will share ours.

Tell 'stories' very rarely and only when
- We have a clear objective
- We acknowledge we are going to tell a story
- We are not the hero

Engage directly with everyone you encounter
- We create warm and welcoming environments, and we seek out opportunities to make learners comfortable.
- We introduce ourselves with a smile, a confident handshake, and our first name; we will maintain eye contact until the client or the learner's name.
- Use their name when speaking with them.
- Stand to shake hands and great clients and learners.

Know your audience, in one on one or in group settings.
- In all situations, we understand with whom we are interacting
- In a group, settings we solicit a professional and personal characteristic of the clients.
- In a planned meeting, we go the extra mile to know they coach little league or formerly worked at place ABC. *This is not hard to do, 30 seconds on LinkedIn or Facebook will tell you what you need to know.*

Acknowledge bad behavior when it appears, in the classroom and beyond.
- Often times simply identifying that it is occurring will eliminate the problem.

Practice a professional relationship with all clients and learners
- We recognize clients and learners are engaged with us to grow their knowledge. Our relationships are focused on this.
- We are not here to make new friends, we are here to support the growth of new knowledge.
- We protect our clients, learners, and colleagues from bullying, prejudice, and bias (especially your own).

(continued)

Table 1.11 (continued)

How we work with internal clients and learners

Practice radical support

- When we need help, we ask for it, early and often
- When asked for help, we respond quickly with meaning and intent
- We sacrifice for our teammates

Prepare, train and guide successors.

- We believe that global success is limited only by personal achievements.
- We are striving to learn and grow every day
- We are our your teammate's keeper

Care personally, challenge directly

- We care for our internal clients and learners personally, their lives are important to us.
- We will challenge our internal clients and learners directly, we are accountable to one another.

Listen

- We acknowledge that hearing is different than listening
- We practice active listening, by elimination distractions, making eye contact and restating for understanding.

Table 1.11 (continued)

How we do our own work

Own the problem and discover the solution with tenacity

- We know that for every problem there are practical solutions.
- We are proactive and self-directive in identifying realistic solutions before seeking guidance.

BPM is the quality of our products
The quality of our products is the details
Execute the work with meticulous attention to detail

- We sweat the details our work is all detail
- We personally own outcomes
- We believe that the details are our work
- Together we are greater than the sum of our individual contributions
- Throughout our work we ask ourselves, "is this the BEST I can do."

Recognize that tactical work is connected to strategic goals

- We are collectively responsible for the success and failures of Best Practice Medicine.
- We are shepherds of the larger strategic goal
- We are individually indispensable; we do our work with a vision of the future, a responsibility to the present and knowledge of the past.

Execute and communicate impeccable time management

- We under promise and over deliver
- We take responsibility for our time management
- We meet individual and project deadlines
- We communicate early if challenges arise
- We create an environment with a high Work: Cat video ratio

Embrace the uncomfortable, foreign and painful, we do not quit

- We believe in learning and growth
- When we get stuck, we recognize this as an invitation to innovation, tenacity, and teamwork.
- We do not walk away when we are uncomfortable
- We keep at our obligation until we are satisfied

Constantly solicit growth opportunities for yourself and the team

- We believe that everyone has growth potential
- We are committed to growth by design
- We commit energy and resources to support individual and team growth

(continued)

Table 1.11 (continued)

Attitudes we display

Show up with your best self

- Bring positive energy (Your best self) with you into every human interaction.

Forgive quickly, never take it personally and be kind.

- Everyone we meet is fighting a battle we never know about.
- We display the basic assumption in our attitude.

Understand the client and learner experience

- We regularly seek out opportunities to be learners, we remind ourselves of what it's like to be a student.
- We travel through our company as a client and as a learner.
- We identify and address pain points for our clients and learners religiously.

Be a Boy Scout

- We hold open the doors, take out the trash, clean up after others, wipe down the bathroom, and we are prepared.

Ride for the brand

A traditional phrase associated with the cowboy culture of the West. Where the brand a cowboy rode for was with his identity and pride.

- We demonstrate our belief that the craft we are engaged in is;
  - meaningful
  - life-changing
  - important
  - fun
- We demonstrate this is the way we represent BPM and our teammates.
- We handle our disagreements and challenges internally.
- We do not air these anywhere except inside the team.
- We are instantly recognizable as professionals
  - We leave our egos at the door
  - We are the kindest, and best dressed
  - We are not concerned with being the smartest person

training, and retention efforts, leaders are well advised to begin planning for programmatic growth through succession. This growth is markedly different from changes in the organization due to attrition (which is related to retention measures).

The high-performing humans on your team aligned with the organization's mission, vision, and values need to see that personal growth and expansion are not only possible, they are expected. Adapting the mindset of "up or out" encourages your entire team to be vigilant for opportunities to challenge themselves and thus build the desired momentum for the whole team.

By defining this attitude as core behavior of Best Practice Medicine,

Prepare, train, and guide successors.

- *We believe that global success is limited only by personal achievements.*
- *We are striving to learn and grow every day.*
- *We are our teammate's keeper.*

every member of the team is charged with preparing a promising candidate to replace them. The benefits of this are far-reaching. By encouraging managers to coach potential successors, the team must focus on what defines success in each role and learn how to communicate those responsibilities effectively. For new teams, this exercise can be vital in establishing best practices and a shared organizational consciousness.

Summary

HFS is proven to reduce preventable medical error, improve patient outcomes, increase healthcare team performance, and identify latent patient care threats [7]. Successful mobile programs must be intentional and dedicate significant, focused resources to recruiting, training, retaining, and planning for succession of the incredible people, which make mobile HFS the next great evolution in healthcare.

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Marketing and Finances

2

Amy Malheim

Key Points

1. Utilize multiple funding sources to achieve sustainability.
2. Utilize electronic resources for marketing.
3. Mobile simulation programs require a budget.

Introduction

There are many different ways to organize and manage a mobile simulation program. Programs can be run in hospitals, universities, private companies, or even state institutions. Mobile simulation can encompass a wide range of situations from one simulator in the back of a van driven around town for in situ simulation education to a state-wide program that has mobile simulation units with multiple simulators in each truck. Regardless of how a mobile simulation program is organized, there are still three things that remain pertinent to all programs: Successful marketing, adequate budgeting, and achieving sustainability.

Advertising Audience

When creating any type of program that provides a service of any kind, an evaluation of the potential stakeholders needs to be completed. This evaluation should first determine who those stakeholders might include and what they can offer in the form

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of insight or even buy-in to the program. *Stakeholders* are individuals or groups which should be included from the beginning to ensure their support for the program and their ability to champion the mobile simulation program to others.

There are many different stakeholders to consider when creating a mobile simulation program. One of the first state-level stakeholders to consider is the State Department of Health and within this group the Emergency Services Section. Many of the mobile simulation programs started their programs through funding or collaboration with their Department of Health. Working with the Department of Health is a way to achieve access to the State Legislature as well as the potential for access to government funding for the program to assist with sustainability.

A mobile simulation education program can benefit from the inclusion of the area or state's large hospitals or health systems. Hospitals and/or health systems can offer a wide variety of assistance for medical education programs. Mobile simulation programs that are not directly affiliated with a hospital might not have the access to expired disposable supplies, which are essential for keeping operating costs to a minimum for mobile simulation. In addition to supplies, health systems can provide the necessary financial assistance to ensure the longevity of a program. Hospitals may have relationships with donors who might fund mobile medical simulation programs, especially if they benefit providers in their communities.

When considering the continuum of care, the emergency medical services (EMS) system should not be overlooked and will likely benefit the most from medical simulation education in their home communities. A majority of EMS units in rural areas consist of volunteers. In rural areas, the call volume is typically around one call every other day [1]. Low call volume doesn't give EMS providers the necessary exposure or practice of high-mortality, low-frequency scenarios. Approaching the State EMS Association or local ambulance services before implementation of a program will help get others on board. State EMS associations can also advocate for the mobile simulation program to their state legislators. This advocacy might or might not be possible for the mobile simulation program. EMS providers have different concerns and have a stake in providing the first care of a patient when arriving on the scene. It is beneficial to get the EMS unit leaders together to gather information as to what kind of education they need as well as providing them the opportunity to give input into the organization of the simulation program. Rural areas also provide a different training environment than do urban areas. Some EMS units might be located in areas with poor cellular reception or limited access to the Internet. Simulation education might be newer to them than to urban EMS units and require more education as to how helpful and beneficial it can be to their staff.

Working with the American Heart Association (AHA) can be beneficial for a new simulation program as the AHA receives federal grant dollars to fund initiatives as well as startup funding for state-wide programs. Another entity that receives federal grant funding for initiatives or new programs through research is the National Organization of State Offices of Rural Health (NOSORH). Every state has an Office of Rural Health which has a stated purpose, "…to help their individual rural communities build health care delivery systems."[2]. These offices have direct contact with critical access hospitals' (CAH) administrations and directors of nursing.

The next group of individuals to engage will be the area EMS instructors. Interested instructors can be contacted by many different avenues such as LinkedIn, universities, technical colleges, and hospitals. Mobile simulation requires flexibility in teaching as well as adapting to different learners and backgrounds. Group dynamics might not always be the same in mobile simulation venues as can be seen in more brick and mortar simulation centers. The instructors participating in mobile medical simulation need to be given an accurate job description. The hiring net should be spread wide as to attract the most qualified individuals, because finding instructors able to teach in mobile simulation settings can be challenging.

Once, or perhaps before, the stakeholders have been identified, a marketing strategy needs to be developed. There needs to be a focus on potential and future learners. There are various ways to access learners and most of them are found via the potential stakeholders that have been listed. Regional or state EMS conferences are a great way to network with EMS squad leaders, personnel, and medical directors. The state's EMS association typically hosts these events, highlighting the value of the EMS community as a stakeholder. Their conferences are avenues for face time with decision leaders about education being provided. Simulation demonstrations at these conferences also give potential learners an opportunity to "try before they buy" (simulation equipment), possible scenarios that can be reproduced, as well as the flexible nature of mobile simulation which can bring education to them. Another opportunity within the EMS world is to reach out to squad leaders and have a short presentation about the logistics and educational content of the mobile simulation education program.

Another key stakeholder is the State Board of Nursing. Reaching out to different Board committees, such as Trauma, Stroke, or Cardiac, is a way to assist these committees in providing education to its nurses with a hands-on approach. Becoming integrated into new curricula or updated protocols makes a mobile simulation program an attractive avenue to assist with education. These committees could also be very useful if providing continuing education units (CEUs) becomes desirable for the program. Some states require different accrediting bodies to evaluate their education, and knowing how each state operates is beneficial.

The State Hospital Association can be accessed through the State Office of Rural Health (SORH). This is a way to reach many CAHs at one time and help become the go-to resource when changes need to be made to protocols through a standardized process such as simulation.

The final group of stakeholders to consider for inclusion are local and state higher education institutions. While mobile medical simulation education generally focuses on current providers, it can be used for technical colleges, universities, and medical schools. Many institutions of higher learning are offering courses consisting of distance learning environment with some on-campus requirements. With distance or multiple campuses, simulation education can allow students to receive the same experiences as those with access to brick and mortar simulation facilities. The recruiting value of a well-run mobile simulation program to attract new healthcare providers to the field should not be underestimated.

After the stakeholders have been determined and initial meetings have been completed, the next step is to determine the best way to advertise to the different stakeholder groups.

How to Advertise

In a sense, the program will need to have an identity or brand that can be easily recognized in the community. *Marketing* materials and activities can be developed via an outside firm that specializes in design and implementation of a marketing plan. If the mobile simulation program is associated with an established entity, it might be easier and cheaper to work with the in-house graphic design team. Logo design and graphic art are not something that can be done with a copy of photoshop and a nice computer. A logo should be created and then digitized for the purpose of transferring onto clothing, brochures, and many other promotional items. It is recommended that at a minimum brochures, pens, banners, shirts, and other small give-away promotional items be purchased at the beginning. Work with local vendors on the production of these items and request proposals for big ticket items such as banners to ensure the best price and see a sample of the products. Print advertisements work best for EMS or hospital publications, that is, newsletters, quarterly magazines, and conference brochures.

Logo and graphic design teams can assist with website development. People are using their cellphone to communicate with the outside world in ways far beyond talking or text messaging. Video production in collaboration with the marketing component can provide an introduction of what mobile simulation can offer, how it works, and what the space inside of a mobile unit looks like. A short promo video can be placed on social media programs, displayed as a digital ad at conferences, or emailed out prior to events to familiarize new learners about mobile simulation.

Nothing beats face-to-face marketing with learners. An efficient method is attending conferences and participate as a "vendor" with a booth display. This method allows for good opportunities to interact with attendees and discuss the program on a one-on-one basis by providing program details and answering questions. Some venues allow for vehicles or more elaborate displays. Take advantage of those situations. Giving tours of the mobile simulation vehicles gives the public a chance to see what their healthcare professionals could be using to supplement their didactic learning. The best PR comes from the word of mouth of those who have been in the vehicle or gone through a scenario put on by the mobile simulation program. Simulation doesn't feel as unknown to new learners anymore and gets other learners excited to share their experiences.

The world in which we live in has come to rely upon social media for news, updates on friends and family, and even to find out about new products or services. The best-known programs are Facebook, Twitter, and Instagram. The use of social media outlets for marketing, communications among various groups, evaluations, and other functions will continue to grow.

Every new program needs an announcement event to showcase the “who, what, where, and when” of the program. Take this opportunity to invite all stakeholders and local media outlets. Use the newly designed logo and language from the brochure to send out a press release to newspapers. It will create some initial buzz that can be used as a jump-off point for starting the program.

Resources Needed

Every program requires personnel and financial resources to operate. In order to have a successful program, a dedicated coordinator is essential. The duties of this position should include scheduling, budgeting, and marketing. The coordinator will keep the program moving forward by creating a presence in social media, coordinating various schedules and outreach opportunities, and networking with potential funding sources.

Everything comes at a cost and funding a mobile simulation program is one of the most monumental tasks aside from budgeting. Mobile simulation programs in the United States have been started in various ways. The Upper Midwest has been fortunate enough to work closely with a foundation for initial equipment funding and personnel costs. Others have been started out of universities or hospitals seeing the need to reach out to other facilities within their system.

Potential Funding Sources

All funding sources should be considered for sustainability of a mobile simulation program. Grants have contributed to the start of many mobile simulation programs. Grant sources include the National Institutes of Health (NIH), private grantors/donors, or even the AHA. NIH grants can be found at grants.nih.gov. State Offices of Rural Health can help locate grants that could potentially help fund a portion of the program. This process involves a stakeholder and allows the program to benefit from their expertise and experience. The same can be said for working closely with the AHA. The AHA routinely has activities that align with mobile simulation and can assist with funding.

Large facilities usually have alumni or donors who like to help fund new and innovative programs, such as mobile simulation. Ask for a meeting with the individual in charge of donations, titles can include: Director of Alumni and Community Relations, Development Officer, Foundation Officer, or Director of Donor Relations. Bring them out to see an education session and give them plenty of information to describe program resource needs. This person can be a lifeline to future funding.

Depending on the state in which the program resides, working with a state legislator might be an option. Becoming a line item in the state budget is the ultimate funding goal. The AHA has events during the legislative session in which they provide lunch for the legislators and have an opportunity to discuss with them data that has been collected and current needs for funding. Once again, getting to stakeholders early and considering the right ones can lead to growth.

Asking for money is not easy and not everyone is willing to do it. One way to help eliminate the number of asks that need to be made for funding would be to get an endowment. An endowment creates the ability to spend the interest on an invested sum of money and an ongoing source of funding.

Operational Costs

Budgeting for any simulation program varies among institutions. There is not an industry standard on charging for simulation at this time. This part of the chapter will discuss the major line items to include in the budget, possible expenses to plan for within those budget categories, and then present a sample budget with realistic numbers based on the average expenses for one mobile truck to operate in a rural region (Table 2.1).

All mobile simulation requires some sort of transportation vehicle. Current options range from a van to a custom-built truck or RV. The choice is typically made based on the funding available and the type of mobile simulation program. If the program will focus on in situ education and will require one to two simulators or task trainers, then a van would be the best choice. If the program will focus on a larger area and hopes to host events with multiple stations or several scenarios

Table 2.1 Mobile simulation budget

Personnel	Base salary	FTE	Total expense
Program coordinator	$50,000.00	1.00	$50,000.00
Educator	$60,000.00	0.5	$30,000.00
Educator	$60,000.00	0.5	$30,000.00
Driver/technician	$45,000.00	0.5	$22,500.00
Driver/technician	$45,000.00	0.5	$22,500.00
Fringe expense		0.25	$38,750.00
Total personnel expenses			$193,750.00
Major equipment			
Transport vehicle			$430,000.00
Simulators			$121,000.00
Warranties			$42,390.00
Total major equipment expenses			$551,000.00
Operating expenses			
Truck			$7000.00
Insurance			$6250.00
Storage			$6480.00
Professional development			$15,000.00
Marketing			$5000.00
Disposable supplies			$2000.00
Office supplies			$1000.00
Team member travel			$5000.00
CEUs			$6000.00
Miscellaneous expenses			$2000.00
Total operating expenses			$55,730.00
Total simulation budget			**$800,480.00**

running simultaneously, then a larger vehicle would be a better purchase. Vans will cost around $30,000, while a custom-built truck with two spaces for education costs about $430,000.

Another cost to consider when deciding which vehicle to use is the operating expenses of the vehicle. Each state has different registration and licensing regulations to consider. If the program will be run out of a hospital, it would be best to integrate the vehicle into their already established fleet so routine maintenance, registration, licensing, and fuel would be covered under a per mileage or engine hour usage rate. Programs that are affiliated with universities or state agencies should research the ability to move the vehicle(s) into the state fleet. Once again, registration, licensing, fuel, and routine maintenance will be covered by a flat rate.

Different vehicles can require different driver's licenses. Additional license testing may be required based on the mobile vehicle purchased. Larger trucks, that is, semis, will require a high class of driver's license due to the increased weight and size. Insurance should also be purchased for your mobile vehicle. Most auto insurance companies will provide a separate policy for the equipment that is to be transported as well. Simulation equipment that is being moved around constantly will require additional insurance to cover accidents of any kind, which is a necessity when thinking about replacing or fixing a simulator that falls during the unloading or loading process.

The most important expense other than personnel will be the major equipment/simulators that are purchased for the program. There are four different categories of equipment to consider: simulators, audiovisual (A/V), task trainers, and real or simulated medical equipment. Simulation programs are a mixture of the four categories based on the learner needs and what best fits within budget.

CAE Healthcare, Gaumard, and Laerdal are three major healthcare simulator manufacturers in the United States All three have adult, infant, pediatric, and birthing simulators. The differences in products from the three vendors are typically based on preference, cost, or familiarity. High-tech and high-fidelity simulators are essentially a combination of AI and computers. It is always beneficial to see what each company offers and base your decision on your needs.

Simulator equipment is most likely going to be the biggest initial capital expensive unless the vehicle chosen is a semi, which will then make it a close second. Full body, high-fidelity simulators will range from $18,000 for a newborn to well over $70,000 for a birthing simulator. All three companies also offer differ levels of capabilities within each type of simulator.

CAE's original focus was on aviation simulators before they branched out in 2009 to form the subsidiary CAE Healthcare, Inc. CAE got their start when they recognized the potential to assist with military simulations [3]. Their start factors into how their simulators look and their rugged ability to withstand multiple simulations. In the world of simulation manufactures, they are relativity new and are still working on perfecting their lineup as the birthing simulator, Lucina, arrived in 2013. CAE's adult simulators do offer the ability to be completely tetherless which keeps the amount of extra equipment to a minimum, whereas their pediatric and infant simulators require an air compressor.

Gaumard Scientific was created by a trauma physician who, in 1946, wanted to create a simulator for frontline military surgery [4]. Gaumard's focus has mainly been on birthing and newborn simulators. Currently, Gaumard has the most advanced pediatric simulator on the market. Gaumard's reputation surrounds their advancement in their hardware, such as Pediatric HAL. All of Gaumard's simulators are wireless and allow for the integration of real medical equipment into the simulations.

Laerdal's original focus was in children's toy manufacturing. In 1960, the founder Åsmund Laerdal collaborated with two doctors to create the original Resusci Anne [5]. The direction of the company changed to helping save lives through resuscitation. Laerdal has continually created reliable and effective simulators. More recently, Laerdal has moved into being completely tetherless. SimMan 3G is one of the most common simulators in simulation centers, nursing colleges, and mobile simulation programs in the country. Its popularity stems from their ability to create a reliable and realistic simulation.

During the process of determining which simulators and from which companies to purchase, don't forget to include warranties at least at the beginning. Warranty coverage with simulators range from on-site repairs in 24–28 hours to shipping the simulator back to the manufacturer for repairs. Preventative maintenance can be a very useful part of a warranty agreement. Preventative maintenance covers either an on-site technician or at the manufacturer going over the simulator once a year and replacing parts that have broken or worn out due to use. Warranty maintenance agreements vary in length, cost, coverage, and service level provided.

Additional consideration should be made to any type of A/V system that might be used as not all companies can integrate seamlessly with the major A/V companies. If the program is being run out of a brick and mortar simulation center, then it might be best to use the same system currently in use at the center so there is less of a learning curve and more continuity. CAE's Learning Space, B-Line's SimCapture, and EMS's SIMULATIONiQ are the major competitors in large-scale A/V for simulation. A/V for simulation is relatively new as all three companies created this product line in the last 30 years and some as recently as less than 15 years ago. CAE's simulators will work with their own software but only capture part of the simulation information with B-Line and EMS. Laerdal and Gaumard's simulators will work with B-Line and EMS but do not have all the capabilities with CAE.

In addition to simulators and A/V systems, another larger purchase and possibly just as important as high-fidelity simulators themselves will be which task trainers to purchase. Mobile programs don't allow for large groups of learners to be occupied all at the same time which brings in the need for other skills to be practiced or tested based on the facilities' need. Task trainers can range from IV arms and IO legs to intubation trainers. These items will cost less than the full adult simulators but will come with more disposable supply costs. Repeated intubation of high-fidelity simulators can cause tears or other mechanic issues. When intubation is required in a scenario, it might be more practical on the equipment to use an intubation trainer, rather than an expensive full body manikin. There are many ways to integrate task trainers into simulations as well as use them separately for skills practice or testing.

The last set of major equipment to consider purchasing will be items needed to create a more realistic medical environment, such as 12-lead generators, adult and pediatric crash carts, Broselow tape, automatic CPR devices, power carts or hospital beds, splints, laryngoscope, and long spineboards. All of these items depend on the type of mobile simulation program that is to be created as well as the space available. Simulation does not require the use of medical-grade equipment so equipment that is expired, not for human use, or refurbished can be used without losing the realism.

While major equipment will be large part of the first year budget, minor equipment and disposables will take its place under the operating portion of the budget if one does not seek out alternative sources for these items. Disposable items to be purchased, created, or donated should include but not limited to IV bags, expired medications, hospital linens, dressings, tubing, stethoscopes, gloves, C-collars, and blood pressure cuffs.

Nothing sets the scene more than a little moulage. *Moulage* is the art of simulating injuries for the purpose of training emergency response teams and other medical military personnel. In the simulation world, moulage can also include clothes, accessories, and smells used to give a more complete picture during a scenario. Clothes can be purchased from thrift stores and makeup for bruises or face can be purchased at dollar stores. Moulage should be easily removed and easily replaced.

Now that all the cool toys are purchased, the vehicle to move the equipment and supplies is fueld and ready to go, the focus should be shifted onto the personnel. Personnel should actually be the first-line item in the budget. Personnel are the educators, technicians, drivers, managers, and coordinators. Finding the right people for mobile simulation can be a tricky endeavor. The salary amounts will differ based on region, educational experience, and willingness to have flexibility of schedule. Mobile simulation programs typically require individuals who have a past educating history, desire for learning, and willingness to work long and sometimes odd hours. Simulation in itself is a highly technical operation so it also requires personnel that are tech savvy or at a minimum open to learning new things and researching technology solutions on their own. Simulations with high-fidelity simulators should include at least one facilitator and one technician to ensure it doesn't become a one-man show. The number of team members for a mobile simulation are based the frequency of use and the modality being used for teaching.

In order to get personnel up to speed or even for continued growth, professional development should also be a budget item each year. Professional development is necessary to help provide opportunities for team members to attend conferences to stay current in medical simulation as well as attend for possible networking opportunities. Conferences or meetings in medical simulation can be international, position specific, regional, or state wide. The Society for Simulation in Healthcare (SSIH) hosts an international conference every year where around 3000 attendees get together for 3 days to learn, collaborate, and experience the latest in simulation through vendor demonstrations and booths. SSIH also has a smaller conference called SimOps. The focus of SimOps is professional development of simulation operations specialists. Many states or consortiums have their own smaller conferences to exchange ideas that are important to them and their programs as well as share education on teaching and learning theories.

Turning the focus to the learners and their professional development and education takes us to another operational cost of CEUs. Most medical professions from physician to first responders require a certain amount of CEUs to recertify. Starting with the medical professionals, it helpful in the promotion and marketing of a mobile program to be able to not only bring the simulation education to them but to also be able to offer CEUs with the education. Some states allow continuing medical education credits to qualify for nurses as well, but other states have different requirements. Research is necessary to determine which route to take. All EMS personnel are now under one system, the National Registry of Emergency Medical Technicians. The State Department of Health in each state will be the contact for the Registry and could have the authority to grant approval and assign credits for the simulation education being provided. This does not mean the mobile program has to provide all the education for the state or even be able to educate in all the categories for national EMT credits. It does cause the program to be more standardized and in line with the current educational standards of your area.

Mobile simulation programs have travel expenses. Based on what vehicle is chosen and how the costs are covered, travel costs include fuel as well as per diem and lodging. Travel expenses for education and professional development should be included in this line item. For budgeting purposes, use the General Services Administration website [5] to help estimate per diem and lodging even if the managing institution has a different method. The website will give a starting point for budgeting and can be adjusted after the initial calculation to factor in organizational polices.

The final budget line item will be for office equipment and supplies, IT communications, and any other minor miscellaneous purchases that need to occur during a fiscal year. Purchases that count against this line item will be laptops, tablets, Wi-Fi hotspots, printing, postage, and printers. Depending on the location of the mobile simulation program, it could be useful to purchase business cellphones for those educators who do the traveling and educating. If the area is rural, the team's safety is an important consideration. There are also many available applications for tablets that can streamline work and give the ability to send and receive information in a more organized approach.

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Designing a Mobile Simulation Program

3

Patricia K. Carstens and Marissa J. Stanton

Key Points

1. Development of a mobile simulation program should begin with a needs assessment of your supporting institution and prospective learners.
2. Development of a strategic plan, including vision and mission statements, should be done prior to establishing a mobile simulation program.
3. A policy and procedure manual should be developed in the early stages of mobile simulation program development and modified as needed.

Simulation is an educational method that grants participants "hands-on" opportunities to practice skills and procedures in a safe, nonthreatening environment. The use of this educational modality must be applied by designing the program through the use of a well-grounded plan. The designing of a simulation program should be built on a sturdy backbone of strategic planning. A simulation program, whether mobile, in-house, or in situ, needs to use the simulation program's identity, ability to sustain itself, its value, and its purpose to support the program. The first item when considering designing a simulation program is to be aware of what is currently being done.

Simulation provides training in high-risk industries such as nuclear power plants and airlines. Low-fidelity simulation has been used to train healthcare workers for

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over 20 years, but the creation of simulation programs and use of technology to support training has been a slow process. Simulation activities have sporadically been applied for a number of years but organized, structured simulation programs have grown slowly.

Before developing a simulation program, you need to do your homework. This chapter will provide insight into the administrative pieces that will support your simulation program. When considering building a simulation program, you will need to ensure you have the support of the administration of your institution; you will also need to survey other institutions and develop a structured step-by-step development plan based on educational theories. This planning allows for smooth launch and operation of your simulation program.

The first step to designing a simulation program is to conduct a needs assessment of which things are being done currently and how they are done. “There are various ways of conducting a needs assessment. You can develop a questionnaire using Survey Monkey or another online tool” [1]. The needs assessment needs to be in-depth. Not only do you need to develop questions about the training you want to provide but you will need to determine whether your program is going to compliment or replace existing training opportunities. Questions of who, what, and where need to be part of your needs assessment. Feaster and Calzada (quoting from Palaganas et al. [2]) recommend using the “six W’s of information gathering information: who, what, when, where, why, and how” [1] Other questions include if there are problems or deficiencies in your current program. You need to look at how your simulation program would address the gaps in training currently being conducted. Some examples of these questions would be: Is there a gap in training? Is there a better way of doing it in a safe non-threatening environment? Does the gap in current training lend itself to educationally sound deliberate practice methods? Deliberate practice *is a highly structured activity engaged in with the specific goal of improving performance* [3]. When you engage in deliberate practice, improving your performance over time is your goal and motivation. When these conditions are met, practice improves accuracy and speed of performance on cognitive, perceptual, and motor tasks. The following are Ericsson’s four essential components of deliberate practice:

1. You must be motivated to attend to the task and exert effort to improve your performance.
2. The design of the task should take into account your preexisting knowledge so that the task can be correctly understood after a brief period of instruction.
3. You should receive immediate informative feedback and knowledge of the results of your performance.
4. You should repeatedly perform the same or similar tasks [3].

Are you able to provide valid training using the “four essential components of deliberate practice” through the use of simulation?

Which educational methods would your program apply? Would your program be stand-alone or institutional or departmentally based? Would you be doing skills training or case-based training? Perhaps your program would be doing both skills and care-based training. Would your program develop the entire curriculum within your program or would your program as part of an institution and/or department call on others to assist in the development of curriculum and/or staffing?

It would be beneficial to perform a needs assessment before embarking into the development of a simulation program. Use of a SWOT analysis to look at the strengths, weaknesses, opportunities, and threats to the current methods of training that your program should also be considered.

The examination of your simulation needs should also include your audience and their specific needs. You should also consider whether your audience is in close proximity or if you need to travel great distances just to get to your learners. You need to look at the time constraints your audience may face when attending training sessions held by your program. Additionally, you should look at federal, state, and local requirements for training. Which programs are fulfilling those requirements now? Is obtaining the mandated requirements easy, or does it cause a burden on the learner to comply with training and certificate requirements? Consider designing your program to alleviate the burdens your learners face. Where and how do clinicians currently receive yearly training for continuing education or requirements? Are there charges for this training or is someone providing it for free? Would your program be able to address mandatory requirements for clinicians to practice or yearly competency requirements for differing healthcare professions? If your program is looking at alleviating the burden of meeting federal, state, and local requirements, you may need additional staffing to track these required training sessions to ensure compliance with individual clinical professions' rules for offering competency testing. Your program may also need to pay fees to become a testing site and may also need to be designed to support continuing educations requirements for different medical professions. Additionally, you should consider how do your potential participants gain the training now? Is it difficult to attend this training at the present? Are they getting the training or would your program provide new training?

As you are developing a mobile simulation program, the questions you need to ask yourself and or development team would need to answer are: Why should it be a mobile program? Creating a mobile program would allow you to reach more participants as well as improve current training or provide new content. You also need to determine what would be your main area of coverage: Where is it located, what cities, counties, states, and/or regions will be included? How often would you be able to support your identified coverage area? Would you be able to operate throughout the year or would there be down time? Thinking of staffing, if you are in an area where you wouldn't be able to operate year-round, how would you handle staffing? How is training being provided to your target areas now?

The aforementioned questions are examples that will provide you information necessary for determining if there is a need for the program you are considering. If you determine that there is a need for a mobile simulation program through this needs assessment, you can then begin the hard work required to develop a simulation program.

Many simulation programs are created through grassroots development. A training session is developed; participants appreciate it and urge the host to provide it routinely. Participants then ask the host to develop additional sessions. While many fine programs have been developed this way, it is not the process you want to follow. For a simulation program to be able to provide training in a consistent, reliable, valid, and measurable way, preplanning and creating a structure for the program is a must before launching it. It is important before creating a simulation program that the program creators work to create three separate living documents that set forth guiding principles, operational practices, and business/budget requirements. These documents need to be created before any program begins but need to be mutable so that as the training environment or mission of the program evolves the documents evolve too.

It is imperative for a new program to first develop a strategic plan that outlines not only strategically why the program is being developed but also what the program's scope is. Although developing a strategic plan can be time consuming, you will find that the work is a worthy investment [4]. This strategic plan must be built using tenants of education and be adaptable. The strategic plan must outline the current mission of the program and its vision (future) for what the program is, in addition to establishing overarching, directive, and measurable goals. It is important for any program to measure the program's accomplishments and areas for improvement through measurable goals. Any learning objectives developed must align with the mission and vision of the program.

Without the guiding principles, a program could potentially lose its way and not support its educational purpose. In addition to the establishment of the mission, vision, learning goals, and objectives, the strategic plan provides a blueprint for your program. This strategic plan will delineate the purpose of the program you are developing. It will provide guidance for the educational strategies to be employed in the curriculum, as well as the presentation of the material, based on your statement of purpose.

When crafting the strategic plan, you should include sections on possible alliances, partnerships, and potential users, as well as how the program will provide any required preparation work that must be completed before participants attend the simulation session. This content, which is derived from the learning objectives, ensures that the program is using the appropriate learning modality for each session.

In addition to the strategic plan, a policy and procedure manual will need to be developed. This document needs to change as the program adapts to the changes in operations and mission. This policy and procedure manual will include topics such as a restatement of the mission, vision, and learning objectives of the program along with operational "rules" for staffing, communications, scheduling of sessions, priority in scheduling of sessions, record-keeping for staff time, and travel time. Additionally, the policy and procedure manual should include policies on licensure, safety, pre-site information, coverage of program, cancellation policies, fees (if applicable), and informational and session requests. The policy and procedure manual will also need to address the purchase, maintenance, updating, warranties, storing, and operations of both simulation equipment and other equipment used by the program.

If the curriculum is being used by outside educators, the policy manual will need to include the debriefing strategy to be employed and opportunities for improvement/repetition of tasks. The policy manual also provides a roadmap of how the program expects the session to be run and includes how debriefing will occur. The policy manual should also include a policy on assessment as well as a timetable of when this will occur. If assessment is provided, the manual will delineate how feedback will be given to the learner. Furthermore, any case-based learning would need to have a debriefing strategy. Your manual will provide guidance on how and when the debriefing should occur. The manual would also outline the types of training opportunities for the program's differing training sessions including the types of equipment available for use. The manual should also specify requirements for in situ vs. stand-alone training space, outdoor spaces, indoor spaces, and time constraints.

The educational strategies would outline what material is to be in included in all curriculum from the program as well as how the material will be presented. This outline would include any "prework," debriefing strategies, and rules for repetition and measurement of requirements. A section of the manual would also address how the program approaches and forges alliances/partnerships, develops grant opportunities, and manages original funding.

This manual would also provide guidance for personnel matters such as leave, definition of working/travel time, employee expectations, leave time, and ongoing educational opportunities. Staffing needs, staffing requirements, and the provision of faculty to lead simulation should also be included in this document. If your program is planning on using local educators and or faculty from other facilities, this and procedure manual must include how the equipment is to be operated and how the simulations should be run in detail.

The manual should also outline who, what, and when the program will be evaluated. Evaluation is key to determining whether the program has succeeded in meeting its goals and objectives, provides evidence of the program's strengths and outlines areas for improvement, and, finally, provides the program the evidence needed to continue to secure sustainable funding and expand operations when necessary.

In addition to the strategic plan and manual, a business plan must also be developed. The business plan outlines what is important on the business side of operations. It should include all budget information, staffing operations, equipment purchases, vehicle purchases, licensure of vehicles and drivers, warranties, purchased dates, and usage information, as well as a depreciation schedule and a policy for upgrading/replacing equipment. The business plan should center on both anticipated and unanticipated costs. Some anticipated costs include paying faculty for time to write, test, rewrite, and retest curriculum; as well as operational time spent by faculty and staff providing training. Costs of operations include equipment maintenance, use and replacement, fuel, shipping costs, damage costs, and any costs associated with the lab maintenance, downtime, or weather issues. For the first year, this business plan will be based on best estimates and information possibly obtained from other similar units in operation. After the first year, the business plan will need to be adjusted for actual costs and considerations—these actual costs and considerations will need to be captured, possibly through the use of a data management system (DMS) that would allow multiple entities to add information.

Very few of the details outlined earlier are exclusive for a mobile unit. The use of simulation as an educational methods is readily documented as the best training for procedural and skills for healthcare professionals. This planning provides a sound foundation for the program to operate in a viable and growing atmosphere. Careful, deliberate planning is required for the development of a simulation program.

Having completed the "homework" before looking to operationalize a mobile-simulation program will provide the backbone for a foundationally solid program. Regardless of whether your program would be institutionally supported or operated as an independent entity, generating the foundational documents described earlier provides any program the infrastructure needed for continued existence. The success of any simulation program is being able to provide evidence of its benefits. Simulation programs can provide numerous benefits for an organization, not necessarily only in student or staff training but also in "improving safety and patient care, improving critical thinking skills, reducing transition time for new graduates, increasing confidence and competence of the participants, reducing and eliminating errors and near misses, improving retention rates, improving efficiency through process improvements, and encouraging interdisciplinary teamwork" [4].

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Assessment in Simulation

4

Patricia K. Carstens

Medical simulation is an educational technique that provides a platform for training in interpersonal communication, teamwork skill acquisition, and skill improvement. The use of simulation allows learners to take time to acquire and/or practice interpersonal communications, medical procedures, real-world medical treatments, and hand–eye coordination. The ability to model medical situations in simulation allows the learner to engage in the situation in a safe environment. Within this environment, the learner needs to have guidance and feedback as to how they have performed. "Evaluation of a learning event is sound educational practice, which demonstrates educational coherence and allows both the session and the facilitator to evolve" [1].

Key Points

- There are two types of assessment: formative and summative.
- Attention must be paid to correctness when using simulation for summative purposes.
- It is essential to be able to demonstrate validity and reliability of assessment exercises.
- Simulation is most commonly used for formative assessment, which must include feedback or debriefing.
- Evidence supports the use of simulation for assessment of technical skills as well as nontechnical skills (i.e., communication/teamwork).

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Definition of Terms

- The terms assessment, evaluation, judgment, or competency are used interchangeably for this chapter.
- When reading the term "patient," this represents an interaction of the learner either with a standardized patient, an actor playing the patient, or in some very limited circumstances a real patient.
- Standardized patients are individuals who have been trained to play the role of a given patient condition and are able to provide relevant information to the learner.
- A standardized patient will give the same "performance" to multiple learners without varying the performance or information given.
- Standardized patients also can be trained to evaluate/assess the learner's performance. Most standardized patients are not medically trained.

Assessment Explanation The definition of assessment: "In education, the term *assessment* refers to the wide variety of methods or tools that educators use to evaluate, measure, and document the academic readiness, learning progress, skill acquisition, or educational needs of students." "Just as academic lessons have different functions, assessments are typically designed to measure specific elements of learning—e.g., the level of knowledge a student already has about the concept or skill the teacher is planning to teach or the ability to comprehend and analyze different types of texts and readings. Assessments also are used to identify individual student weaknesses and strengths so that educators can provide specialized academic support and educational programming" [2].

The guidance comes in the form of assessment.

"Epstein suggests main goals of assessment in medical education are to:

1. Identify learning needs including knowledge, skills and professionalism in order to drive future learning
2. Set professional standards of competence and performance to safeguard the public" [3].

Providing a well-crafted formative assessment or reflection of a learner's actions provides critical information for the learner. The learner needs to carefully consider guidance and assessment of their learning and repeat the exercise/lesson with changes made based on this assessment. It is important to have an assessment for any type of exercise or lesson. The assessment can be used to judge knowledge, interpersonal skills, communication skills, technical skills, or technical performance. These assessments can be either formative or summative in nature. The important principles of the process of the assessment in education should include:

- The use of different methods to evaluate differing sections or parts of a performance.
- Assessment tools need to be aligned to the learning objectives within the curriculum or course
  - Differing areas to consider include technical skills, nontechnical skills, medical knowledge, personal attitudes, teamwork, clinical reasoning, patient management skills, and self-confidence.
- Specific aspects of the learner's actions that are measured.
- Ongoing assessments that are set up at appropriate stages of the curricula/training.
- Combined focused assessments in a controlled environment.
- Use of appropriate expert evaluators for specific domains of knowledge.
- Use of combinations of assessments both formative assessment with feedback and summative assessment to verify learners are able to achieve required standards of practice.

There are a number of types of assessment. Most individuals look at assessment as a vehicle to evaluate learner success or to improve learner outcomes.

Learner Assessment

Historically, there has been the assessment of learners from early times. Learner outcomes (scores/grades/achievements) are reflected in the summative assessment of the learner's performance, and the learner is advanced based on these summative assessments. Formative assessments allow the learner to see how they are performing to gauge what they know and what they still need to learn or practice to perform a skill.

An additional piece necessary when using simulation as a teaching tool is that of event assessment. All simulation activities must meet the standard of specifically meeting the goals and learning objectives of a specific exercise.

Event Assessment

An event assessment provides the platform for the evaluation of a given exercise. It is important that the event designed meets the requirements of the learning objectives and provides the basis for the learning experience. Simulation activities must be assessed to verify that the exercise is providing the experiences necessary for the learner to achieve the goals set forth in the learning objectives for the exercise.

Both formative and summative assessment have the ability to provide performance feedback to the learner.

Formative Assessment

Formative assessment is designed to direct future learning. Formative assessment is most frequently employed with the use of simulation. A student is able to compare their performance to the required performance standards with an eye to improving performance rather than obtaining a single standard mark. Formative assessment is also known as learning assessment, whereas summative assessment is designed to provide the process of making standardized judgments about the learner's performance.

Feedback must accompany formative assessment. Feedback tells the learner how they are doing, whether they have achieved a given standard, or what they need to do to improve their performance. The feedback can be in verbal, video taped, or written form. Formative assessment also gives the instructor information on how well the learner has grasped the previously provided educational material and provides the instructor a glimpse of what they may want to reemphasize before a summative evaluation or assessment of the learning. Formative assessment must be valid and should be reliable. Repetition of an exercise *with feedback* is a form of formative assessment.

Summative Assessment

A summative assessment demonstrates the achievement of standards or procedural requirements for a specific course, lesson, or technical skill. Specific technical skills are required before the learner can perform given procedures on a patient. Summative assessments allow the learners to be compared to specific standards and can be used for licensure or renewal of licensure. These competency assessments are summative in nature. Summative assessment is generally used as a final score or mark of completion.

Validity in Assessment

Assessment tools need to reflect what is tested. The tool must also be valid for the given exercise. The tools need to reflect what expectations of completion a learner must accomplish. You need validity in your assessment tool for both formative and summative assessment.

Content validity refers to the extent to which the elements of the exercise are *relevant* and *representative* of what the learner needs to know and is being tested on.

Construct validity judges the assessment tool to see if it is actually assessing what it should. Has the assessment tool been developed in such a manner that it was consistent with the exercise learning objectives arranged in an orderly manner?

Predictive validity provides evidence that the assessment tool reflects the standards or similar assessments for the same topic.

Reliability in Assessment

Reliability in assessment describes the ability of the assessment to be reproduced in similar circumstances or at other times when the simulation event is held (test–retest) reliability.

In addition, an assessment tool needs to have inter-rater reliability. *Inter-rater reliability* refers to the achievement of the same results between multiple raters scoring the same performance. Intra-rater reliability refers to the ability of the scores given by a single rater at multiple assessment of the same performance would be the same. The reliability of assessment tools should be performed.

"There are a number of differing methods or tools for use for assessment as outlined by the 2010 Ottawa (Assessment in Medicine) Conference in 2011" [3].

Some of these tools include checklists, satisfaction surveys, self-assessments, ongoing assessments, peer assessments, rubrics, and global rating scales.

Checklists

The use of checklist-type assessment allows for the direct observation of performance. A checklist allows the evaluator to indicate whether a step was taken or not. Generally, checklists are used in conjunction with task trainers where there is specific set of steps and are usually yes/no type questions. Checklist assessment can be a list of steps or a multistep process, and only the items completed or not completed could be marked for quick tally of points or scores. Additionally, checklists can be employed for communications between a learner and a "patient," but there are limitations to the ability of the checklists to accurately record the interactions between the patient and learner. If using checklists for interaction, the checklists have to be extremely specific in nature so that the "patient" or evaluator is able to determine yes/no, right/wrong. If the assessment has degrees of rightness or wrongness, a rubric or global rating scale would be a better fit.

Checklists have a number of limitations. With a checklist, generally it is yes/no or did/did not complete. This type of assessment is easy for novice evaluators to use but has limited ability to judge the "completeness" of the skill or step. Checklists are too limited in nature to provide definitive evaluation of competence. The inability to add information or to provide incomplete or incorrect steps to the lists of questions does not provide the substance for use in competency determination.

Rubric/Global Rating Scales

A rubric/global rating scale allows the evaluator to evaluate the learner on a scale or degree of completeness. A rubric provides multiple scoring scales for a given skill performance or degree of competence. Rubrics are descriptive in nature and are provided in a grid pattern of the sliding scale from the lowest to the highest scores or highest to lowest scores. Under each score is a brief description of the performance required to earn that specific score for each individual step of the performance. Global rating scales or rubrics are extremely helpful with assessing the learner's ability in being professional when being faced with a delicate situation. Developing rubrics/global rating scales takes time and skill.

Likert Scale

A Likert scale is a questionnaire or survey tool that allows the evaluator to determine the levels of completion of a skill, task, or step. It is similar to a rubric or global rating scale in appearance but is used generally when attitudes, opinions, and behaviors are assessed. Likert-type survey assessments work well when questioning satisfaction and/or confidence. You will always want to have at least three choices for any Likert scale assessment.

Satisfaction Surveys

The use of a satisfaction survey allows the assessment of the learner's attitude toward the training. It can also be employed as a device to measure whether the learner is planning to adopt a new process or skill through repetitive follow-up surveys based on the continued use of a new process/procedure.

Self-Assessment

Self-assessment allows the learner to assess their skill or confidence in the completion of a given task or interaction with a "patient." Self-assessment generally measures critical thinking skills dealing with principles, attitudes, judgments, and philosophies. A self-assessment tool needs to be included if you are looking for the learner to make changes in their habits or thoughts with regard to their day-to-day activities. A self-assessment tool can help the learner understand their current competency level and provide a vehicle of the learner to accept change.

Peer Assessments or Reviews

Peer assessments or reviews assist with the reinforcement of behaviors and is well suited for the use with team training and/or interprofessional training. Peer assessment can be achieved with two differing formats. Peer assessment is a valuable tool for formative assessment but is peppered with complications for summative assessment. You can do peer evaluation either in written form or orally with oral feedback. If the learners have never experienced peer evaluations before, it is best to start with a written evaluation that the learner can read, digest, and react privately before doing any oral peer evaluation. The success of peer evaluations are dependent on the comfort level and relationship of the peers and the acceptance of nonthreatening formative assessment by the peers. All learners will need to be instructed on the guidelines and appropriate topics for peer evaluation *prior* to either written or oral peer evaluation being completed.

For peer evaluation to be successful, ground rules for the peer evaluation must provide for:

- Training in the process of peer evaluation
- Explicit boundaries of the evaluation that is to be given
- An environment for the peer to give the evaluation
- An environment for the learner to receive the evaluation
- The ability of a recognized instructor, administrator, or simulation expert to support the peer evaluation process

Live Evaluations/Video Playback Evaluations

There are pros and cons to the use of just-in-time evaluations versus the review of video playback for the assessment of a learner. Just-in-time evaluation can damage the learner's ability to perform "under scrutiny," and the learner may be more engaged with the evaluator's actions than that of a standardized patient during the demonstration of skills.

Video playback may not have the capabilities of seeing all the actions taken by the learner if the cameras are not set up properly or if the learner moves out of the camera's line of sight. Multiple technical problems with sound, inability to see clearly, and inability to see over the learner hamper the effectiveness of evaluation of a learner on all the steps or processes the learner is required to complete.

Feedback/Debriefing

All *formative* assessment *must* have a process for providing feedback on the learner's performance or skill acquisition. The learner needs to know what they have completed correctly and what they need to do to improve their performance. Formative assessment feedback can be done in a number of different ways. "The BEME simulation review identified feedback as the single most important condition to facilitate learning using…simulation." The BEME "found approximately 75% of the studies indicated a positive effect of feedback" [3].

Assessment tools themselves can provide some feedback to the learners. A checklist will provide information on steps missed or done incorrectly; likewise, a rubric will illustrate to the learner what they need to do to get a higher score.

Feedback is where the learning happens in simulation. Similarly, when performing formative assessment with the student, providing information on what was done incorrectly or not done and what was done correctly helps the learners focus their additional efforts on the exercise. Repetition with feedback is a form of formative assessment.

Quality Assurance

"According to Van Der Vleuten's 'utility index' good assessments should combine FIVE properties: reliability, validity, educational impact, cost efficiency and acceptability…a sixth attribute-feasibility" needs to also be included" [4]. These properties need to be viewed as a whole. "The relative importance given to each of these properties may depend on the goals of the assessment and the setting in which it is being conducted" [3].

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Program Evaluation

5

Andrew Musits

Key Points

1. Program evaluation plays a critical role in any mobile simulation program.
2. The program evaluation needs to remain objective, context appropriate, with data-driven recommendations.
3. A well-executed program evaluation can help a simulation program reach its full potential.

Introduction

Program evaluation is not unique to healthcare simulation. It is a well-developed technique applied across many industries. Indeed, the concept is common in the educational world, but it is also applied to public health initiatives, manufacturing, advertising, and marketing industries.

First, a few definitions need to be agreed upon. For the purposes of this chapter, the following terms are defined:

- Program: A defined education, research, or assessment activity that has specific objectives. This may be a course, assessment, or quality improvement program.
- Evaluation: Assessment and investigation to reveal the quality and effectiveness of the subject under review.

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Program evaluation has been defined as "a study designed and conducted to assist some audience to assess an object's merit and worth" [1]. A program evaluation in the context of simulation programs is an investigation of a simulation course or initiative to understand its quality and effectiveness.

Program evaluations must be differentiated from learner evaluations. A learner evaluation is an assessment of the individual, to provide either a summative or formative feedback. Learner evaluations are often a key component to a successful simulation training program and are covered in depth in the previous chapter. The success or failure of learners in a program may be one component used to assess the quality and effectiveness of the simulation program. Therefore, data from learner evaluations may be included in a program evaluation. The other components of program evaluation will also be discussed in this chapter. However, before the individual components are explored, the overall framework needs to be considered.

Why Perform Program Evaluation?

The most generic answer to this question is to see if the program is meeting the goals, or if it has accomplished what is set out to do. An evaluation can provide meaningful data to improve the program in the future. Lee Cronbach promoted the idea of using program evaluation to make decisions about educational initiatives in the name of course improvement in the 1960s [2]. Accrediting bodies can use program evaluation to grant certification and suggest a certain level of quality. Program evaluations can help a simulation center appropriately allocate resources. In a busy simulation system with limited resources, it can help one decide which programs to continue, modify, or discontinue. Program evaluation helps with future budget proposals and may demonstrate the value added to the institution or health system. Program evaluations help simulationists understand how to better integrate into the larger picture, in a cost-effective manner, with appropriate resource allocation. Program evaluation is a feedback mechanism to prevent one from flying blindly or investing resources in ineffective programs. It can empower one to make these programs more effective.

Existing Models/Framework

Speaking in broad terms, program evaluations can be divided into two categories: institutional self-study or external accreditation [2].

Institutional self-study example: Your mobile simulation program runs a CPR training course for providers throughout a large hospital system. As the director of the simulation program, you undergo a self-study. You want to determine how successful the program is and how to take it to the next level. You start a cycle of program evaluation for internal purposes.

In contrast, external review occurs when an outside organization reviews your program. The Society for Simulation in Healthcare's accreditation program performs external review of simulation centers. Other examples of external program evaluation include the Liaison Committee on Medical Education (LCME) for medical schools and Residency Review Committee (RRC) for physician residency programs. One of the first and most well-known examples of external review in medicine is the Flexner Report. Abraham Flexner published a report in the early 1900s after visiting 155 medical schools, performing a program evaluation of each. He believed in the value of an outside perspective, as he was not in the field of medicine [3].

Both categories can have various levels of rigor. A self-study may be more prone to bias. One must remain conscious of this as data is collected and interpreted. Objectively collecting and analyzing data and making honest self-assessments will result in more meaningful program improvements, albeit may require one to swallow their pride.

There are several existing frameworks to help conceptualize and operationalize program evaluation. Examples can be found in healthcare organizations including the Centers for Disease Control (CDC) and National Diabetes Education Program. The CDC model is illustrated in the "framework for program evaluation in public health" [4]. This graphic emphasizes the continuous loop of feedback and evaluation contained in a strong program evaluation. It begins with engaging important stakeholders and ends with sharing lessons from the program evaluation. It has been used to evaluate public health initiatives such as tuberculosis contact investigations [5]. A similar framework is used by the National Diabetes Education Program to evaluate its educational programs [6].

Circle of Program Evaluation Adapted for Simulation Programs

Considering the aforementioned frameworks, a simplified model appropriate for healthcare simulation programs is presented. It serves as the scaffold for the remainder of this chapter. This model begins by identifying program goals and objectives. It suggests a continuous feedback loop to gather and analyze data and suggest program revisions while taking the context and stakeholders into consideration (Fig. 5.1).

Let us expand each of the components defined by the model described earlier using illustrative examples relevant to healthcare simulation.

Context

Holden and Zimmerman developed a conceptual model for program evaluation called "Evaluation Planning Incorporating Context" [7]. This model emphasizes the importance of understanding the underlying factors surrounding a program. This includes the level of organizational support, expected uses of the evaluation results,

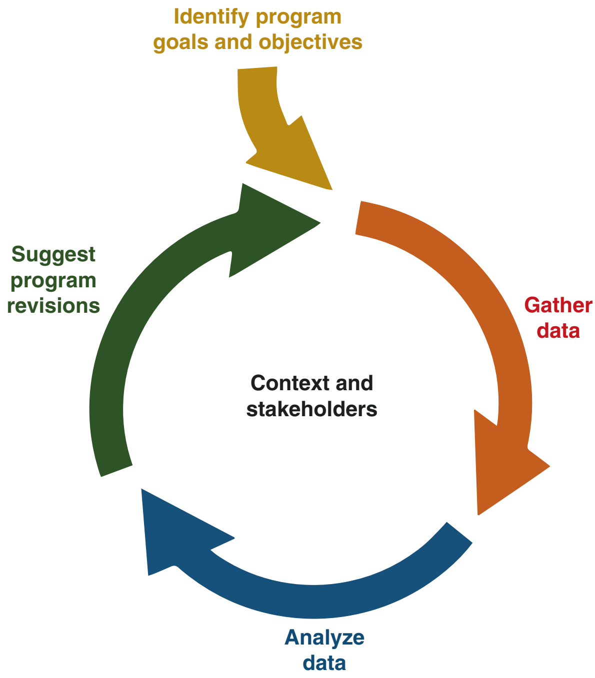

Fig. 5.1 Circle of program evaluation for simulation programs

and the organizational and political environment surrounding the program. Consider the following two examples that demonstrate very different organizational and political contexts.

> *Contextual example 1: Your hospital system has recently invested in a mobile medical simulation unit. This is part of a larger public relations campaign to demonstrate a commitment to patient safety. The hospital president and marketing department have asked you to provide a program evaluation.*
>
> *Contextual example 2: Your hospital system is struggling financially due to a shifting payer mix and decreased reimbursements. All services are being evaluated, and those not deemed critical or financially feasible may be discontinued. The hospital president has asked you for a program evaluation of the mobile medical simulation unit.*

In this first example, hospital administration is eager to see the success of the program. The focus here may be on the visibility of the program. A simple program evaluation with simple user metrics may be satisfactory. In contrast, the hospital administrators in the second example may be much more critical of your evaluation, and it will be important to have clear objective data regarding the value of the program. In this context, the focus may be on the return on investment.

One of the key contextual questions to answer is what is going to be done with the information obtained from the program evaluation. At the start of this chapter, a broad range of reasons for program evaluation were proposed. Common questions to answer with a program evaluation include:

- Which programs should continue?
- Which programs should be terminated?
- How can one make an existing program more efficient and cost-effective?
- How can one improve the quality of an existing program?

Is one attempting to identify which programs are continued and which ones are to be terminated, much like a fisherman culling his catch? Is the program required but needs to be more efficient and cost-effective? Is it a new program that needs evaluation and possible improvement before expanding to additional sites or learner groups?

Stakeholders

In healthcare simulation, one might argue that the ultimate stakeholder is the patient. The training and evaluation efforts often focus on the end goal of improving bedside patient care. Sometimes simulation programs may be several layers removed, and one must consider other surrogate stakeholders. Ask the questions: Who is the client? Who is the customer? The answer may be broader than one realizes.

Stakeholder example: Consider an in situ program for urinary catheter placement. You have been consulted for this by the hospital quality office after noticing a rise in urinary catheter-related infections. Note the following different stakeholders:

The patient: The patient is arguably the ultimate stakeholder, looking to avoid a longer hospital stay, complications from the infection itself, or the antibiotics prescribed to treat it.

Hospital administration: The administrators from the hospital quality office are providing you with the funding for this program, so they are an obvious stakeholder. They are expecting a return on investment. When a hospitalized patient gets a catheter-related infection, some of the hospital stay may not be reimbursed by the insurer. Therefore, every catheter-related infection results in increased costs and lower reimbursement. By investing in the simulation program, an overall expense reduction is expected.

Clinical nurses: The simulation training participants undergoing the training are stakeholders. Is the training done at a convenient time and location? Does it make them feel empowered or belittled? Do they actually learn new techniques?

Faculty: Your nurse educators are stakeholders. Are they given the time, tools, and support they need to teach effectively?

Simulation operations staff: The staff responsible for delivery, maintenance, and setup of the urinary catheter task trainers are stakeholders. Are they given the time, tools, and support they need to effectively do their job?

Goals and Objectives

Keeping in mind the context and stakeholders, one can now develop the goals and objectives. These guide the specific questions asked and data gathered in program evaluation.

Goals and objectives may already be identified during the development of the program. This is a critical step in the development of a high-quality curriculum [8].

However, one may come across a program that does not have clearly stated goals and objectives. In this case, it is important to meet with the course director and other stakeholders to clearly identify the goals and objectives of the program.

The development of goals and objectives is beyond the scope of this chapter. Briefly, goals are broad desired outcomes. Objectives are specific and measurable.

Example: Consider an airway course for hospitalist physicians.

Goal: The program goal is to improve the ability of hospitalist physicians to ventilate patients during Code Blues when other specialists are not immediately available.

Learner-focused objectives: The program objectives include: (1) Obtain effective bag valve mask seal. (2) Demonstrate the ability to properly position a supraglottic airway device. (3) Give one breath every 4–6 seconds with sufficient volume to cause chest rise.

Objectives may be learner focused, process focused, or outcome focused [8]. The aforementioned examples are learner focused. When starting a program evaluation, you may want to expand beyond the learner and include process- and outcome-based objectives. These can be more difficult to measure but can also provide valuable information.

Example of process-focused objective: 80% of hospitalists will participate in the airway course in the next 18 months.

Example of outcome-focused objective: 60% of in-hospital Code Blues will have supraglottic device in place within the first 5 minutes of hospitalist arrival.

Gather Data

Once the goals and objectives have been defined, one can begin to gather data for the program evaluation. Collecting data on the performance and effectiveness of a program is what many traditionally think of when it comes to program evaluation. While it is only one step of the process noted in the circular model of program evaluation, it is critical. The conclusions and recommendations are only as good as the data used to derive them.

Scope and Volume Data

One of the easiest and most objective metrics to collect during a program evaluation are usage statistics. This may include the number of courses in a program, the number of participants, or the geographic scope of a mobile simulation program.

Other discrete numerical data that can be collected involves resources and costs. How many hours of sim specialist labor were used? How many miles were driven? How much in tuition and fees was collected?

One important element to consider is the concept of fixed versus variable costs. A program likely has many costs which are steady regardless of the number of courses. Other costs are more dynamic and related to the number of simulations delivered. Equipment, staff, and case development time make up fixed costs.

Variable costs are related to the individual event and include expenses that are directly related to the number of simulations conducted. Consumables such as manikin skins, IV catheters, and disposable gloves make up variable costs. These materials are only good for one or a few uses.

Operations Data

Just as participants and learners are surveyed about their experience with the simulation program, it is valuable to collect satisfaction data from your operations staff. Questions one might be interested to include are: What makes the program run well on good days? When the program does not run well, why is this? What challenges and inefficiencies do you face on these days? Are there equipment or resources that would allow you to provide better service to our participants? Often, the frontline operations staff can provide qualitative insights into how a simulation program can improve. Data from this source should not be overlooked.

> *Example of qualitative data from operations staff: You receive qualitative feedback from your simulation specialists that they are often missing equipment during in situ mock code events. They note that a lot of time is spent in preparation and gathering the needed equipment from the store room and various locations around the simulation center.*

Learner and Patient Data

Measuring the performance of the learners in your simulations is another source of data for program evaluation. This data exists on a spectrum of quality and rigor. It can range from simple outcomes, such as self-reported participant satisfaction, to highly objective outcomes. William McGaghie described one framework to categorize data along this spectrum using a translational research model [9]. Level one (T1) is the ability of the learner to demonstrate the skill in the simulated environment. The second level (T2) assesses the participant's skill in the clinical practice environment. The third level (T3) involves assessing patient outcomes. This no longer looks at the individual learner, but at patient outcomes (Fig. 5.2). An even higher level of impact is sometimes considered (deemed T4), looking at larger systems-based outcomes.

The following are examples of all three levels presented, using the simple example of central line placement.

- T1: The learner is able to successfully place a central line on a task trainer using the appropriate technique.
- T2: The learner is able to successfully place a central line on a patient in the clinical environment using the appropriate technique.
- T3: Patients have fewer central line-related complications.
- T4: There is a health system cost savings due to shorter hospital stays and less material waste.

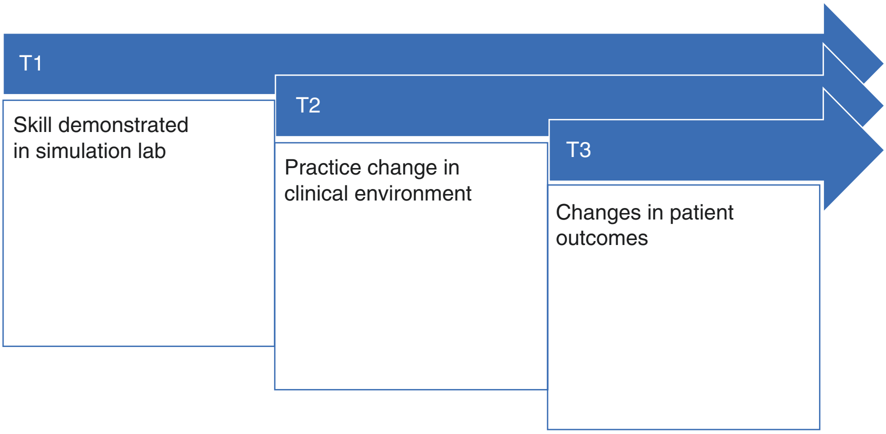

Fig. 5.2 Translational research levels adapted for simulation assessment

As you progress from level T1 to level T4, the overall rigor and quality of the data improves. However, there are some trade-offs. As you progress toward level T4, the data is often more difficult to collect in terms of both time and money. It is also more likely to be affected by confounding variables (more on this later).

Validity

When gathering data, it is vital to understand the concept of validity and how it relates to your data gathering tools. In the most basic sense, a valid tool is one that measures what it intends to [10]. For example, let's say I want to look at how busy a simulation program is. In other words, what are the learner contact hours? A database function that counts the number of different students that come through my program may not be a valid measure of this. Why? It does not account for repeat business. What if the same learner participates in the program twice? To further increase validity, it would also have to look at how long the learner participates in the program. Thirty minutes of participation needs to be counted differently than 2 hours of participation for a valid measure of learner contact hours.

When collecting data, learner evaluation instruments such as checklists and global assessments with anchors are often used. The validity of these instruments becomes even more complex than the earlier example about learner contact hours but remains equally important. There are various levels and types of validity. For example, a test might be valid with one type of learner, but not others. A complete description of the types of validity and how to validate evaluation tools is beyond the scope of this chapter, but one must be aware of the validity (or lack of validity) of the tools used to collect data in the program evaluation process. If the tool used to collect data is not valid, then there is no way to draw appropriate conclusions from it in the program evaluation process.

Data Collection: Logistical Considerations

Whether you decide to collect learner outcome data, basic usage statistics, or operational efficiency data, there are practical considerations regarding how you collect and store them. Some examples include:

- Surveys: Surveys can be used to collect qualitative data from simulation participants, operations staff, and other stakeholders.
- Exams: Exams range from written knowledge-based exams to practical evaluations. This provides more objective data than surveys and is one method of obtaining learner data. Exams should be validated in order to provide the highest quality evidence.
- Checklists: These can be used to observe performance in simulated and clinical settings. Checklists are one way to score practical exams. Similar to exams, checklists should be validated in order to provide the highest quality evidence.
- Patient data: Patient data can be gathered from databases and chart reviews. This will often require a unique set of permissions and must maintain a vigilant level of security to protect patient information and confidentiality. Some healthcare systems may be able to provide de-identified aggregate statistics on some variables like rates of certain patient outcomes through the patient safety or quality office. The accessibility of this information will likely depend on your institutional policies and may require written institutional review board approval.

Traditionally, surveys, exams, and checklists have been completed on paper. However, many options now exist for the electronic gathering of data. This input at origin technique can save data transcription. It has been shown to reduce personnel time and reduce errors [11]. Many applications can be used for collecting survey data. A few examples are Qualtrics, Red Cap, Survey Monkey, and Google Forms. Some are free and openly available, while others have cost associated with them. Other applications can be used to input other forms of data. Google Forms is free and customizable. It can be used for creating electronic sign-in sheets, surveys, feedback forms, and course evaluations.

> *Practical application example: Previously, you used to track participant data by circulating a clipboard at each event, having participants write down their name, credentials, and email. After the event, you would enter the information into an electronic database. This was time consuming. Occasionally, you would have a typographical entry error. Frequently, a participant's handwriting would be illegible.*
>
> *Now you have created a Google Form to create sign-in attendance. You write a short link on the board, and individuals can access this on their smartphones. The forms asks for the same information: name, credentials, and email. This information goes directly into a spreadsheet you can access online. You bring a couple of tablets to circulate for those learners that do not have a device of their own with them.*

Other opportunities for electronic data collection and entry include various mobile applications, high-fidelity simulation software, and clinical device software. iCoda is a mobile application that can be used for recording real-time observations. With this application, each button click records a time-stamped event that can be easily transferred into a spreadsheet. Many of the software programs used to run high-fidelity mannequins have the ability to create event logs, recording all of the actions detected by the mannequin and operator. Some clinical equipment is also capable of collecting data. For example, some defibrillators can track the rate and depth of chest compressions during CPR.

While the aforementioned techniques can help improve your ability to collect data in real time during simulation events, this can still be challenging. It may be tempting to video record events to aid with data collection by allowing for review in a controlled environment. Many options exist for video recording, ranging from cell phone cameras to commercially marketed audiovisual systems. Several complexities must be recognized when video recording. It is advisable to get participants permission before filming and inform them of how the recording will be used, retained, or distributed. Filming in patient care areas is even more complex due to the privacy issues surrounding incidental captures.

Quantitative vs. Qualitative Data

The examples of data discussed earlier include both quantitative and qualitative data. Quantitative data is usually numerical or binary. Examples include the number of learner contact hours or the number of certifications granted. Usually, this is objective data. In contrast, qualitative data is more subjective. It includes satisfaction scores and participant perceptions. Both types of data are incredibly important and provide different levels of insight. Quantitative data is discrete and often easier to organize, summarize, and perform statistical analysis. The story-like nature behind qualitative data can provide insight and understanding of objective quantitative data [1]. This will become evident in the next section when we begin to talk about the data analysis phase of program evaluation.

Data Analysis

In the analysis phase of program evaluation, one attempts to make sense of the data collected. The first step in this process may include running basic statistical tests, especially if the data is quantitative. One might recognize patterns, disparities, or trends in data. Trends may occur over time, across various geographic sites, or across learner groups. In addition to trends, one might obtain results different than expected. Once differences are identified, one ought to ask the question of why. Why has satisfaction decreased? Why have test sores increased? Why does one site perform better CPR? Perhaps there are differences based on the equipment or facilitators. In the analysis phase, you identify disparities and look for explanations.

Example: Perhaps you were expecting your rookie facilitator to be associated with less favorable evaluations. You realize that evaluations on the rookie's teaching days actually outperform some of your veteran facilitators. You ponder the following possibilities: (1) Your rookie facilitator is more skilled because he has recently undergone training and is up to date on the latest techniques. (2) Your veteran facilitators are burnt out, resulting in a demeanor and interactions with participants that negatively affects their evaluations. (3) You have been really nervous about this rookie facilitator, so you have always paired him with your best operations specialist. Maybe all your facilitators are equal and your operations staff is the cause of the disparity you see in your evaluations. Which of these possibilities is true? You must look to your qualitative data for an explanation.

Alternately, some of your data may be qualitative. Here you can also look for trends, but first it is important to look at themes. What are the common themes presented in comments on evaluations and surveys? While there are formal methods to perform thematic analysis, in most circumstances, a simple review by the program evaluation team will suffice.

Example from analysis phase: You have a mobile simulation van and travel to provide simulation enhanced basic life support (BLS) and advanced cardiac life support (ACLS) certifications for various urgent cares, public safety departments, and childcare centers. You have gathered data on the course completion rate for last year. While 100 people enrolled in the course, only 80 certifications were granted. In your analysis phase, you calculate the pass rate as 80% and ask the question: What you can do about the 20% failure rate? Is this something beyond your control? Do participants drop out when they interact with a particularly abrasive instructor? Is the material challenging? Could you enhance your pass rate by providing pre-course materials? What about providing some remediation from struggling learners? You review your course evaluations from participants and faculty and meet with your operations staff to obtain qualitative data. Can you find any causes or explanations?

Attribution

The concept that a result is caused by a given thing or action is known as attribution. During the process of program evaluation, especially in the analysis phase, the program evaluator draws conclusions based on attributing various outcomes to certain processes. However, the change might actually be attributable to some other concurrent factor. For example, central line infections are noted to decrease after an institutional central line insertion program you started. Your program evaluators attribute this to the training program. However, at the same time the insertion program for physicians was started, a new nursing protocol for central line care and dressing changes was also initiated. Is the decrease in central line infections attributable to the physician training program, the nursing protocol, or both? This concept is similar to a confounding variable in medical research.

Conflict of Interest

Program evaluators must be conscious of potential conflicts of interest. When evaluating one's own program, the program evaluator may insert their underlying bias into the type of data that is gathered and how it is evaluated. This bias may occur unconsciously and without any intent to affect the results. It is important to be aware of your own preconceived notions, remain as objective as possible, and involve objective third parties when appropriate.

Outliers

Whether the data is qualitative or quantitative, your analysis may uncover some outliers. An outlier is a data point that is greatly separated from the rest. If there is a sole outlier in a large data set, it may be due to an input error (a user misunderstood the scale on your survey tool) or data transcription error (error when checklist data is entered into a database), and it may be appropriate to discard this data point from your analysis. However, the program evaluation team should consider other explanations prior to removal of a data point (Fig. 5.3).

In the analysis phase of program evaluation, you learn things are not always as they initially appear. Careful review of the quantitative and qualitative data may bring new revelations.

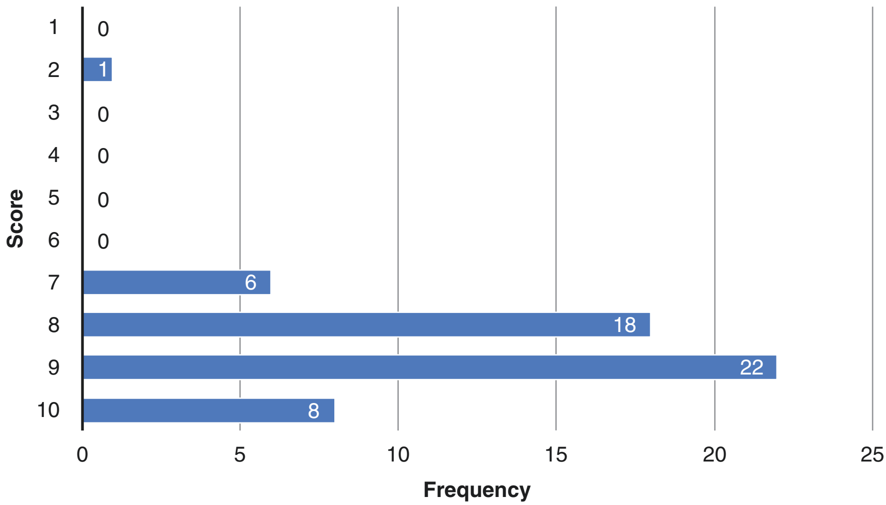

Fig. 5.3 In the following example, one participant had a score of 2. This is a clear outlier when compared to the other 54 participants

Suggest Program Revisions

The next step in program evaluation is to suggest program revisions that will address the issues identified in the program analysis. When making suggested program revisions, it is helpful to think of them categorically. The categories may vary based on the type of simulation program but may include curricular changes, operations changes, and evaluative changes. It is especially important to categorize revisions if different people in the organization are responsible for these different areas.

Curricular changes may include what is being taught, the order in which it is presented, or the teaching methodology. Healthcare is a rapidly evolving field, and sometimes the curriculum may need to be updated to correspond with the latest evidence-based medicine, clinical practice guidelines, or local policies and procedures. Core faculty members are responsible for curriculum development, changes, and updates to curricular materials.

Operational changes may include types of equipment. Perhaps new equipment is now available in the clinical setting. Operational revisions need to be made to reflect this in the training environment. Scheduling of training sessions may be another operational change. Perhaps the time of day or calendar month is affecting the breadth of participants available. Scheduling changes may be necessary to maximize the impact of your program. Simulation specialists, or an operations manager, may be responsible for operational decisions. There may be other underlying influences such as staff availability or the availability of teaching space that need to be considered.

Evaluation tools might need to be swapped with more valid measures. Perhaps the user interface needs to be changed, allowing for easier accessibility, higher response rates, or easier data management.

When suggesting program revisions, it is critical to know who the stakeholders are. Who is empowered to make changes? If you are not empowered to make changes yourself, who do you report to? One common example of this includes evaluation of Code Blue response programs through the use of simulation. As the program evaluator, you are not likely to have the ability to make changes to the code response system. Instead, you need to share the results of your evaluation with the personnel with the ability to make changes. In this case, it may be the hospital cardiac arrest committee. In another example, you have identified operational changes the simulation specialist must implement. They answer to an operations manager, so the suggested revisions must be presented to him or her.

How program evaluation data and suggested revisions are presented is important. To help facilitate buy-in, avoid being negative or overly critical. The best way to do this is to remain objective, data driven, and nonjudgmental. Support your recommendations with factual information. Structured reports can be helpful. A report may be structured in terms of the phases of a process. Another approach is to organize in categories. Example categories might include curriculum, operations, and assessments. Regardless of the structure chosen, this becomes increasingly helpful when involved in continuous program improvement using multiple cycles of program evaluation. If you are providing a monthly or quarterly report, maintaining a consistent format makes it easier to compare one cycle to the next. It also helps the recipients interpret the information as they become comfortable with the format.

Confidentiality/Sensitivity of Data

The data collected during program evaluations is particularly sensitive and must be treated confidentially. This applies to the macro (institutional) and micro (individual) levels. Patient data will likely fall under HIPPA regulations. De-identified and composite patient data is also particularly sensitive. Healthcare systems, individual practice groups, and emergency medical services (EMS) agencies are sensitive to their reputation and public perceptions. Similarly, learner data is sensitive. On a global level, the educational institution is concerned with is reputation of producing competent highly qualified graduates. The individual learner is concerned with who can see their educational outcomes. This concern arises out of fear that it may affect future evaluations or their ability to land a desired job after graduation.

After making revisions to your program, the cycle repeats. The next cycle of program revision assesses the effectiveness of the changes just implemented. Think of program evaluation as a continual process. It is also important to periodically review the goals and objectives, as well as the context and stakeholders in the program.

The circle of program evaluation is best suited when the context of the evaluation is process improvement to help a simulation program reach its greatest potential. However, if your results demonstrate that a program has become ineffective and cost prohibitive or has outdated objectives, the best course of action might include terminating the program and investing your simulation efforts in a new program.

Conclusions/Recommendations

Program evaluation plays a critical role in any mobile simulation program. It should be based on the program goals and objectives and be conscious of the context and stakeholders. The cyclical nature to the program evaluation process allows for continual improvement and reassessment. The program evaluation needs to remain objective, context appropriate, with data-driven recommendations. Well-executed program evaluation can help a simulation program reach its greatest potential.

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Mobile Simulation Logistics

6

Timothy J. Devine

Key Points

1. Logistics for simulation exercises includes planning for instructors, equipment, staff, learners, supplies, site, schedules, location, and weather
2. Representatives from each group participating in the simulation exercise should be represented or included in pre-exercise planning
3. Scheduling is often the most challenging logistical problem facing mobile simulation planners
4. Back up parts and plans are essential for mobile simulation exercises

Logistics The detailed coordination of a complex operation involving many people, facilities, or supplies

Logistics of Simulation

Simulation logistics is the detailed organization and implementation of a complex operation that has many moving parts. The management and flow of these parts from the beginning stages to the end of your simulation have to be evaluated and checked for accuracy. The simulation must provide coverage to your learning objectives and insure that all stakeholders have had their objectives met.

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Many issues can arise during any simulation and considering mobile simulation those issues can increase in a number of different ways because typically you are not in your normal simulation environment.

Resources managed in logistics with regard to simulation can include physical items, such as your simulator, workspace, equipment, and supplies; as well as abstract items, such as information and time management.

The logistics of physical items usually involves the integration of information flow, material handling, production, packaging, inventory, transportation, housing, and often security.

Mobile simulation can mean a lot of different things depending on how your system works. For example, a mobile simulation could mean that you take your simulator outside your facility and run it in a place other than in your simulation lab, or it could mean that you have a simulator that is constructed in the back of a van (ambulance), truck, or mobile home. In this chapter, we will discuss the differences and logistics for all of these types of scenarios. Included will be logistical concerns from the beginning of your case information guide to testing your simulator in the environment it is to be used in.

Case Information Guide

The case information guide is the very beginning of the building blocks of a particular simulation; often times, this is where the logistics of the simulation begins to take shape. During the development of the case information guide, you will begin to formulate plans on how to accomplish the learning objectives of the case.

When developing the case information guide, it is important to understand the capabilities of your simulator and make sure you can accomplish the desired effect. All simulators are not created equal and typically have specific functions; there is nothing worse than developing a case and realizing that the functionality does not exist on your simulator.

The development of the case information guide should include input from all stakeholders. It will discuss topics such as date and time, case title, demographics of the patient, the developers of the case information guide, subsequent revisions, and the desired learning groups for the case. The next section should describe the rationale for the case and list the goals of the educational rationale.

The learning objectives should also be listed and you may have different objectives based on the level of the learner working on the particular case. For example, let's say you have a case for acute myocardial infarction (AMI); you may use the same case information guide for a basic provider and an advanced provider. The learning objectives may be completely different, the basic provider may have to evaluate and recognize signs and symptoms of AMI and begin treatment by providing aspirin; whereas, your advanced provider would also have the same initial objectives but continue with advanced treatment such as IV (intravenous) placement, drug dosing and administration, and EKG (electrocardiogram) recognition.

This is where the logistical aspects of the case come into play; you must insure that you will have the capabilities to simulate all treatment and ailments for the patient described. When you're in mobile situation, meaning your simulator will be outside in the elements, simple things like weather conditions can have a significant impact on the way your simulator will react. Conversely, if your mobile simulator is in a van (ambulance), truck, or mobile home, the simulator will be protected from the elements; however, the vehicle may be impacted and other logistical things will need to be considered. Vehicle noise in a residential area may be an issue and figuring out the best way to limit that is a logistical concern. Extreme temperature may also influence the length of time a case can run, thus limiting the number of participants who can take part in the sim.

Resources such as articles, books, and perhaps standardized guidelines that are used to develop the case stem should also be listed in the case stem; this can be updated to reflect any changes in methodology.

Next, a preparation list should be generated; this will list the type of simulator to be used and the supplies to be commonly used during the simulation. This may also include any supporting files such as lab values, X-rays, and other documents that guide the provider. A simple checklist will suffice (see Table 6.1).

A description of the duration of the simulation should also be listed and include all portions of the simulation. See the following example:

- Set-up – 10 minutes
- Pre-brief – 5 minutes
- Simulation – 20 minutes
- Debrief – 35 minutes
- Clean-up – 5 minutes

The total duration of the simulation should be timed several times and tested for accuracy, for instance, a 10-minute set-up time may increase depending on how many simulations are done consecutively. In other words, for the first case, it may only take 10 minutes to set up the simulator but as it is used over and over again, the time needed may increase based on what the providers are doing to the simulator. For example, if the case requires that the simulator has to have bleeding control, then over time you may have to change linens, or clothing on the simulator to insure

Table 6.1 Sample preparation list

x	Simulator or equivalent	x	Urinalysis
x	Oxygen	x	Cardiac enzymes
x	12 lead EKG	x	Coagulation studies
x	ETI equipment	x	SPo2
x	IV equipment	x	Body temperature
x	IV simulator	x	Spare batteries
x	Waveform display		
x	Chest X-ray (digital)		
x	ABG		
X	CBC		

that the case is repeatable for the next participant. This may add significant time thus delaying the next encounter for the learners.

The case stem should be included in the case development guide to provide a general, repeatable explanation of the events to take place for the beginning of the case.

Example:

55-year-old man presents to the emergency room with crushing chest pain after shoveling snow. The pain takes his breath away at times and radiates to his jaw and left arm

Following the case stem, an extensive background and briefing information should be listed for the facilitator/coordinator. Included in this section should be the patient data, background, and baseline state. A review of systems: CNS (central nervous system), cardiovascular, pulmonary, renal/hepatic, endocrine and hematology/coagulation. A medical history is provided: current medications, allergies, past medical history, past surgical history, and a general physical examination that includes height and weight, vital signs, airway status, and lung and heart sounds. These are all logistical components of the simulation: reviewing for medical accuracy, printing of specific lab results, and editing information as needed so the simulation can be repeated and evaluated based on the team performance utilizing specific repeatable information.

Cases may present identically; however, lab values can change the overall differential diagnosis of the scenario. For example, you can have the simulation start with a patient who has altered mental status and lab values may indicate hypoglycemia or you can change the values in the lab work to indicate intoxication. Either way, the initial set-up for the patient would be identical; however, the student experience and treatment may be altered based on the findings. This helps prevent students providing other students with information about the case. By doing this, you can start a case and actually change it "on the fly" if you feel the learners have been "tipped off" on what the case represents. The goal of the particular case does not change but the learners will have uniquely different experiences. These differences should be developed with faculty awareness so they are not surprised to see a different patient outcome on a case designed for "altered mental status." Continuity of the learning objectives must be maintained in order to provide consistence when evaluating either a specific learner or a learner group. Changing learning objectives during a case will degrade the consistency of your evaluations.

Class Preparation Guide

Class preparation guide (CPG) is one of the most important steps in setting up your simulation. The CPG is created to provide the learner with an expectation on what the simulation expects of them, and it includes the following:

- Title
- Desired learners
- Date of simulation
- Outline of the session (time frame)
- Learning objectives
- Resources needed
- Learner expectations
- Participant roles
- Evaluation tool to be used (Box 6.1)

Box 6.1 Sample Class Preparation Guide "CPG"

CPG

(Class Preparation Guide)

1. *Title of Session/Instructor:* Mannequin-based case 3 – Cardiology/ Simulation staff
2. *Course:* Core clinical competencies Seminar CCC 600
3. *Date of session*: September 25, 2018
4. *Brief outline of session*: 60 minute session per group
   - 5 minute pre-briefing question and answer period
   - 15–20 minute mannequin scenario
   - 30 minute debriefing period
5. *Learning objectives of the session*:
   - Formulate a differential diagnosis of a patient with an acute cardiovascular condition
   - Prepare treatment plan and diagnostic evaluations
   - Identify critical changes in patient condition
   - Treat critical changes in timely manner
   - Collaborate together as a medical team
6. *Resources:* Preparation for the session requires consulting the following appropriate resources:
   1. Myocardial infarction http://www.emedicine.com/emerg/TOPIC.
   2. Sim Com-T Holistic Rating Guide File
   3. Videos of intubation and IV access located on XYZ movie site.
7. *Questions to assess student preparation.*
   1. What are the different types of causes of acute chest pain?
   2. What is the treatment protocol for each type?

    3. What tests should be ordered upon admission of patient?
    4. What are the roles used in New York College of Osteopathic Medicine, NYCOM's simulation laboratory?
    5. What is the assessment rubric used in NYCOM's simulation laboratory?
8. *Team roles:*
    - In regards to team roles for the simulation, please refer to the schedule as posted previously for your session. The roles in the room are as follows:
    - Position 1: Team leader
    - Position 2: Medication manager
    - Position 3: IV manager
    - Position 4: Historian/Airway manager
    - Position 5: Recorder/Scribe
    - Position 6: Vital sign manager

During the development of the CPG, it is crucial for all interested parties to be on hand for input. Course director, faculty, and simulation specialist should be involved to make sure that the goals and learning objectives are met and are easily identified by faculty. The simulation specialist/facilitator should be on hand to insure that the capabilities of the simulator can provide the desired effect and fulfill the expectation of the director, the faculty, and the learner. The CPG should not include specific information of the case and is just an outline of things the learner should expect during the case.

The CPG should be provided to the learner prior to the day of simulation; it may include things like instructional videos to watch prior to a simulation, for instance, a video review of IV placement may be embedded so that the learners can prepare themselves to complete the task. The logistical concern here is to make sure that the video is current and accurate and also that the functionality of downloading the video is available and it works. This is the same with providing articles in the CPG, as articles should constantly be evaluated for relevance and accuracy based on proven clinical science. Articles can range from a broad spectrum of relevance to the case to specific details. For example, for a beginning provider, you may choose to provide an article on treatment of pneumonia; however, for an advanced provider, you may provide an article on respiratory distress. By doing this, you will help the beginner to evaluate and treat pneumonia, while providing the advanced learner the opportunity to formulate own differential diagnosis. Participant roles are defined and assigned to each learner; these roles should provide the learner with a general expectation on what is expected of them to do. Typically this should be reviewed during the pre-brief to make sure the learner understands the expectations of a particular role. Learners should be familiar with all roles in case they need to switch or assist a fellow learner during the case. If roles are not clearly defined and explained, then often delays in treatment and confusion by the participants will affect the performance of the learner or learner group, thus undermining the learning objectives.

The evaluation tool to be utilized is most often relayed to the student prior to the case; a checklist or PARS (patient at risk score) can be generated for individual learners while a Likert scale is preferred for groups of learners. The tool should be standardized for each case and training for evaluators should be completed well in advance of the simulation because it is imperative that the scoring remains consistent from learner to learner and group to group.

Large-Scale Simulation

A large-scale simulation can mean many different things to different people. For instance, a large-scale simulation case could mean the number of people that will be completing the simulation. Or consequently, it could mean many different types of learners or entities working a case as different levels of learner. Either way, large-scale simulations present their own unique set of logistics and the coordination of the simulation if not done properly can result in critical failure of your simulation. At times, this large-scale simulation will be both static and mobile at the same time. The planning and timing of the simulation is a major concern during development and often can be a daunting task. The organization and coordination of the simulation will depend on a tremendous amount of communication between you and all parties involved. If your simulation utilizes "outside" parties, this becomes even more difficult. These types of simulations require extreme attention to detail and often require the delegation of authority to several people.

As the simulation designer evaluating the logistics of your simulation case, you will have to develop liaisons within each selected party of the simulation and give them the ability to develop their own set of learning objectives within the case. For example, if you are doing a case that involves multiple agencies, the learning objectives may be different for each agency and the cross coordination can and should overlap. This is done so the leaders of each agency understand the learning objectives of other agencies and limits the amount of conflicts during the case.

In a case simulation that will be utilized for large numbers of people, like a medical school or an emergency medical service, the case itself is typically and relatively easy to set-up. It does however require significant amount of planning with regard to scheduling and learner flow and the continuity and consistency with regard to the specific learning objectives. Faculty involvement is imperative and maintains the integrity of the program as long as the faculty remains consistent and stays on message. Often times, the faculty may go off topic or go off on a tangent, overlooking the main learning objectives for the case. When this happens, the responsibility of the simulation facilitator is to keep them on message. That is not to say that there cannot be other teachable moments during any case but those moments should be limited and possibly developed into a separate case. As stated previously, the learning objectives and practicing the case can eliminate some of these issues but the facilitator and faculty have to have the ability to adapt to what the learners are doing.

Organizing the flow of the learners has its own set of logistical consequences, and most times when dealing with large number of learners over several days can degrade the case simulation if not done carefully. This is evident when a case simulation with the same learning objectives runs over days or even weeks depending on the amount of learners to complete the simulation case. In these cases, the learning objectives should be broader; the case stem can be identical but the patient diagnosis can be altered as previously discussed.

Large-scale simulation cases utilizing multiple entities with different learning objectives for each learner type are time intense. This type of simulation is not usually designed to be repetitive. Often large scale is designed to be done one or two times in a day to disclose areas of opportunity to improve; it not only helps in response and communication between agencies but also identifies and solves easily overlooked obstacles that may only arise during a simulation. These types of cases will have separate logistical questions to be answered. An example is a multiple agency response to a mass causality incident. Agencies may include facility, security, local police department, local fire department, emergency medical services, and perhaps even a federal response. Each entity will require logistical concerns with regard to staffing, transportation, lodging, meals, staging area, pre-briefing areas, and debriefing areas, to name a few. In these case simulations, a liaison from each entity will be needed to coordinate their individual logistical concerns. A helpful way of accomplishing this is to be consistent with utilizing the incident command system. This standardized approach will create defined roles and responsibilities for each entity. The group should meet several times prior to the simulation case and discuss all logistical concerns well in advance of the scheduled date of the simulation. Each entity will provide the learning objectives for their piece of the simulation so that the objectives can be incorporated into the case. For example, a large-scale simulation is planned at a school for a “post active shooter case”. The case itself will be designed to have the coordination of a police response for criminal activity, while the fire department and EMS (emergency medical services) respond to the treatment of the injured people. The learning objectives for the case are all different but coordinated within the same scenario. While the responders have their tasks, the school itself will have tasks of its own, things like updating its policy and procedure, how notification to the student body will be handled, coordinating an evacuation, how to handle media response, and family notification of the injured are some of the logistical concerns. Testing the plans prior to the simulation is important; however, the simulation case itself will, if done properly, identify areas of weakness and concern.

The areas of weakness and concerns will be discussed during the debriefing of the simulation and the coordination of the debriefing or “hot wash” will aid each entity to understand its own unique limitations or area of opportunity. Most times, this is done immediately after the simulation and should be conducted as a large group with smaller groups meeting after the large group debriefing. This is not the time to “point fingers”; this is the time to discuss areas of opportunity within both the larger group and then again with each individual group. Sometimes, a report is generated after the simulation and provided to the liaison individuals for evaluation of the team’s performance. This is not always required but is beneficial in most cases.

Scheduling

Scheduling can be the most daunting task when it comes to simulation and staying on schedule is of the utmost importance. The logistical issues that can be anticipated include but are not limited to staffing, learner availability, number of learners compared to amount of simulators, faculty availability, learning space availability, to name a few. Considerations may also have to be made if you have learners who are awarded "extra" time; in these cases, you may have to work the logistics of how that time will be initiated as not to embarrass or make the learner feel uncomfortable. These learners will, at times, have to write a timed SOAP (subjective, objective, assessment, and plan) note and if certain guidelines are met, this time must be afforded to the learner. This can cause a logistical problem based on the availability of equipment and space. For example, if you have six learners assigned to a mannequin-based case and a portion of the case is for the learner to document a SOAP note or equivalent, and one learner is afforded more time, you must consider things like location, proctoring, equipment, etc. This is even more relevant if you are working in a mobile simulator where space and time are paramount and these accommodations may be difficult to ensure.

The scheduling of space in a sim lab is very different from scheduling a mobile simulator. In a simulation lab, space is often dictated by availability of personnel to man the space as well as the day, date, and time of the simulation and what is happening around that space during the effective period. An example of this would be, perhaps, you have a space that shares a common hallway with a standardized participant (SP) area and your mannequin case requires a confederate to enter the case and create a distraction to the team treating the mannequin. The timing may be extremely crucial so as not to interfere with students utilizing the SP rooms and perhaps going from one SP to another. These issues can impact the effectiveness of the cases and result in unwanted delays or decrease the desired effect of the case distraction. Infrastructure is of the utmost importance here; if you have the ability to have separate areas for your simulations, you can avoid many of these obstacles. Simulation space design can aid in scheduling by limiting access to only participants of a particular case, thus removing interference from outside forces.

Mobile simulation is scheduled somewhat different from lab simulation; this is because the mobile simulator has its own set of distinct areas of use. If your mobile simulator is the rear compartment of an ambulance, then the only people that are utilizing that space will be the technicians responsible for patient care, with the modification of a person to run the simulator.

In the years past, I worked for a large heath care organization and it had a "simu-lance"; this was a converted ambulance with a high fidelity mannequin placed on the stretcher in the back. The idea was to take this around to the ambulance crews that were on duty during downtime, cover mandated topics, and do a re-credentialing of certain procedures to reduce overtime by covering these topics. It seemed like a good idea initially; however, the execution was done poorly and often times in the middle of the simulation, the on duty unit would be pulled away for an assignment creating a waste of time and resources for the simulation team. Eventually, it was realized that personnel had to be scheduled and assigned a specific simulation time.

This could be accomplished during the hiring phase as well as during the annual update but the reduction of overtime was never realized; in fact, it increased overtime.

Scheduling and student switching can be one of the biggest logistical problems in simulation; most schedules are produced weeks in advance and as we all know, life sometimes gets in the way. In simulation, we are not immune to this; however, there has to be a cut off when switching is allowed. This is not as simple as replacing Jonny with Jane, because there are so many pieces that have to be changed and they could include managing your video software, rescheduling the SP that the learner was supposed to see, or the disruption of a team composition with mismatched learner abilities. When video taping learners, you want the learners to have the ability to view their case; this can become an issue if switching is allowed as the wrong learner could end up seeing another learner's video causing a Family Educational Rights and Privacy Act (FERPA) violation.

A specific person should handle the proper scheduling for each case. This will ensure accountability for the case, and multiple schedulers will inevitably end up with scheduling conflicts or errors. This does not mean that one person should cover all your scheduling needs but if a person is assigned to schedule a case, others should not have access to change the case without notifying the assigned scheduler. Scheduling programs can be an excellent use of technology and often can identify conflicts easily. These programs contain simple algorithms that aid the scheduling personnel and often contain reporting features for accurate documentation that can be utilized for recording attendance and frequency of the learner. Another use for these programs is that you can easily evaluate the faculty or SP that is evaluating the learner while also identifying the specific number of times a faculty or SP sees each individual learner.

Learner Orientation

Learner orientation, simply said, is that you must expose the learners to the simulator before they have a chance to use it. This is often overlooked and accounts for delays and poor performance by the learner and unmet expectations by faculty. Learners should have an opportunity to see the simulator that they will be using during the case. This access should be guided so the functionality can be described and, in some cases, practiced by the learner so they become familiar with its capabilities. This also prevents a learner from becoming "freaked out" by working with a simulator. Orientation becomes extremely important when utilizing a high fidelity mannequin; for example, if the learner is not aware that the simulator/mannequin is capable of having abnormal lung sounds and they have not had the opportunity to listen to the simulator's normal lungs sounds, they may not understand the difference and score poorly on assessment.

Orientation to the simulator should include all of the functionality of the simulator and examples should be given. Conversely, information should be provided on the limitations of the simulator. An example of this is, perhaps you want the learner to complete a physical exam on the simulator and perhaps a reasonable expectation and portion of the physical exam was to ask the simulator to squeeze the learner's hand. If this capability does not exist, it should not preclude the learner from doing the exam; however, the faculty or simulation specialist/facilitator can provide the response to that portion of the exam, for example:

–Learner: Sir, can you squeeze my hands?
–Faculty: Your patient squeezes your hands with equal strength.

This will allow the learner to recognize that they can ask for information that may not be able to be produced by the simulator; especially, if it is important to the case and should not be missed due to the lesser capabilities of the simulator.

Participant roles must be reviewed and explained to the learners so that they know what the expectation of the roles entails. Learners should have a detailed explanation describing the specific details of what is expected of them during the case and the expectation of fellow learners based on the role they are portraying. For example, the IV manager is expected to place an IV on the patient; this will include getting consent of the patient. Subsequently, the team leader will understand that the IV will be placed by the IV manager and that person is required to obtain consent for the IV. Logistically, when all participants understand the role they are playing, it will prevent wasted time during the case. Often, this review will be performed during the pre-brief to make sure the team is aware of who will be doing what.

In my experience, the more information you can provide the learner and faculty about the type of simulator and its capabilities and incapabilities, the more successful experience for all involved. This information should not just be a document but actual "hands on" experience so you can show them how the functionality is utilized. If the case calls for the learner to start an IV, then a demonstration or even provision of time for the learner to practice with the simulator they are to use will be helpful. This will instill confidence in the learner and prepare them for the actual simulation. It also provides the faculty the ability to assess the learner's ability and not worry about the differences in simulated IV placement and IV placement on a human being.

Have a Back Up

When working in the world of simulation, having a backup plan is a must. Considerations have to be made in the event of product failure/malfunction; replacement parts, tools, and alternative power supply are of the utmost importance. There have been many times when I tested my simulator the day before a simulation and it had run perfectly, then the day of the simulation, something happens and it doesn't work or the functionality becomes inconsistent. Regardless of this, you must practice with the simulator; the more you practice, the more opportunity you will have to work out any simulator malfunctions or obstacles.

Most of the high-fidelity mannequins/simulators today run on battery power and have an option for plug in. Alternative plans need to be made if the simulator is expected to run for extended periods of time. Downtime for the mannequin or simulator is an important factor; it is easily overlooked by directors and faculty and facilitators as they may not understand the inner workings of the simulator.

Other areas of back up opportunity include what I call "learner abuse." Learner abuse is the sometimes uncontrolled efforts of the learners who do not understand the capabilities of the simulator. Most of the time, you can control this by making sure you cover the abilities of the simulator during the orientation period; however, sometimes, you get an overly aggressive learner who may not understand the limitation of the simulator and end up breaking or damaging it. I have often seen this in cases where poor technique during intubation causes damage to the simulator. Questions then arise about whether to stop the simulation or continue and let the simulator be damaged. I subscribe to the theory of stopping and correcting poor technique and use it as a teachable moment. If the simulator becomes damaged, then, in these cases, it is important to have back up parts and tools to troubleshoot or fix your simulator. In this case, I believe in the theory of two equals one and one equals none. This may not be possible with all parts of your simulator, but should be observed whenever possible. Tape, glue, screwdriver, scissors, clamps, and wipes are just a few things you may need to help you during your simulation. Replacement parts to your mannequin may not always be fiscally available but things like replacement skin or tubing for vasculature most times are quickly and easily replaced.

As part of your back up plan, another technique that can be used is when creating an injury on you mannequin or moulage. Place a Tegaderm on the mannequin, then create the injury/wound on top; this allows an easy way for you to remove the injury while not staining your mannequin. The learner will not see the Tegaderm and it makes clean up much easier and faster because once you pull the Tegaderm off, all the moulage will come off too. At times, when the learner begins to treat wounds and injuries, the stained Tegaderm will have to be touched up for the next case. This is a time saver and helps you to easily reproduce the injury or wound very quickly. Check with the manufacturer before placing anything on your mannequin; most companies will tell you what is safest to use on their products.

Good backup plans are usually the result of a previous failure or something that has been overlooked during the case information guide. It is not always possible to imagine all types of failures and potential problems until they happen; this is where testing and practicing can assist in finding potential areas of opportunity for issues that can arise. Experience and the ability to react quickly can mean the difference between a quality simulation and a disaster. Simple things like a baby monitor can be used in place of a high-fidelity simulator voice; yes, it is low tech but it can save the day if the speaker blows up on your simulator. (See Fig. 6.1).

Fig. 6.1 Simulated head wound (**a**) and simulated burns (**b**) on top of a Tegaderm. Simulation mannequin utilized for pediatric trauma simulation; note that a Tegaderm was used to create the head injury, then removed for easy clean up. Simulated third degree burns on the forearm of patient; again, Tegaderm was used to protect SP skin. (Photos by: Timothy Devine 2018, burn moulage created by: Tim Devine and Jess Boyle)

Test Your Simulator in the Environment You Will Be Working In

Practicing with your simulator in the environment you going to be working is ideal; however, sometimes, it is not possible. Make sure with the manufacturer that what you're planning to do is capable with the equipment you are utilizing. For instance, when working outside, understand the tolerance for rain, cold, and heat; these may have an impact on the simulator and its capabilities.

Often a full-size mannequin simulator will not fit in a compact car, so if you are doing a simulation utilizing a vehicle make sure your simulator will fit. (See Fig. 6.2).

Checklists can be extremely important when utilizing mobile simulation and should be used whenever possible. By using the checklist, you can minimize the problem of leaving behind equipment needed for your simulation. Checklists are also extremely effective when setting your case up. I often equate this to when a

Fig. 6.2 Full-size adult simulator in the driver seat of a van; pediatric simulator on the ground in sub-30° weather).Two simulation mannequins utilized for pediatric trauma simulation and adult extrication training simulation. (Photo by: Timothy Devine 2017)

pilot does his preflight check before taking off. This is particularly important when doing a mobile simulation because you may not be able to have all of your normal resources available to you. In our simulation lab, we have developed carts with all accessories on them for any foreseeable malfunction. Within the cart, there is a mobile "go bag" that contains replacement equipment and tools for repair. The bags have a checklist inside and are reviewed for content before a simulator goes mobile. The checklist is also utilized when packing up the simulator to ensure that nothing is left behind; the bag will contain disposable equipment as well and is replaced upon return to the simulation lab. Constantly update and review the checklist. At times, a bag may be sealed with a simple plastic device to ensure content for the next simulation.

Logistically, checklists are not just for maintaining equipment; they can also be used for just about any part of the case including but not limited to scheduling purposes. By setting time frames for things to be completed, your checklist can aid in providing due dates to responsible parties associated with the timeline of events. It can be as simple as a calendar note/task, an actual document or even a computer program depending on the size of the case and the amount of people involved. An establishment of policy should be created, as it creates accountability and efficiency for you, your staff and the people using your simulators.

At my school, there are times when faculty member may ask to utilize equipment/simulators for a smaller group of students. For instance, perhaps the emergency medicine club wants to practice IV placement; a faculty member may request six IV arms and supplies. A checklist is then created with all of the equipment and supplies and who the responsible party is. Upon return, the equipment is evaluated utilizing the same checklist, thus insuring the completeness of the returned items. By using the checklist, anyone for the simulation lab can check the equipment in and out.

Every part of the simulation has logistical concerns; these concerns need to be identified and examined for potential complications. Ultimately, some concerns will be out of your control; however, if you can identify and understand what is *out* of your control and develop a plan on how to mitigate what is *in* your control, your simulation will be a success. Early assessment and consistently appraising your simulation while keeping logistics in mind will provide a level of accomplishment and reduce the stressors that can lead to an unsuccessful simulation.

Suggested Reading

U. S. Department of education. https://www2.ed.gov/policy/gen/guid/fpco/ferpa/index.html.

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Co-debriefing for simulation-based education: A primer for facilitators. Cheng, Adam MD, FRCPC, FAAP; Palaganas, Janice PhD, RN, NP; Eppich, Walter MD, MEd; Rudolph, Jenny PhD; Robinson, Traci RN, BN; Grant, Vincent MD, FRCPC. https://journals.lww.com/simulationinhealthcare.

“The Checklist Manifesto”. By: Atul Gawande.

“The Tipping Point”. By: Malcolm Gladwell.

7 Special Cases

Austin J. Adams, James N. Sullivan, and Amy Duhachek-Stapelman

Abbreviations

AED	automatic external defibrillator
BLS	basic life support
ECMO	extracorporeal membrane oxygenation
FTTE	focused trans-thoracic echocardiography
LST	latent safety threat
NICU	neonatal intensive care unit
NTS	non-technical skills
TBST	team-based simulation training

Key Points

1. Technical skills can be acquired and maintained through repeated simulation experience.
2. Mobile simulation allows greater exposure and participation in simulation, especially for practitioners in rural locations.
3. Interprofessional simulation promotes improved communication, teamwork, and patient safety.
4. In situ simulation may result in the detection and correction of latent safety threats before they affect patient care.

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P. K. Carstens et al. (eds.), *Comprehensive Healthcare Simulation: Mobile Medical Simulation*, Comprehensive Healthcare Simulation,
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Introduction

Simulation allows the practitioner to take part in patient care without actually placing lives at risk. The old mantra of "see one, do one, teach one" has given way to state-of-the-art simulation labs, where learners still benefit from the teaching of the experts, but can hone their skills and knowledge in a low-risk environment. High stress situations demand peak performance and critical thinking, but the necessary skills and poise can only be refined when a learner is forced to take part in those situations. Practitioners of other high risk professions, such as those in the airline industry, have come to this realization, and rely on simulation to train pilots on how to anticipate and manage critical errors during rare inflight complications. Methods similar to those developed by the airline industry have been translated and utilized in healthcare over the past decade. For example, the crash of Air France Flight 447 has been used to train surgeons not only the technical skills needed for a given situation but also the teamwork, communication, and decision-making skills needed in an emergency [1]. In the case of Flight 447, small critical errors were missed due to reliance on mechanical devices; it ultimately lead to the loss of 228 souls. Medical error has been cited as the third leading cause of death in the United States, with as many as 700 patients affected per day.

Simulation creates an environment where task training, development of technical skills, and testing of new sites and procedures can all be done in real time, allowing participants to learn while not placing the health and wellness of others at risk. Mobile simulation has brought about new opportunities for simulation. Technical skills can be acquired and maintained without having to travel long distances to a simulation center, decreasing a practitioner's time away from their clinical practice and encouraging greater participation in simulation. Mobile simulation does not necessarily imply large trucks equipped with state-of-the-art equipment however, but instead may involve a mobile cart with a few monitors, mannequin, and other simulation equipment [2]. The mobile cart can be transported within hospitals, even those with simulation labs, to sites of clinical practice as simulation labs are not able to replicate every clinical environment.

With the advent of crew resource management, simulation has been utilized to educate entire teams in the skills needed to manage difficult and stressful situations. Educational protocols have been developed and instituted in many realms, including the intensive care unit, air transport, cardiac surgery, as well as others [3–5]. Team-based simulation allows team members to function in their own capacity, while learning alongside their usual colleagues. Simulation of high-risk scenarios during interprofessional simulation allows individuals to understand the role of other team members; they can then better predict the action of the other members of the team, leading to efficiency in practice. Additionally, a team can identify its strengths and weaknesses and establish a hierarchy in decision making.

Complicated, crisis situations are thought to arise primarily in tertiary care centers, but smaller rural communities are not without the need for education, especially in light of the limited availability of resources. Rural providers are often the single clinician for that entire area. High-fidelity mannequins have been used to train rural practitioners in a multitude of scenarios [6–9]. Educators from larger centers with increased resources can be used to deliver educational resources to smaller communities, allowing local practitioners to remain up-to-date with the most current literature and enhancing their ability to deal with uncommon complications. These rural areas range from small community hospitals to complex battlefields encountered by the U.S. Military, or as remote as the Australian Outback.

Acquisition of New Skills

An optimal time for acquisition of new technical skill sets is during school and/or postgraduate training. During this time period, learners have access to experts in the field who can teach them new procedures in a one-on-one manner (in both simulation centers and clinical settings) and help them to hone their skills to the level of proficiency. Additionally, dedicated time is set aside to gain new knowledge and skills.

After the completion of a formal training program, the acquisition of new skills can be challenging. This is due to limitations of time (taking time away from one's practice to learn new skills), lack of adequate equipment or resources, and a paucity of mentors and educators. As will be discussed later in this chapter, there is improvement in retention of new skills with repeated practice. This challenges the validity of being able to go to a weekend course to learn a new skill set. Newly acquired skills are unlikely to be retained unless they are immediately incorporated into one's clinical practice. Incorporation of the skills into one's clinical practice would lead to the enhancement of these skills through regular performance. Simulation provides the ability to engage in ongoing practice to learn new skills and enhance skill levels. In fact, a 1999 article published in the *Journal of the American Medical Association* commented on the ability to utilize simulation technology to become "self-directed lifelong learners" [10]. Mobile simulation provides a mechanism to take this valuable resource from large academic centers to rural communities.

While several studies have revealed the value of practice for acquisition of new skills, the optimal repetition interval has not been determined. A randomized trial in 24 surgical interns attempted to answer this question by assigning subjects to either weekly or monthly practice distribution for a complex procedural skill [11]. While there was an improvement in both acquisition and retention of the skill, there was no significant difference in competence between the interns receiving weekly training and those receiving monthly training. Conversely, a randomized controlled trial evaluated the effect of different training intervals in the acquisition and retention of laparoscopic suturing skills [12]. The researchers found that there was an advantage to once daily training sessions in comparison to both massed practice (2–3 times per day) and weekly training. Additionally, they found that medical students undergoing "optional deliberate practice" between training sessions had enhanced skill retention. Despite the fact that the optimal practice interval is unclear, it is evident that repeated practice is an important component in skill retention. Mobile simulation would provide the opportunity for ongoing, intermittent procedural skill practice.

Skill Maintenance

Once new skills are developed, either in a primary training program or through post-training courses, a challenge lies in the maintenance of those newly acquired skills. Maintenance of expertise of any skill involves ongoing performance or practice of that skill, both within and outside of medicine. Decline in skills is sometimes attributed to aging; however, Ericsson discusses how experts are in fact able to maintain performance into old age by participation in regular deliberate practice [13].

Loss of skills is a significant problem in medicine as well, where studies have shown that without regular use, there is attrition of technical skills over time. A recent systematic review evaluated randomized trials analyzing the effect of spacing on surgical skill retention. The findings of the review revealed that students who practiced spaced training sessions performed better on retention tests compared to those who practiced mass training [14]. A randomized controlled trial of medical students utilizing a laparoscopic surgery videotrainer revealed that those students undergoing ongoing training had better skill retention than those who received no additional training [15].

The challenge of both the acquisition and retention of a new skill is common. An example of this is the rapid expansion of the use of focused transthoracic echocardiography (FTTE) in the evaluation and management of critically ill patients. Many providers currently in practice did not have exposure to this vital skill while in their training programs, and now have the desire to become proficient. One study assessed the utility of an FTTE course consisting of both didactic sessions and hands-on experience [16]. It found that even a short course was effective in helping learners acquire basic skills and knowledge. However, there was significant decay in skill level over time, which was seen as early as 1 month post-training. This decline had continued at 3 months.

The aforementioned findings have implications for both the acquisition of new skills and the maintenance of rarely performed skills. This is particularly concerning when these technical skills are associated with high stakes situations. Lack of proficiency in critical skills may lead to significant patient morbidity or mortality. It is clear that a mechanism must exist to assist providers in optimizing their competency at many of these procedures and that methods for ongoing practice of technical skills must be developed. Mobile simulation has the opportunity to fill this gap.

Technical Skills in Rural Practices

Glazebrook evaluated the barriers for maintenance of advanced procedural skills in rural providers based upon a review of 66 articles [17]. A number of issues were identified, several of which might be addressed using mobile simulation. The major barriers for maintenance of these advanced procedural skills included: limited opportunities, cost, inability to find clinical coverage to attend training sessions, limited options for education, and limited availability of training for advanced procedures, among others. They also found that the limited opportunity for training was related to the difficulty in retaining rural physicians who perform advanced procedural skills as part of comprehensive care in their communities. Mobile simulation has the opportunity to alleviate a number of these barriers by making group skills training sessions available on site. This would provide enhanced opportunities for providers to receive training, while allowing them to be available for clinical coverage if necessary. Additionally, these sessions could be individualized, so that they mirrored the needs in the community.

Learning New Systems or Incorporation of New Equipment

Development of new medical devices is occurring at a rapid pace. Hospital systems must frequently select new equipment without the opportunity for providers to utilize the equipment in clinical settings and without having the ability to compare the equipment with other devices. Simulation may play a role in this situation by allowing the trial of a variety of different products and comparing their functionality. One example is a study that allowed providers the opportunity to evaluate two laryngoscopes by intubation of neonatal, child and adult airway simulators [18]. The 34 healthcare providers in this study strongly preferred one device over the other (89% vs. 11%). This data provides clear evidence for the ability of healthcare providers to discriminate between the desired features of equipment they will ultimately use in clinical practice.

It is also imperative that all providers receive appropriate training on the use of new equipment. Simulation has much potential in this arena. For example, when a hospital purchases new airway equipment or central venous access kits for use in the operating room, product representatives are often on hand to exhibit the new features of the equipment. However, this orientation might be augmented by experiential, hands-on training utilizing simulation, as opposed to self-teaching on the fly during the care of a critically ill patient.

Life Support Training Uses

It is possible to create valuable learning environments for practitioners in the absence of a high-fidelity simulation lab. One of the most valuable situations where this could be realized is through life support training.

Neonatal and perinatal fellowship trainees underwent a randomized trial that involved the participation in two simulated resuscitation sessions. All of the fellows previously completed the Neonatal Resuscitation Program and received advanced resuscitation training prior to the study. The fellows were randomized to perform neonatal resuscitation utilizing either a high-fidelity or a low-fidelity mannequin. There was no difference in resuscitation performance between the groups. Additionally, investigators found that while salivary cortisol increased in both groups of trainees, suggesting a stress response to the simulation experience, there was no difference between the high- and low-fidelity simulation subjects [19].

Based on the results of the aforementioned study, providing on-site training in life support utilizing low-fidelity simulators might be a feasible option to provide education to a wider population. Mobile simulation utilizing low-fidelity simulators offers the opportunity to train a greater number of lay people basic life support (BLS) skills and the proper use of automatic external defibrillators (AEDs). Emergency operators may be able to talk an individual through BLS procedures or AED use until medical personnel arrive, but greater public awareness of the proper procedures and protocols prior to their use has the potential to improve outcomes following out-of-hospital events. Mobile simulation presents an opportunity for greater community awareness and training in life support measures.

Financial Implications

Cost is an important consideration when mobile simulation programs are developed. However, it is not necessary to create a high-fidelity simulation lab at every institution due to the ability of mobile simulation units to bring high-risk, low-frequency clinical experiences to providers in their work environment. It is well known that the value of simulation does not lie solely within the participation in a simulation session. A significant portion of the learning involved stems from didactic presentations and debriefing [2]. With this in mind, Weinstock et al. developed a self-contained mobile simulation cart that allowed these critical components of simulation to occur in the clinical setting. The cost of the simulation cart (not including the mannequin) was $8054, which included a laptop computer and LCD projector to support slideshow-based didactics. Additionally, the cart had space for the mannequin and all of the associated equipment. Integrated audiovisual equipment made it possible to record performance with superimposed vital signs to support the debriefing process. Over the course of 3 years, this cart was utilized in 57 simulation events, involving 425 clinicians. The cost of these adjunct materials is relatively small given the number of providers who benefited from the experience in a short time period. Thus, full-scale simulation (including didactics and debriefing) can feasibly be carried out with mobile simulation.

In addition to the cost of equipment, the value of the trainer's time must also be considered. To fully assess the cost of this time, it is essential to determine the level of expertise required in the individuals evaluating the acquisition of new skills. Mahmood et al. presented an interesting study that questions the importance of needing highly trained individuals (who it can be assumed would be more costly) to assess the acquisition of new skills. A blinded observational trial compared the ability of medical students and experienced providers to assess competence at flexible cystoscopy and differentiate between novice and experts in the performance of the procedure [20]. They found a high degree of consistency and inter-rater reliability between specialist and non-specialist raters. Further study supporting this finding would lead to a decreased need for highly trained specialists to assess competence in the performance of procedural skills.

Interprofessional Simulation

Simulation has long been recognized as a valuable resource for medical education; however, in recent years, interest in team-based approaches to training has increased significantly. Current evidence suggests that simulation should be performed from an interprofessional or multidisciplinary standpoint [21]. Simulation-based education, in general, can expose participants to a wide variety of clinical scenarios, while allowing practitioners to gain knowledge as well as develop technical and non-technical skills in a low-risk environment [22]. Unlike traditional simulation where learners simulate scenarios among peers of their own profession, interprofessional simulation allows entire teams of healthcare professionals from various disciplines (i.e., physicians, nurses, respiratory therapists, clinical perfusionists, paramedics, etc.) to train and learn together.

Interprofessional simulation allows medical teams to be exposed to scenarios that are routinely encountered in their work environment, as well as the low-frequency, high-risk emergency events that demand peak performance by every member of the team [23]. Inclusion of team members from various professional backgrounds helps create an atmosphere that is more realistic to the clinical work environment; it breaks down the notion that providers work in “silos.” Team-based training encourages teamwork and effective communication for safe and efficient patient care.

Inclusion of multidisciplinary teams in simulation helps encourage the development of non-technical skills that are necessary for safe and efficient patient care [24]. Non-technical skills (NTS) are the cognitive and social skills that augment a clinicians’ medical knowledge and technical skill when providing medical care [24, 25]. They include leadership, teamwork, communication, situational awareness, and effective resource utilization. Failures in teamwork and/or communication are commonly linked to medical errors and lapses in patient safety that can result in significant harm to the patient [26]. NTS cannot be acquired during a crisis situation; they must be learned prior to and effectively deployed during a crisis. Interprofessional simulation may aid in the acquisition and development of non-technical skills.

In Situ Training

Simulation centers are frequently confined to larger academic centers which have the space, resources, personnel, and funds necessary to operate and maintain a dedicated simulation lab [2, 27]. Consequently, clinicians and other ancillary personnel in more rural practices have limited access to simulation. Clinicians interested in participating in a simulation experience must take time away from their practice to travel to a simulation center. Mobile simulation allows the state-of-the-art technology commonly found in a simulation lab to be taken to practitioners [28]. Mobile simulation technology may allow for greater participation in simulation, especially in more rural areas where access to simulation resources is limited.

In situ training, a form of mobile simulation, is the process by which simulation occurs within an actual work environment, rather than a simulation lab. It allows for entire medical teams (i.e., rapid response/code team, trauma team, operating room, etc.) to simulate patient care within their unique work environment, utilizing the equipment and resources routinely available to them [29]. Interprofessional simulation in the clinical worksite, with all team members present, leads to increased fidelity for both the team and the environment [2]. Unlike simulation in a lab, in situ simulation does not require stand-ins to play the role of missing team members. Additionally, in situ simulation allows for increased participation as there is no need for travel, minimal time is required away from one's clinical duties, and participants can return to their clinical duties if an actual emergency were to require their attention.

Training together in one's unique work environment helps improve safety, especially during crises [30]. In situ team training may additionally allow for the identification of latent safety threats (LST) that "predispose to medical error" and expose patients to potential harm [29]. Performing simulation where actual patient care will be provided allows the teams or hospital system to identify and intervene on previously unrecognized LST before they impact patient care and safety. Weinstock suggests that the clinical worksite is the ideal location to practice one's common clinical tasks [2]. Repeated simulation throughout the year may allow for the identification of seasonally related threats that would otherwise go undetected if simulation is not performed when a threat is most likely to occur [29].

Patterson et al. demonstrated the utility of in situ simulation for identifying latent safety threats in a pediatric emergency department [29]. Previously unannounced simulation sessions were initiated by activating the medical or trauma alerts indicating that a critically ill patient had arrived. Responding providers of various disciplines believed that an actual medical or trauma activation had occurred, and would then participate in the simulation. The simulations lasted only 10 minutes, and were followed by a 10 minute debrief session. As the simulations were unannounced and would occur without supplemental staffing, measures were set in place to allow for the cancellation of a simulation if it would interfere with patient care. A total of 90 simulation sessions were held over a one-year period, and during that time, 73 LSTs were identified with causes varying from medications to equipment or resources. Latent safety threats were identified every 1.2 simulation, compared to one LST every seven simulations performed in their simulation lab. In addition to identifying LSTs, in situ training can help reinforce the need for teamwork and improve patient safety.

A pilot report of in situ team-based simulation training (TBST) in the neonatal intensive care unit (NICU)further illuminated these safety benefits [31]. Sixty-five TBST events were performed over a 4-year period, involving more than 500 NICU staff members of varying disciplines. As a result of these sessions involving critical events, several systems problems were remedied and educational deficiencies were addressed. From a feasibility standpoint, 90% of planned sessions were successfully completed in the clinical setting.

Shared Mental Models

Traditional approaches to simulation allow peer groups with similar education and background to train and learn together. This approach to simulation reinforces the notion that members of a team work within "silos," not as a cohesive unit, and can lead to communication breakdowns, ineffective teamwork, and lapses in patient safety, especially in times of crisis [23]. In contrast to traditional simulation experiences, medical teams are composed of individuals with widely different levels of knowledge, training, technical and non-technical skills, and poise while under pressure [32]. Such differences result in team members having different mental models of a given scenario and can limit our ability to interact and respond in a timely manner.

Interprofessional simulation attempts to overcome the differences in mental models by encouraging teamwork, communication, and shared responsibility. As discussed earlier, interprofessional simulation allows medical teams to be exposed to scenarios that are routinely encountered in their clinical environment, as well as a variety of low-frequency, high-risk crises. Simulation of such events can help teams better understand individual member's roles, identify dissimilarities in thought processes, assumptions, or expectations for what should be occurring, and correct deficiencies in knowledge or skill. Once a shared mental model is developed, situational awareness, anticipation, communication, and teamwork can all be improved.

Debrief

Formal debriefing following a simulation is arguably the most important component of the simulation experience. Sawyer indicates that the debrief is important for "maximizing learning" during the simulation experience [33]. Experience alone is not sufficient to lead to long-lasting learning; one must intentionally reflect on their experiences through introspection and discussion to retain newly learned concepts [33, 34]. The simulation debrief is an interactive discussion that allows participants to reflect on their experience, express the feelings or emotions the experience evoked, and coalesce their knowledge.

Numerous models of debrief can be found in the literature, but limited data exists in identifying which method is most effective. Sawyer suggests that the specific method employed may not be important, so much as formal debrief occurs following a simulation experience [33]. Facilitators should ensure that any discussions during the debrief occur in an open, supportive environment [34]. Participants should be allowed to speak freely about their experience without any concern for judgment. Additionally, learners should be encouraged to reflect upon both the positive and negative aspects of their performance, and how they would change their behavior in the future. All learners should be encouraged to actively participate during the debrief, with the facilitator redirecting the discussion as necessary to help maintain focus on the learning objectives [33].

Debrief traditionally occurs at the conclusion of the simulation event, referred to as “postevent” debrief, but may also occur during the simulated event, referred to as “within-event” debrief [33]. “Postevent” debrief allows individuals, as well as the entire team, to reflect upon and learn from the experience, whereas “within-event” debrief allows for important corrective action to be conveyed at the time of a critical error. Following a “within-event” debrief, the scenario can be reset, and repeated with the newly acquired corrective action taking place.

Debrief rarely occurs after traumatic or challenging patient care experiences in real life [29]. Invariably, some team members continue providing care to the patient elsewhere in the hospital, while others return to their regular clinical duties. Holding a debrief in this setting would often times be very beneficial, as it would allow the involved parties to decompress, discuss what went well, and what could have gone better with the ultimate goal of improving future patient care.

While the focus of a debrief is usually on individual performance, the debrief following interprofessional simulation allows for the entire medical team to reflect on their actions collectively. Individual members of a medical team approach any given situation with different assumptions and understanding of what is occurring. As previously discussed, this is due to differences in education, training, and experience required for one’s particular job. Debrief allows individuals to discuss the scenario from their point-of-view, highlighting how that perspective may be different from that of the other team members. Discussion of the events allows learners to gain greater understanding of how the actions of one team member affect those of the other members, as well as the overall outcome [35]. Effective debrief should help learners gain new perspectives and understand teamwork patterns that promote improved patient care and safety.

Future Directions

Mobile simulation and simulation in general can be further expanded for first responders and other emergency medical personnel. Procedures such as endotracheal intubation, surgical airways, chest tube placement, etc. require significant amounts of practice to achieve reliable proficiency. Anesthesiologists or surgeons, who perform such procedures on a routine basis, do not have a significant issue achieving a level of mastery. Paramedics and military medics however, often do not have frequent enough exposure to acquire the level of proficiency necessary to reliably perform these procedures. Adding to the issue is that many of the procedures they perform are in the field or in an air or ground ambulance, not in a simulation lab where ergonomics and many other parameters can be idealized prior to performing the life-saving intervention. Finding ways to mimic the chaotic environment of a motor vehicle accident scene, war zone, or other environments routinely encountered by first responders may increase the utility of their simulation experience.

Extracorporeal membrane oxygenation (ECMO) and other mechanical assist devices present another opportunity for future expansion of mobile simulator education. Initially used in pediatric populations, ECMO is an advanced life support mechanism that has emerged as an option to temporarily support cardiac and/or respiratory function in certain critically ill adult populations in whom traditional management techniques have failed [36]. A meta-analysis performed by Ouweneel et al. indicates that ECMO utilization increases 30-day survival rates for patients suffering from refractory cardiac arrest or cardiogenic shock, while other studies have demonstrated successful use of ECMO in patients experiencing acute respiratory failure [37, 38]. Use of ECMO is usually confined to tertiary care centers with the experience, personnel, and resources capable of managing these complex patients. Mobile simulation, however, presents an opportunity to train medical professionals outside of large, tertiary care centers to initiate this life support system, and achieve initial stabilization of a critically ill patient until they can be transferred to a tertiary care facility equipped to further manage these patients.

Conclusions

Many hospitals do not have the resources or space to invest in a state-of-the-art simulation lab; hence, mobile simulation units can increase the opportunity for rural providers to partake in simulation experiences without having to take time away from their clinical practice. Transfer of newly gained knowledge and skills to their clinical practice helps ensure that patients receive the most up-to-date care, while longitudinal simulation can help practitioners maintain the technical skills previously learned. Advancements in technology and availability of mobile simulation units will increase the opportunity for rural healthcare professionals to participate in medical simulation.

Interprofessional simulation promotes the development of non-technical skills, such as teamwork and communication. Team-based training improves simulation fidelity, as entire teams that routinely work together are exposed to a multitude of clinical scenarios. The shared experiences of team-based training provide the additional benefit of attaining greater awareness of other team members roles, thought processes, and limitations, which is especially important in times of crisis. Similarly, in situ training helps teams and hospital systems identify and correct latent safety threats. The goals of interprofessional and in situ training are to improve teamwork, communication, and patient safety.

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Recording/Feedback/Debriefing

8

Travis Spier

Key Points

1. The use of AV (audio-video) recording can greatly improve the educational value of simulations.
2. The AV recording system used will depend on existing resources and desired functionality.
3. "What happens in simulation, stays in simulation."

Introduction

The educational benefits seen with the use of mobile simulation are multifaceted experiences that draw upon the experiential knowledge and skill of the participants alongside the educational objectives embedded within the immersive encounter. Learners are provided a clinical experience that allows them an opportunity to apply clinical skills in conjunction with critical thinking during lifelike simulated encounters. The education and learning captured during this encounter extends beyond the simulation suite into the debriefing session. Debriefing provides learners an interactive opportunity to openly discuss pressing and influencing factors that impact the actions, decisions, reactions, and communication witnessed within the scenario [1]. Capturing actions, interactions, reactions, and communication witnessed during a simulation scenario can be an unseen benefit to an interactive debriefing session [2]. A variety of methodologies are earmarked by the industry as best practices for

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conducting a debriefing session following an immersive simulation session [3]. The methodology applied into practice by the educators should be considered best practice and should follow established principles as applied to a safe yet transparent debriefing session [4]. Additionally, a variety of conduits and technologies are available to the simulation educator to complement the debriefing session. One of these technologies is the use of video recordings and playback features. The simulation administrator should weigh the availability and budgetary feasibility of implementing and applying technology into the debriefing sessions. Various options and levels of recording systems are available and applicable to a mobile environment. The extent to which a recording technology is integrated into simulation sessions is likely restricted most by budgetary and infrastructure capabilities.

Moving the Simulation Experience into Debriefing

The design and execution of a simulation session will follow a predetermined script and curricular path to fulfill educational objectives [5]. The purposeful intent and desired outcome from the simulation experience provides a variety of established expectations set by the simulation team. Aside from the immersive clinical experience encountered by participants, an effective and interactive debriefing session should be factored into the educational timeline. The environment associated with the immersive experience can enrich the educational encounter by far exceeding the objectives identified in the curricular script. Measurable and obtainable participant-based outcomes should be identified as part of the scenario curriculum [6]. In addition to achieving predetermined outcomes during the scenario, observational questions can further define the rationale behind individual or team behaviors and actions.

The simulation scenario goes far beyond the dedicated lifelike immersion that demands participant engagement and technical actions during each session. A post scenario debrief provides the simulation team and participants an opportunity to openly discuss the scenario and events that transpired within the session [1]. It is imperative that the debriefing is conducted in a safe and respectful manner due to the vulnerability of individual and team performance exposed during the discussion. Learner participation is essential as the debriefing session unfolds and expands into various levels of content and performance discussion. Desirably, learners will reflect on their experience in the simulation session. Open discussion by participants on scenario objectives, reflective feedback, technical performance, cognitive considerations, and application of critical thinking along with communication techniques are all focal highlights to include in a debriefing session.

As participants reflect on the encounter during the debriefing session, a debriefing facilitator can guide the conversation through leading and embedded questions and objectives. The questions should generate feedback and individual perspectives around the scenario. A complimentary tool used within the debriefing session is the ability to apply video playback. The recordings can highlight various events, actions or encounters during the scenario. The video recording and technology can reinforce a positive attribute seen within a session or bring attention to a performance opportunity that transpired during the scenario [7].

Within the simulation industry, various video recording methods are utilized by debriefing facilitators. This chapter intends to bring attention to the various options and applications that AV (audio-video) technology can offer an educator or facilitator. Despite the various options available, a useful and feasible option should be identified by the simulation administrator overseeing a mobile simulation program. A practical and portable system is essential when using AV recordings in the mobile environment. Dedicated brick and mortar sim centers typically host a robust fixated AV recording system along with dedicated debriefing rooms [3]. Within a mobile or portable environment, dedicated debriefing space is typically difficult to find near the in situ space. Some mobile/portable simulation programs augment this challenge by hosting an effective bedside debriefing following the scenario when debriefing space is not available. Fixated AV technology can be easily applied in a dedicated mobile lab similar to brick and mortar facilities. Identifying essential needs, desired features, and infrastructure are all valid considerations when planning to implement an AV system into a mobile lab.

Selecting a Recording System that Fits Your Needs

As mentioned earlier, the program administrator should select an AV system that meets operational needs and budgetary allowances. A list of defined features and intended uses should be factored into the selection of an AV recording system. In some cases, simulation programs have opted to go with a homegrown system that simply provides audio and video features for viewing a sim session. Expanded options for a homegrown system may include recording capabilities, playback features, and camera control options. In a homegrown design, simulation administrators typically reach out to individuals with internal resources or staff that have a background in AV or videoconferencing technology. The homegrown design offers a starting sim program with an entry level platform that can be implemented at a relatively low cost. The simulation administrator should always consult an AV expert to assure all technical, functional, and operational considerations are addressed prior to making a final decision on a system. Technical factors will impact some level of implementing an AV system in a mobile or portable environment. Consulting with system experts will be key no matter what level of AV system the simulation administrator intends to install.

When considering a homegrown system, it is important to understand that the system is typically limited in functional features, and, at best, the AV quality will only achieve basic features. Common homegrown platforms may leverage videoconferencing software and hardware, video surveillance camera systems, and mobile app based software. In most homegrown systems, wireless, Wi-Fi or some level of network connectivity is needed to link cameras to the viewing station. Utilizing an integrated system with paired audio and video streaming is essential to assure effective viewing of the simulation event and experience. A user selected playback option is essential if the simulation facilitator is planning to utilize the recording during the debriefing. This allows the facilitator to move throughout the recording to predetermined timelines in the video to include in the debriefing. Additionally, it is important to determine how and when the recording will be available for the debriefing session. Some homegrown systems require an upload or recording finalization timeline at the end of the event. This timely event will limit efficient access to the recording immediately following the sim scenario. Other systems may use a video card that can be pulled out from the recording device and moved to a computer for playback options.

A variety of commercial vendors offer robust AV recording systems dedicated for the sole purpose of simulation education. These commercial systems commonly offer in-depth qualitative, operational, educational, and logistically driven features that streamline the operation of a sim center. The software that drives these robust system commonly provides file management for records and recordings, multi-user access, various reports, evaluation tools, calendars and scheduling features, scenario management, and inventory controls. The level and quality of audio and video features matches the unique demands required in the simulation and education environment. In a commercial system, the camera and video controls typically include multi-camera angles, pan-tilt-zoom, time stamp, and comment entries within the recording.

Obviously all of these features and resources come at a cost. Additionally, commercial systems typically require ongoing annual expenses to support warranty and preventative maintenance needs. Consideration should also be given to the progressive advancements occurring within AV technology. Taking note of new and emerging technology will assure that the implemented system will serve the simulation program into the future and not require technology updates or upgrades immediately after a system install. The simulation administrator should consider the investment cost and benefit during the design phase of their program [8]. Though a homegrown system offers upfront cost savings, the commercial system can save a simulation program money in providing embedded resources essential in managing a successful simulation program.

When the simulation administrator is considering the type of AV recording system to invest in, he/she should make a working list of uses and features that they desire and those that are essential for their program. One should not focus on the immediate timeline but also consider programmatic growth and future needs. Frequently, simulation administrators report a one-time opportunity for capital dollars invested into building their program. Some of these budgetary constraints are guided by the proposed budget that the simulation administrator prepares or a budget that their organization provides them to work within. A tight budgetary schedule will prompt the simulation administrator to prioritize their capital and expenditure requests. Mindful consideration in evaluating all aspects of the program is essential during the planning phase of the program. Table 8.1 can render assistance to the simulation administrator while considering features and options of their proposed AV system.

Table 8.1 Uses and features of a dedicated AV system

Immediate live AV viewing	Camera angle
Playback option for debriefing	Pan, tilt, zoom cameras
In session video comments	Wireless connectivity
Video archiving	Audio level adjustments
Calendar and program scheduling	Integrated data collection from the case
Record management and archiving	System connectivity – point to point connection or routed path for streaming
Generating reports	
Inventory tracking	System interface with medical equipment
Scenario repository	Integrated training EHR file viewing
Performance scoring documents	Offline access
Document deployment	PC or server based software
Participant learning portal	Portability and ease of setup

Integrating a Recording into the Debriefing Session

As mentioned earlier, video playback can be a useful tool during a debriefing session. However, if video playback is used incorrectly, it can expose vulnerability and lead to shame and discourse. It is imperative that the simulation facilitator engages in formalized training for debriefing and the use of video playback prior to implementing it in a debriefing session. Successful techniques and practices are taught during formalized courses to assist the facilitator in effectively using video playback as a training tool during debriefing [1].

The facilitator can identify unique events that occur during a simulation scenario that can be highlighted in a debriefing that includes video playback. Often, learners are unaware of unintended actions and behaviors that occurred during a scenario. These behaviors and actions can be brought forward to aid learners in optimizing their performance within a scenario. Following an established curriculum that clearly pinpoints objectives can assist the facilitator in effectively using video segments that will benefit the learner and team performance. The facilitator should be well versed in the scenario plan and observant of participant actions [3]. The facilitator can script notes about individual and team performance during the scenario utilizing either an electronic evaluative tool or on a paper form. Using an evaluative tool that looks at performance within the scenario allows the facilitator to take note of objectives and ancillary topics that can be addressed in the debriefing. Some commercial AV technology platforms allow facilitators the ability to capture commentary notes within the video. These notes can be easily referenced within the video playback feature to assist the facilitator in generating timely conversation during the debriefing.

Historically, it has been noted that the process of debriefing can start as early as the scenario ending and prior to the team entering a formalized debriefing session. Often a conversation starts between participants in the simulation room as soon as the scenario ends. Capturing this conversation and including it in the opening dialogue of the debriefing can at times set the stage for an effective debriefing process. Allowing the learners to lead and drive the debriefing conversation is a well-established practice applied by many as a core principle of debriefing formats. At times, the facilitator may need to interject with leading or observational inquiries that further drive participant interjection and remarks. As the conversation unfolds, key components of the interaction can be expounded upon by utilizing video playback features.

The use and function of video playback can highlight a variety of individual and team interactions. These focal points can showcase favorable and unfavorable performance that occurs during a simulation scenario. Effectively using the video is a skill that the facilitator needs to master to prevent an unsafe educational experience for the participants. The facilitator can utilize the video to showcase a key action within the scenario that lead the team to achieving one of the pre-identified objectives. The video might bring attention to the critical thinking and conversations taking place while addressing a clinical complication during the scenario. Yet another use might be highlighting implementation of best practices during a scenario. Implementing video playback for performance opportunities should proceed with established boundaries and an agreement for respectful participant behavior and comments. It is essential that the team adheres to the principle of mutual respect while engaging in the debriefing session. A common statement made by facilitators in the opening dialogue of a debriefing is *"what happens in sim stays in sim."* The simulation experience should not be used as a shaming or blaming platform for individual and team performance. The conversation and actions that take place during a debriefing should bring value to the learners experience and be productive to impact future actions. Utilizing video playback can bring individual and team opportunities to the forefront of discussions. The purpose of showcasing performance opportunities with video playback is not to place blame but determine the state of mind the learners were in while engaging in the specific actions or demonstrated behaviors. Learning from the untimely actions and behaviors of learners can aid the team in understanding the consequences of performance shortfalls [4].

The format behind optimally using video playback in performance shortfalls should be well controlled and scripted by the facilitator. Learners are commonly critical of their own performance following a simulated case. Bringing attention to individual or team performance gaps can be an embarrassing encounter for participants. This is especially true if one or more of the participants are internally identified as a professed expert or leader of the team. Ineffectively bringing performance gaps forward among peers can be perceived as a humiliating encounter or discrediting experience. Inappropriately highlighting performance gaps through video playback can be perceived as a threatening experience despite the intended drive of building and improving individual or team deficits. Care should be taken within the debriefing session to make it a safe learning encounter interaction.

The facilitator should open their dialogue with ground rules should they or the team identify a performance gap that video playback can optimally address in the debriefing. The video might be utilized prior to embarking on the underlying conversation or within the conversation to validate an observation or action [9]. The brief segment of video playback should capture enough of the situation to drive the ensuing conversation and not be too much to generate embarrassment or hostility.

Often during video playback, a brief 10–15 second clip can be enough to identify the focal point of the question or conversation. At times, a longer segment might be utilized to highlight behaviors or actions concurrently occurring in the scenario.

A common encounter during a debriefing session is highlighting a performance gap that occurred within a team's group performance. However, this performance gap may not be intentional or deliberate but extenuated based on the team's lack of experience with a clinical case, a specific skill, or treatment modality [6]. When discussing a low frequency event during a debriefing session, the team likely knows that their performance gap is magnified by their lack of experience in a given situation. Utilizing video playback in this situation should focus on specific criteria identified in the objectives and during participant driven conversations. The team will likely respond optimally to coaching on the shortfall or gap vs. reinforcing known poor performance with a video segment playback. Participants might advise the facilitator in this situation that *"we know what needs to be done; we just don't know how to do it since we have never encountered this before."*

Effort should be placed into designing, implementing, and utilizing an AV system that is functional for the purposes of a mobile or portable simulation program. It is important to not under or over build the AV system being implemented into the mobile environment. Capturing efficient and effective options within the available technology will be a delicate balance for the simulation administrator. The administrator should be attentive to immediate needs and future growth of their program. Working around budgetary restrictions may be a challenge when considering a commercial platform for a mobile or portable AV system. Time should be spent leveraging and soliciting for the optimal system for program implementation and use. Applying the technology and utilizing it correctly is an essential part of the deliverable education while conducting simulation debriefing aided by AV playback options. It is agreed by many that the AV live feed is an essential component of simulation when the facilitator is not directly in the simulation room. This feature allows the facilitator to observe and listen to the participant's clinical performance within the scenario while outside of the simulation space. The level of performance authenticity should match a realistic clinical scenario that learners partake in. Should the facilitator reside in the simulation room during a team's immersive experience, their presence could potentially impact behaviors and actions of the team. Leveraging the versatility and convenience of a mobile or portable AV platform provides a convenient option for facilitators and educators while working in a remote space outside the walls of a fixated simulation center. Matching the AV system to the needs of the program and the essence of portability can be a time saving strategy when implemented correctly.

Once an AV platform is implemented for a mobile simulation program, the staff should be properly trained in the use of its technology and features. It becomes important that staff maintain technical competency along with routine application of the AV recording platform within the learning environment. Using the playback options for simulation debriefing can be an effective educational tool when used correctly. However, in the untrained hands of staff, it can be used ineffectively and generate a discourse for simulation as a whole and the debriefing experience. Mature programs will optimally record their staff and facilitators conducting a debriefing session and submit the recordings for peer review. This routine assessment of facilitator performance can assure that program and industry standards are being followed to deliver an optimal educational experience for learners.

In summary, the use of AV recordings during debriefing sessions can be an effective tool to enhance the participant's experience. The simulation administration should carefully consider the best system to implement into their mobile or portable environment. Matching the program needs with financial capabilities is a driving influence when selecting an AV system. Investing in staff development and ongoing career development is an ancillary consideration for optimal implementation of an effective AV playback debriefing format. Including industry or AV content experts will be essential to assure that all technical considerations are addressed prior to making an overall decision on implementing an AV platform. Continued system and facilitator growth can occur with maturation of implementation and use of AV playback features.

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Research in Mobile Simulation

9

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Abbreviations

mSBE	Mobile simulation based education
MSU	Mobile simulation unit
PRISMA-P	Preferred reporting items for systematic review and meta-analysis protocols
RCT	Randomized comparative trial
SBE	Simulation based education
USD	US Dollar

Key Points

1. Research in mobile medical simulation is key to improving simulation programs and delivery of simulation education.
2. Most of the initial research in mobile medical simulation has been centered on learner satisfaction with the training.
3. Research in mobile medical simulation should ultimately prove that mobile simulation training improves patient outcomes.

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Introduction

The purpose of this chapter is to identify and describe the peer-reviewed evidence base on the use of mobile simulation units (MSUs) and the outcomes of mobile simulation based education (mSBE). As a result of this research, gaps in the available evidence will be sought to provide direction for future research.

Background

Within the field of simulation based education (SBE), the use of mobile simulation units (MSUs) is well known, and they are often exhibited at conferences. Like simulators themselves, the vehicles offer a new and interesting approach to teaching. The logic behind their use is simple: if trainees cannot make it to the simulators, you take the simulators to the trainees. What is perhaps less well known is the extent of the peer-reviewed literature that examines the role of these vehicles.

In this chapter, the term MSU will be used as a generic term to encompass all types of mobile simulation vehicles. Similarly, mobile simulation based education (mSBE) will be used to describe the type of education delivered from these vehicles.

The authors acknowledge that there is information published on the Internet describing the implementation of mSBE. A review of this material noted significant variation in the type and quantity provided on each site, with reported content typically promoting the vehicles rather than assessing their implementation. To ensure the inclusion of higher quality data, the authors have therefore only included peer-reviewed literature.

Methods

To ensure a structured approach to this review, a rapid research protocol was developed a priori. This review used the preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 checklist [1]; and, although designed for systematic reviews, its comprehensive requirements facilitated the clear research approach used. Table 9.1 details the pertinent information from the protocol regarding the search parameters for evidence-based literature. A full copy of the protocol is available in Appendix "Research in Mobile Simulation: Research Protocol Used" of this chapter.

A data extraction template was developed to record information reported in each of the included studies. This template was specifically designed to collate information on the intervention and outcomes defined in Table 9.1.

Table 9.1 Rapid review literature search fields

Study design	Systematic reviews; randomized controlled trials; non-randomized comparative (RCT) studies
Population	All health professions excluding alternative health
Intervention	Mobile simulation based education
Comparator	Non-mobile simulation based education
Outcomes	mSBE learning areas mSBE learning outcomes Participant satisfaction Participation levels Financial outcomes Resource utilization
Information sources	A systematic literature search of three biomedical databases (MEDLINE, EMBASE, and Cochrane Library) was conducted
Search strategy	A date limit of 10 years and an English language limit were applied to the following results to ensure their recency and as no translation services were available #1 Mobile simulation #2 Education #3 #1 AND #2

Note: Definitions of each of the outcomes listed are provided in the full protocol located at the end of this chapter

Results

The developed protocol was implemented in February 2018; no deviations from this protocol occurred. A total of 181 studies were identified; following the removal of duplicates and review by title, 174 were excluded, resulting in a total of 7 for full text assessment. Based on this secondary assessment, a further three studies were excluded (full details are reported in Fig. 9.1).

Consequently, a total of four studies were included in this review [2–5]. An overview of each of the included studies is detailed in Table 9.2.

Utilizing the data extraction table, information reported by each of the included studies was collated with the following information reported per outcome.

mSBE Learning Areas

Each of the included studies reported the types of mSBE learning areas delivered from their MSU [2–5]. A review of these areas identified that all taught technical skills, the most frequent of which, reported in three of the four studies, was laparoscopic skills training. Basic surgical skills were also noted by two studies.

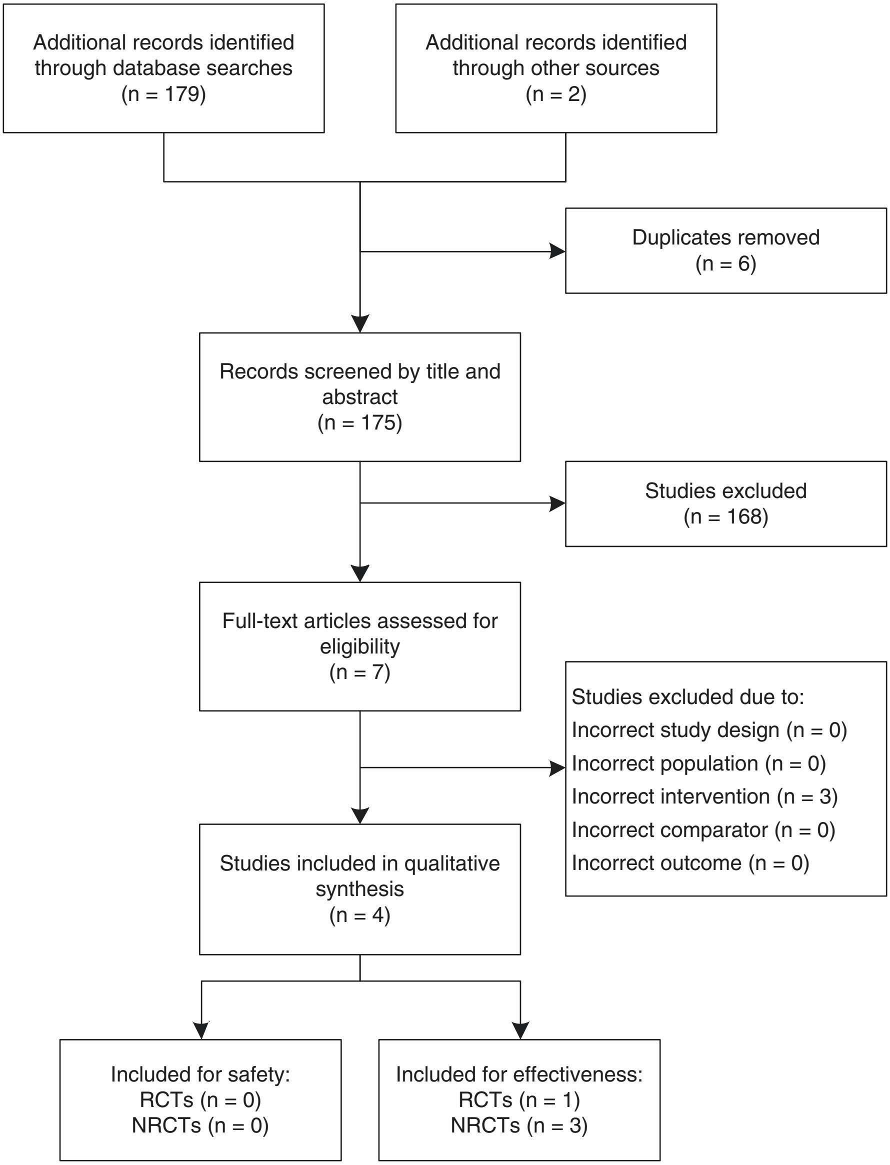

Fig. 9.1 Included and excluded studies flow chart

Table 9.2 Overview of included study: mSBE implementation details

Martin et al. (2017) [2] Case series Canada	Vehicle type: Motorhome Participants examined = 131 Participant type: Nine different populations were noted; however, their full composition was not reported Outcome measures: Satisfaction
Pena et al. (2014) [3] Case series Australia	Vehicle type: Transit van Participants examined = 55 Participant type: Resident medical officers, trainees in surgical education, fellows, international medical graduates Outcome measures: Satisfaction
Xafis et al. (2013) [5] Comparative Australia	Vehicle type: Transit van Participants examined = 228 (Fixed site n = 144, MSU n = 84) Participant type: Final year medical students, resident medical officers, trainees in surgical education, postgraduate year 1 and 2 trainees Outcome measures: Satisfaction, skill acquisition
Shaikh et al. (2011) [4] Case series Ireland	Vehicle type: Large custom trailer Participants examined = Unclear Participant type: Surgical trainees (years 1 and 2) Outcome measures: Satisfaction

mSBE Learning Outcomes

One author examined mSBE learning outcomes. Changes in participant skill level achieved in an MSU and those achieved in a "fixed-site" were compared. This comparison was performed separately for two SBE interventions - low- and high-fidelity laparoscopic simulations [5].

When a low-fidelity laparoscopic simulator was used, mSBE participants achieved a significantly higher skill acquisition score than participants trained in a "fixed-site" (value not reported). When a high-fidelity laparoscopic simulator was used, no significant difference in skill acquisition was identified between mSBE and "fixed-site" participants (value not reported).

Participant Satisfaction

The most commonly reported outcome in the studies was participant satisfaction. Three out of the four studies reported participant satisfaction results. Although two of these studies noted the use of a questionnaire, limited information was provided on their content. Responses reported by these studies, however, were consistent and strongly positive. One reported that "All participants agreed that the physical environment regarding lighting and noise level was comfortable. Fifty-one out of 53 responses concerning temperature inside the vehicle described it as comfortable...” [3]. The other study reported averaged results out of five, with the lowest reported score of 3.7 when confirming the utility of the MSU as a forum for lectures; the highest was 4.7 when assessing the MSU as a location for practical sessions [4].

The remaining study reported participant satisfaction outcomes resultant from a Likert scale and short answer questionnaire. Details on the 11 point Likert scale questions were reported (wording and response rate); however, information on only half of the six short answer questions were provided (wording and response rate). A median response score of 5 was reported for each of the 11 point Likert scale questions. Scores were similarly high for each of the reported short answer questions: MSU believability (87.0%), confirmation of limited access to simulation (82.7%), and confirmation of limited training opportunities (92%) [2].

Participation Levels

Three of the four studies reported the number of participants trained in the MSU. In one of these studies, 131 participants undertook a “trainer led” mSBE program that ran for 90 minutes [2]. The second study reported that 84 participants undertook mSBE; however, the format and duration of this training was not given [5]. The third study reported that 55 participants undertook self-directed learning, averaging 118 minutes across one to five visits [3].

Financial Outcomes

None of the included studies performed any financial analyses. One of the included studies reported MSU development costs of USD $920,000, and an yearly operational cost of USD $285,000 (adjusting for cumulative inflation at 10.9%, USD $1,020,675 and USD $316,187, respectively)[1] [4].

Resource Utilization

Information on the types of simulators used as well as the number and role of staff required to deliver mSBE training were variably reported.

Simulators

A range of simulation modalities were reported across all four of the included studies which included:

- Laparoscopic basic skills (box trainer)
- Laparoscopic basic skills (high fidelity trainer)

[1] http://www.usinflationcalculator.com/; Accessed 14/04/2018.

- Anatomy models
- Virtual reality trainers
- manikin

Staffing

The numbers and roles of staffing were poorly reported across all studies. All mentioned the presence of trainers in the MSU; however, their number and respective responsibilities were never clearly defined.

Mobile Simulation Unit

One of the included studies reported details on how and when the MSU was used during their study period [3]. Their facility was open between 12:00 and 6:00 pm, and over the duration of the study period, the MSU was operational for 52 days. This equated to a reported total of 303 hours, of which 108 MSU utilization hours were reported [3].

Conclusions

The peer-reviewed literature base assessing the implementation of MSUs and the outcomes from mSBE is very limited. As a consequence, limited commonalities were identified in this work. However, the commonalities that were identified are listed as follows.

- *None of the included studies noted their use for non-technical skills training.*
  Technical skills training, although only one facet of SBE was the only modality included. Non-technical skills training, such as breaking bad news, could also be delivered with ease within these setting.
- *As demonstrated by the range of modalities used in these vehicles, MSUs offer a flexible medium.*
  Although only technical skills were delivered, the range of simulators used in this form of training was diverse.
- *MSUs are adaptable.*
  Facilities reported in the included studies were used across Ireland, Canada, and Australia. Although the country, the training type, and the modalities in these instances were different, the training was delivered from an MSU. This demonstrates that in the same way that a classroom setting can be adapted to deliver training, so too can an MSU.
- *Very little data was available on the level of MSU use.*
  Participation, as defined by the number of individuals who attended, was reported; however, the capture rate of all individuals that could have participated was not reported. What was reported well, however, was the amount of training time undertaken by each participant.

- *MSU training is well received.*
  The reported satisfaction data had its limitations; however, the participant satisfaction results it identified were very positive. Positivity directly attributable to the MSU may be due to its novelty factor or a true reflection of its efficacy; either way, such high scores indicate that they are an extremely effective method for engaging with learners.

Areas for Future Research

As noted earlier, research into mSBE is limited, and more research is required. Indeed, the scope of this required research may extend further depending on the specific physical environment or distances over which these vehicles are utilized.

Training Delivery

As identified in the results reported in this study, mSBE is capable of delivering technical skills training using a variety of simulation modalities. An important area for future research would be to examine how these modalities perform when used to deliver non-technical skills training. Many mobile simulation units include an area for the educator; this may be utilized to represent an office or waiting room in which non-technical skills could be practiced (e.g., breaking bad news).

Similarly, the use of actors in mSBE has not been reported. This is an additional and important training modality that warrants further examination, particularly in relation to issues of transportation and opportunities for local employment.

Cost

It is widely advocated that fixed-site simulation centers are expensive to set up and utilize, and similar positions are likely to be leveled against the use of mSBE. This argument is, however, typically based on set-up costs and does not take into account other factors. Of major importance to this calculation is the cost incurred by health facilities and professionals in regional areas. In countries where the distance between regional hospitals and metropolitan training centers is large, the time and cost of being away from work can be significant. Studies examining mSBE should seek to include the cost for delivery of a course at a fixed site in comparison with the cost for delivery in an MSU.

Utilization

The advocated strength of MSUs is their ability to bring training to the trainee. This capacity must be better described in future publications to justify their necessity. At a minimum, the research fields that should be examined are: total opening hours,

hours of utilization, number of targeted participants, and number of actual participants. Other additional fields include: number of visits per participant, training demand (per time of day). Responses to each of these fields will help to define MSU usage and assist in substantiating the important role MSUs play in the delivery of health services training.

Research Tools

The description of tools used in the examination of mSBE needs to be fully explained to ensure robustness of reported outcomes and to allow for the comparison of studies.

Description of how a research tool was delivered (hardcopy forms, online survey forms, audio feedback), what it contained (Likert scale questions, short and long answer questions) need to be included in mSBE reports.

Comparative Evidence

Future research into the efficacy of mSBE must include some comparative evidence. Although limited, there is evidence to indicate that as a modality, MSUs can be used to effectively deliver SBE. Evidence comparing the training outcomes achieved as a result of mSBE should be compared to training outcomes achieved within a fixed site. At a minimum, training course (or intervention) must be congruent in its content and delivery, participants should be randomly allocated, each cohort should not be significantly different, and assessors should be blind to the participants training background (i.e., training location). With these commonalities in place, research will be well placed to identify whether any difference due to location exists, and to what degree.

Appendix: Research in Mobile Simulation: Research Protocol Used

The following are details of the PRISMA-P research protocol developed to answer the mentioned research question.

Contributions

NM produced this protocol. All authors were involved in carrying out the rapid literature review and synthesis.

Sources
Nil.

Sponsor
Nil.

Role of Sponsor or Funder
NA.

Introduction

Rationale
This protocol has been developed to provide scope to the proposed research reviewing the existence of mobile simulation based education (mSBE).

Objectives
The objective of this project is to provide a rapid review of the literature in order to answer the following research question:

- What is the scope and size of the evidence base published for mobile simulation based education?

Methods

A rapid review methodology was used to conduct this review. Rapid reviews use streamlined methods for expediting literature reviews, allowing faster completion, while maintaining the level of methodological rigor required to answer targeted research questions [6, 7]. Time savings are made primarily by limiting the study inclusion criteria, methods of analysis, and duplication of tasks that would otherwise occur in a comprehensive systematic review.

Eligibility Criteria (PICO, Population-Intervention-Comparator-Outcome)
Studies will be selected according to the following criteria.

Information Sources
A systematic literature search of four biomedical databases (MEDLINE, EMBASE, and Cochrane Library) was conducted.

Search Strategy
A date limit of 10 years and an English language limit were applied to the following results to ensure their recency and as no translation services were available.

#1 Mobile simulation
#2 Education
#3 #1 AND #2

Study Records

Data Management

Literature search results were uploaded to Endnote Software and reviewed for their eligibility for inclusion within the program. Standardized templates were used to collate extracted data.

Selection Process

Predefined inclusion criteria guided study selection. Inclusion criteria was based on the relevance of the study population, intervention, comparator, outcomes (PICO) and aligned with the research questions [8]. NM screened all search results by title and abstract. A shortlist of potentially relevant articles was selected for full-text review by NM and GM.

Data Collection Process

NM extracted data from the included studies using a standardized data extraction template.

Data Items

Following are the definitions of each of the outcomes from Table 9.3.

- mSBE learning areas: Format of training delivered in an MSU teaching technical or non-technical skills
- mSBE learning outcomes: Examine training outcomes achieved as a result of an MSU training intervention (either technical or non-technical)
- Participant satisfaction: Qualitative or quantitative measures assessing participant views on the delivery of and content of simulation-based training programs

Table 9.3 PICO table

Study design	Systematic reviews; randomized controlled trials; non-randomized comparative (RCT) studies
Date limits	10 years
Language	English language only
Population	All health professions excluding alternative health professions
Intervention	Mobile simulation education
Comparator	Non-mobile simulation delivery
Outcomes	mSBE learning areas mSBE learning outcomes Participant satisfaction Participation levels Financial outcomes Resource utilization

- Participation levels: Qualitative or quantitative measures (counts or ratios) of the participation of targeted participants
- Financial outcomes: Including but not limited to cost effectiveness, cost utility, etc.
- Resource utilization: Resources (including staff and equipment) required for the delivery of mSBE

It was anticipated that the identified results will be reported in non-randomized comparative or case series studies; systematic review and RCT study designs have been added to allow for the opportunity to include the highest level data.

Outcomes and Prioritization

The outcomes of interest include, but are not limited to, the list provided in Table 9.3.

Risk of Bias in Individual Studies

Where applicable, established tools were used to assess the methodological quality of included studies and reported at both study and outcome level. The methodological quality of the included systematic reviews will be determined using the 11-item assessment of multiple systematic reviews (AMSTAR) checklist [9]. RCTs studies will be assessed using the Downs and Black instrument [10]. Critical appraisals were summarized to describe the methodological strengths and weaknesses for each study, highlighting any key sources of bias.

Comparative and case series studies were not appraised.

Data Synthesis

Study characteristics and results are reported in Tables 9.1 and 9.2 and summarized narratively in relation to each research question. Both quantitative and qualitative data will be reported.

Meta-analysis

If possible, meta-analysis will be conducted.

Confidence in Cumulative Evidence

The strength of the overall body of evidence was described narratively in relation to each reported outcome.

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Do's and Don'ts: Tips and Tricks Learned from Experience in Designing Mobile Simulation Programs

10

Laurie S. Callen

Key Points

1. Excellent preparation is important for an effective mobile simulation.
2. The number of new variables to prepare for in a mobile simulation increases compared to the number of new variables in a static simulation.
3. Practical tips can ease the burden of preparation and improve simulation outcomes.

Introduction

Outside of a simulation laboratory, simulation exercises can take place in a classroom, conference room, in situ in a hallway, waiting area, hospital room, or stairwell; in a hotel room, theater, studio space, outdoors on a beach, on a sidewalk; or over the Internet. The possibilities are endless. When taking a simulation from a lab with more controlled variables such as equipment, power sources, light, technology and sound, to a new or unfamiliar location, it is necessary to think carefully about the relationship between the simulation design and the infrastructure and how the two might impact one another. Practically, there are new elements to communicate to the participants and simulation staff members as well.

In the lists of suggestions in this chapter, "participant" refers to the individual experiencing the simulation for training, teaching, or assessment purposes (these might be considered the "learners" or "students"). "Simulation staff" refers to the

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team executing the simulation and may include simulation managers, facilitators, simulated patients, and technicians.

Outlined in this chapter are tips and suggestions applicable to the following:

1. Mobile simulation exercises in general.
2. In situ simulation.
3. Mobile simulation incorporating simulated patients.
4. Mobile simulation incorporating unannounced simulated patients.
5. Mobile simulation utilizing video calls.
6. Mobile simulation outside.

Suggestions for Mobile Simulation in General

Before designing any mobile simulation, consider the following tips:

- Understand clearly why the simulation is taking place at the location site and align objectives accordingly.
- To establish levels of noise, activity, and light that might impact a simulation, do a site visit approximating as closely as possible the day and time of the week when simulation would be executed. Do this as early in design process as possible.
- Maintain a flexible attitude at every point of the simulation design and implementation. Things will change and be out of one's control even more than usual.
- Things will likely not go as planned. Don't sweat the small stuff – improvisation is your best friend.
- When possible, re-frame logistical constraints into positives, or enhancements.
- Communicate transparently so that all participants and simulation staff understand the objectives of the exercise as is necessary. Acknowledge the limitations or opportunities of the space.
- When rating a participant, be mindful that an unfamiliar location could affect performance.
- Clarify what is being assessed and streamline the simulation to measure what you want it to do (e.g., rating the ability to perform a psychomotor skill versus rating the ability to *find the equipment in an unfamiliar area* to perform the psychomotor skill, or measuring the time for a participant to arrive at a code versus the time it takes to properly execute skills once arrived).
- Clearly define the physical boundaries of the simulation area and what to do should a simulation move beyond those boundaries.
- Define and communicate the reasons why a simulation might be aborted.
- Ask for post-encounter feedback from all participants and simulation staff to make improvements next time. Embrace critical feedback.
- Consider supporting the realism of the environment with audio or visual aids (e.g., sound recordings, props, patient background videos).

- Make sure everyone who is supposed to see and hear the simulation is able to. Be open to repeat the simulation in smaller groups if necessary.
- Under no condition should any simulation staff or participants be put at risk. Be open to aborting any exercise if necessary.
- Have a backup plan that includes alternate dates that are already scheduled and communicated if possible.
- Don't assume that the participants are as familiar with the mobile simulation site as the simulation team is. Point out elements that are necessary to objectives in advance.

In Situ Simulation

When simulation is moved to the workplace where patient care is actually happening, there are additional factors to assimilate.

Keep in mind the following suggestions specific to in situ simulation:

- Design scenarios that are linked to incident reporting and patient safety initiatives [1].
- Design simulations for the specific site [1] and to promote collaboration and self-motivation, seek scenario ideas from the healthcare providers who work where the simulation will take place.
- Inform staff and providers why in situ simulation is being implemented and listen to their concerns and suggestions. Work to maximize buy-in, or self-motivation.
- Ask institutional leaders to promote benefits of in situ training and to share their expectations of participation and behavior, especially during mock codes.
- Regularly inform stakeholders about the practical lessons learned from previous in situ simulations. Demonstrate the value of their input and support of in situ simulations.
- Don't assume that the simulation team is permitted (or prohibited) to execute a simulation in a specific place. Seek permission, buy-in, and understanding.
- To establish levels of noise, activity, and light that might impact a simulation, do a site visit approximating as closely as possible the day and time of the week when simulation will be executed.
- Determine the geographical boundaries of a simulation and if appropriate, communicate this to participants before simulation begins.
- If all participants are not familiar with the area where the simulation will take place, consider providing them, in advance, with photos/video of the space where simulation will take place, as well as nearby equipment and resources available to them.
- If a simulation moves from one location to another, do several walk-throughs of not only the expected outcome, but possible outcomes as well, with as much equipment as possible.

- Determine the factors unique to the in situ scenario which could STOP the simulation (e.g., location:- if participants move equipment or take the simulation out of bounds, situational: if an emergency takes place).
- Explain to participants in a pre-brief which external factors to regard, accept, or dismiss during the simulation (e.g., *"During this simulation, we will listen and respond appropriately to hospital-wide announcements," "During this simulation, you may (or may not) answer phone calls, pages, or texts."*)
- Despite knowledge of a mock code simulation event, anticipate resistance from participants who are dismayed to realize that they rushed away from their activities, or patients, to participate in a simulation.
- Assess if non-participating team or staff members should be informed that a simulation will take place and communicate details as needed, giving them enough lead time to make accommodations.
- Respect the working environment and culture of the specific site where the simulation will take place.
- Minimize set-up and break-down time by storing simulation equipment as closely as possible to site [1].
- If operating electrical equipment, always note in advance where outlets are, travel with extension cords of varying lengths (including USB extensions) and travel with backup batteries.
- If simulation requires institutional Internet or Wi-Fi, practice running the equipment at the same time of the scheduled simulation to determine the strength of the Internet, as it can vary day-to-day and at different times of the day. Consider providing a Wi-Fi hotspot, keeping in mind that necessary software might be subject to institutional firewall policies.
- Have a transport plan for your equipment that includes who will be transporting it to and from the simulation, if stairs or elevators will be necessary (and can accommodate the equipment), if training is needed in handling it or setting it up, and who will be on site during the simulation to support the equipment if it malfunctions.
- Understand the physical limitations of the team responsible for transporting the equipment.
- Determine the challenges to audio or video recording the simulation and communicate with appropriate legal staff what steps need to be taken to record [1].
- Determine what, if any, medical equipment will be used and how it will be replaced. If simulating medical equipment, create a safety plan to ensure that there is no mistaking medical equipment for simulation equipment. If using and discarding medical supplies and equipment, address financial costs [1].
- Don't individually make determinations about who should or should not know about the simulation. Confer about the official messaging with all necessary parties.
- Don't assume that technological support (e.g., electricity, Internet) will be readily available, or as strong as the simulation requires.

- Don't run a mock code simulation without some formal, prior announcement to participants that they may be called into a mock code scenario, explaining the purpose and objectives.
- Don't ignore passer-by or patient perception. If applicable, communicate in advance what will be taking place and the simulation objectives, connecting the exercise to improved patient care.
- Don't ignore the fact that participants are being asked to take risks in an environment where they may feel judged by colleagues, co-workers, or patients. Debrief the exercise in private, free from observing eyes and ears so that participants and simulation staff can communicate authentically about the experience.

Mobile Simulation Incorporating Simulated Patients (SPs)

Certain training or assessment situations call for encounters incorporating simulated patients (SPs) to take place outside of a simulation laboratory.

Keep in mind the following suggestions for such exercises:

- Inform simulation participants and SPs details of the location, including the address, directions, and the type of space (e.g., classroom, conference room, hotel room, theater, studio space), providing maps and photos if possible.
- Remind participants and SPs what amenities may or may not be on site and to prepare accordingly.
- Communicate evacuation plans and the locations of staircases and restrooms to all involved.
- Inform participants and SPs what equipment will be provided and what they are responsible to bring.
- As much as possible, inform individuals around the environment that simulation experiences will be taking place, especially if extreme emotional responses are expected such as shouting, sobbing, or fighting.
- Seek permission to post clear signs directing participants and SPs where to go, using an adhesive product that can be removed easily without damaging walls.
- To establish levels of noise, activity, and light that might impact a simulation, do a site visit approximating as closely as possible the day and time of the week when simulation will be executed.
- When writing clinical scenarios, pay attention to the intended volume of the SP. Determine if increased volume (e.g., shouting) is permissible in the surrounding areas, or if adjacent simulation encounters will be affected by it.
- Utilize clinical scenarios that can be executed effectively within the constraints of the space.
- Make sure there is a cleared, flat surface to keep hand sanitizer and medical equipment. If the floor is not clean, permit SPs to wear slippers and/or shoes and socks.

- If a case requires an SP to lay down, ensure that there is a comfortable, sanitary table equipped to handle the weight of the SP along with a clean pillow and pillowcase. Use clean sheets and linens for each SP.
- Unless using a medical examination table, gurney, or massage table, consider eliminating any clinical scenarios where lying flat is necessary.
- Determine a staging area away from any simulation sites to store documents, completed assessment forms, miscellaneous equipment, baby wipes, cameras, tripods, pens, clipboards, hand sanitizer, wipes, gowns, makeup, blood pressure cuffs, stethoscopes, sheets, pillowcases, and pillows.
- Provide clean drapes for any physical exam encounters. Communicate to participants and SPs if they are to be discarded or reused.
- Determine a comfortable location for pre-briefing and debriefing with a sufficient number of chairs for participants if possible.
- Have a clear plan for the timing of the encounters and announcements to the participants and SPs. If a facilitator must knock on multiple doors for announcements, allow time to do so.
- Make hand sanitizer readily available for participants and SPs during the encounters.
- Provide drinking water for participants if water is not available. Communicate to participants and SPs if they are to bring their own.
- Establish separate areas for participant personal use and SP personal use where they may leave belongings during the simulation. Establish if food can be consumed there, and if electrical outlets will be permitted to charge personal items.
- If video recording, review with SP any instructions or restrictions about touching the camera/tripod, when video/audio recording will start and stop, and what is in camera frame. Instruct SP if they are to walk out of the camera frame after the encounter and when to return. If a technician is responsible for multiple cameras, allow time to move from camera to camera between encounters.
- If video recording, arrange room to ensure camera does not capture unwanted items such as water bottles, personal items, or paperwork.
- If video recording, make sure all people tasked with touching the cameras are trained to use and/or move them.
- When possible, replace batteries with plug-in power sources, and travel with various extension cords.
- If applicable, inform all participants in advance if facilitators and/or observers will be entering the room during the simulation. Check for loud door noises and keep doors ajar to prevent interruptions and extraneous noise on video recordings.
- Don’t assume that the participants or SPs understand where, or how, they are meant to move in and around the mobile space.
- Don’t underestimate the impact an unfamiliar space can have on all involved.

- Don't put a clinical scenario requiring an abdominal exam in a room without a table sufficient for the simulation (including having the patient roll from one side to another).
- Don't ignore the people around who might also be sharing the space. They have work to do too.

Mobile Simulation Incorporating Unannounced Simulated Patients (USPs)

Unannounced simulated patients (USPs) may be incorporated in mobile simulation to observe and assess patient care in a variety of settings (e.g., waiting rooms, patient rooms, billing offices, registration desk areas). These might be referred to as "embedded participants" or more colloquially as "mystery shoppers." Make sure to see the section on "In Situ Simulation" for other ideas.

In situations where USPs are being integrated into a simulation:

- Inquire from program leaders if staff will be notified of the USP simulation. Be sure all simulation staff keeps the details of the USP in strictest confidence.
- If a USP is to register, check-in, or meet with a healthcare provider, work with administrators to ensure that a complete patient file is created in EHR (electronic health record). IDs need to match any simulated profiles. Unless it is part of the scenario, the USP should blend into patient population in behavior and dress.
- Remind the USP not to respond to any personal calls or messages during the encounter, unless designed.
- Create an assessment form that the USP can easily fill out after the encounter in an inconspicuous location. An online form could allow a USP to fill out certain items from a phone, potentially even during an encounter.
- Prepare the USP for every potential outcome of their encounter including how to respond or react if individuals suspect they are a USP, or if they are recognized outside of their role as a USP.
- Define the beginning and endpoints of a USP encounter (e.g. "*The encounter begins when you walk through the front door of the clinic and ends when the front desk staff has finished speaking with you and you exit the clinic.")*
- Be clear and communicate under what conditions the USP should abort the encounter.
- Know the cell phone number of the USP in the event a facilitator needs to communicate once the USP has headed into the encounter.
- Have a facilitator ready to answer a phone call from the USP with any urgent questions or updates.
- As much as possible, do several inconspicuous walk-throughs of the expected outcome as well as alternative outcomes to determine any potential challenges to the fidelity of the scenario.

- Don't dismiss an aborted encounter as unhelpful. Assessments may still be informative.
- Don't dismiss the USP for the day without verifying that all reports and checklists were submitted completely and clearly. Ask for anecdotes and qualitative observations to support checklists if necessary.
- Don't put off communicating to the appropriate collaborators any unsafe behavior that was observed by the USP.

Mobile Simulation Utilizing Video Calls

Advances in distance learning software and technology allow simulations to take place with participants, and at times, simulation staff, at a distance. Simulations can address a variety of topics from patient encounters to residency interview preparation.

In these instances with mobile simulation using video calls:

- Communicate software requirements to all parties participating in simulation.
- Coordinate with all sides "calling in" to optimize audio and visual beforehand.
- Webcams should capture only what is necessary for simulation and avoid extraneous information.
- Select location of webcam carefully and avoid facing bright windows.
- Train simulation staff to practice using webcam, playing back what they capture so they understand what is heard and seen from other parties.
- Remind all participants and simulation staff to speak clearly and audibly and to stay within the webcam frame for the duration of the conversation.
- Remind teleconferencing participants of professionalism standards and to pay attention to eye contact, tone of voice, articulation, enunciation, and professional dress.
- Clearly communicate what should happen in event of malfunctioning software or technology.
- If assessments are being filled out during a teleconferencing web video call, make sure documents are not visible to participant.
- In training, and if applicable, clarify to raters how to rate participant body language and eye contact.
- Plan how simulation staff will relay chart or doorway information to the participant. If using subjective, objective, assessment, and plan (SOAP) notes, ensure participant knows where to type it and to whom to send it. Establish how timing will be enforced.
- If assessing physical exam skills, agree with administrators how to execute and rate the physical exam. Some options include having the participant verbally outline what exams they would do, asking the participant to instruct a practitioner in the room what exams to do, or writing down what exams would be important in this patient scenario.
- Design a real-life application of a clinical webcam call such as a telemedicine visit at a clinic, where the patient might already be dressed in a gown, or a patient calling in from home.

- Don't instruct SPs to pretend they are in the same room as the participant but rather have them acknowledge it is a video call in the script (e.g.*,"I came in today because I'm not feeling well and the nurse asked me to sit down and speak with you. I've never really done this on a computer before; "I didn't realize I could just call you from home. I'm so glad because I really don't feel like going anywhere.")*
- Discourage anyone on camera from sitting in a swiveling chair.

Mobile Simulation Outside

An inordinate variety of simulations can take place outside for emergency medicine, wilderness medicine, natural disaster relief response training, military preparedness, and patient transportation to name a few.

When planning a mobile simulation outside:

- Have alternate plans for weather conditions (rain, extreme heat/sun, snow). Be flexible with simulation script/design to accommodate last minute weather changes.
- Have at least one shelter that can house all participants, simulation staff, and equipment.
- Designate a sheltered area where participants and simulation staff can wait, rest, and prepare.
- Communicate to all participants and simulation staff where to go for breaks.
- Create group texts to communicate with participants or simulation staff that are farther afield. Have phone numbers of all participants and simulation staff easily available for quick communication.
- Be realistic as to the scope of the simulation and how large of an area can be clearly and safely observed for participants and simulation staff.
- Clearly define the physical boundaries of the simulation area and what to do should a simulation move beyond those boundaries.
- Test all equipment in the elements beforehand. If equipment will be used near sand, make time to inspect and clean it as thoroughly as possible before storing.
- Be prepared with sunshades for cameras if recording.
- Locate all power sources and be prepared with generators and extra power sources if necessary.
- Recognize the challenge of recording audio at the specific site and plan accordingly with microphones if necessary.

Conclusions/Recommendations

Mobile simulation can be very rewarding for the participants and simulation staff alike. It is most important, however, that in the process of creating and implementing a mobile simulation, the simulation is not compromised. The location and maneuverability of a simulation engender a host of new elements that must be carefully addressed in advance to optimize the outcomes.

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Part II

Training and Teaching in a Mobile Simulation Program

11 Mobile Simulation Training and Teaching Overview

Thomas James Lockhart and Audrey Paulman

Key Points

1. Mobile simulations offer advantages over simulations in a fixed location.
2. Mobile simulations must be carefully planned based on trainee needs.
3. Mobile simulations have some disadvantages compared to simulations in a fixed location.

Caring for patients in a rural or remote area has many challenges. One such challenge is the need for opportunities for real-life training for rare, high impact medical events. In fact, even the more common medical emergencies may be considered a rarity due to the low population density in these settings and the time and distance between providers.

Advantages of Mobile Simulation Training

Research has shown a volume-outcome relationship in improvement of skills among emergency responders. A greater volume of repeated skill practice is related to improved skill performance. In remote areas where the frequency of

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emergency events is infrequent, mobile simulation provides current review, refreshing of skills, and presentation of new knowledge to the emergency medical personnel.

Mobile simulation can provide equipment and staff to deliver advanced educational resources to a broader audience of health care professionals (compared to a fixed location simulation lab) with a goal of improving the quality and safety of patient care throughout any region.

Location is an important component to consider when planning, executing, and assessing mobile simulation scenarios. Mobile simulation provides unique opportunities for learners to train and practice in their home care environment. It is safer for rural or remote communities (compared to providers traveling to distant sites for training in fixed lab facilities) as it reduces the time employees must be away from their community for travel. In addition, it allows for entire communities to be trained together, allowing for real-life team, using their own equipment. It allows for simulation of healthcare in the communities own emergent or urgent situations such as flooding, mass trauma triage, or chemical and factory accidents. Today's high-fidelity manikins and supporting equipment are designed to travel and can be used in almost any location.

Mobile Simulation Caveats

See one. Refresh the skills. Learn new skills. Practice many through simulation. Teach one. Simulation has been used successfully to achieve these goals.

Logistically, setting up training in a mobile simulation program consists of a series of complex tasks that occur well before the simulation session.

Personnel must be hired and trained and educational methodology selected. The simulation scenario must be designed based upon resources and needs. The simulation session should be recorded for debriefing and review. Appropriate facilities must be secured, and the learning outcomes need to be defined.

Each component of simulation training needs to be assessed, along with ongoing evaluation of the instructors, equipment, and simulation environments. Educational objectives need to be established, including outcomes measurement.

A well-planned session will be enjoyable. The key is to ensure that the session is doable, and that educational objectives are achieved.

Drawbacks of Mobile Simulation Training

The transport of manikins increases wear and tear on the mannequin. Technical support in remote areas can be problematic, and the requirement of portability limits simulation of some physiologic functions in some manikins. Planning for equipment purchases for mobile simulation training must include consideration of the effects of transportation and use in a variety of conditions on manikins and supporting equipment.

More complex scenarios, which require physically moving the mannequin during simulation, may cause the mannequin to lose power. It is possible to lose fidelity due to limited mannequin function without full connectivity to power or the Internet.

With increased complexity comes increased cost, including transportation cost, increased personnel travel time, remote technical support, and wear and tear on fragile equipment.

Another difficulty with mobile simulation is that it is cumbersome to transport large equipment. It is necessary to develop transport protocols for manikins, computers, and medical equipment including code carts or anesthesia machines. Large mobile simulation vehicles may have limited access to remote sites due to maneuverability and may require level terrain.

Skills and Programs Which Work Well with Mobile Simulation

Training in some skills and certain programs and scenarios are well suited for mobile simulation. These include use of low-fidelity task trainers, such as airway, IV, chest tube trainers.

Common task trainers include:

- Chest tube trainer: Trauma Man
- Central line trainer: Blue Phantom
- Femoral line trainer
- Lumbar puncture trainers
- IV trainers
- Intubation trainers
- Glidescopes
- Foley/GI trainers

Communication scenarios are also well suited for mobile simulation, especially those focusing on inter-professional communication and patient handover.

Pediatric advanced life support, advanced cardiac live support, and basic life support are very successful examples of programs which can be performed using mobile simulation.

Examples of Successful Mobile Simulation Models

Helmsley's Rural Healthcare Program including Simulation in Motion Nebraska, Simulation in Motion Montana, Simulation in Motion North Dakota, Simulation in Motion South Dakota

The Helmsley's Simulation in Motion is a statewide, mobile education training system, which brings state-of-the-art, hands-on training, using high-fidelity human patient simulators, to all pre-hospital and hospital personnel in the region. These teaching tools are some of the most technologically advanced training tools available to the medical community today. This unique program delivers standardized education to every emergency care team in each funded state. More information may be found at: Helmsley Charitable Trust: https://helmsleytrust.org/programs/health-rural-healthcare-workforce.

University of Missouri Mobile Simulation Unit

In 2011, the University of Missouri launched a mobile simulation unit in response to the need for interactive and high-tech training resources in rural areas. The mobile sim unit provides an opportunity to take simulation training on the road. On board the 30-foot vehicle are four computerized patient manikins and virtual reality devices with the ability to simulate more than 110 medical scenarios. The mobile sim's trained staff provides on-site set-up and assistance for each session. Patient actors can be employed to make learning experiences even more realistic and effective. The mobile sim is also equipped with two cameras to record participants and data storage devices to capture a variety of information from training sessions. The eight-hour mobile simulation orientation class is included in the initial cost. More information may be found at: Sheldon Clinical Simulation Center: https://medicine.missouri.edu/centers-institutes-labs/shelden-simulation-center/services/mobile-sim.

Mobile simulation training has proven useful in improving the skills and knowledge for those providers who practice in rural or remote areas. The uses of mobile simulation will expand as the technology matures and its utility continues to grow.

Suggested Readings

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Mobile Simulation Lab Staffing

12

Kami Willett

Key Points

1. The mission and scope of your lab and your customers' needs will determine your lab's staff size.
2. All mobile simulation labs' position requirements are similar.
3. Cross training of simulation staff is key to a high functioning mobile simulation lab.

This chapter discusses the personnel of your simulation lab. The number of lab staff is determined by the size and capacity of your program and the needs of your customers. The positions listed in this chapter may be held by a single individual who works with a small customer base or you may have multiple full-time staff holding similar positions in a large educational or corporate facility.

Simulation lab staff members ultimately determine the type of lab which will develop. It is crucial to identify your customers and collaboratively work with them to identify their needs.

Is your lab affiliated with an academic institution or is it a standalone facility in a private small rural hospital? Choosing appropriate staff to meet your needs is essential for the success of your lab, and ensuring the best training for your customers.

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Staffing can be challenging as institutional budgets can be tight, and it may be difficult to get funding for positions for your simulation lab. Marketing can be helpful when it comes to securing funding for positions for the lab.

Roles/Positions

Medical Director

The director needs to be a visionary and be recognized as a cheerleader for the use of simulation throughout the institution which sponsors/supports the lab.

The director needs to encourage all simulation staff and provide leadership by example.

The medical director is responsible for the entire simulation program: from its mission and vision to its philosophy for the use of simulation. The director sets the tone of the lab. The medical director provides the link between administration and the lab and encourages the use of simulation as an educational tool throughout the sponsoring institution.

The director needs to be a clinical professional who is well versed in the educational process of simulation; the director needs to have a keen understanding of how simulation works and what it takes to develop simulation programs.

Simulation Director

The simulation director manages simulation program operations, training, and logistics. Tasks assigned to the simulation director include oversight of personnel; budget; expenditures; internal/external customer relations and development; and collaboration with all system educators and trainers.

The director collaborates in the development and implementation of simulation-based clinical education and works in conjunction with appropriate officials to ensure that simulation programs align with curricular needs.

The simulation director provides oversight of the day-to-day operations of the lab. Their job duties include supervision and coordination of all staff working with the facility. They need to be able to defuse a stressful situation, encourage novice simulation users, and be able to fill in whenever, wherever needed. The simulation director may be responsible for collaborating with facility users in the development of large simulations, research, grant applications, and all aspects of funding and promotion of the simulation lab.

The simulation director is the "face" of the simulation facility and needs to be energetic, positive, and enthusiastic about simulation. The director *must* be knowledgeable of the pedagogy and educational theory driving the educational process of simulation and must be able to fulfill any gaps of the other positions in the lab.

The simulation director develops job descriptions and provides hands-on leadership and direction in the hiring of new employees.

Simulation Curriculum Designer

This position has the need for someone with education and simulation in their background. The simulation curriculum designer meets with the individual educator/patron of the facility to develop, coordinate, and provide assistance in the development of any skills and/or high-fidelity activities in the lab. The individual must be knowledgeable in the types and capabilities of all equipment within the facility. This person must be able to communicate effectively with individuals not well versed in the use of simulation to develop, test, refine, and provide evaluation processes for each simulation designed. The staff in this role should also be a Society of Simulation in Healthcare (SSIH) Certified Healthcare Simulation Education Certified Healthcare Simulation Educator-Advanced (CHSE-A).

Simulation Operations Specialist

The simulation operations specialist provides oversight of the multiple simulation technicians employed by the facility. The simulation operations specialist determines who and when each simulation technician provides service for individual projects. Additionally, this person must continue to provide training opportunities for themselves and all the simulation technicians under them. The simulation operations specialist provides workflow and evaluation processes for the simulation technicians in collaboration with the simulation lab director as well as the entire simulation team. This role should also be a SSIH Certified Healthcare Simulation Operations Specialist (CHSOS).

Simulation Technician(s)

Simulation technicians will provide technical support for all simulation operations of the simulation lab. They will assure that facility and equipment are organized and set up for teaching sessions, including preparation, maintenance, and repair of computerized manikins, task trainers, and related multimedia peripherals. Simulation technicians will program, test, and run scenarios with instructors and facilitators prior to scheduled training. They will also troubleshoot manikins, audio/video (AV) equipment (e.g., displays/monitors, controls panels, projectors, computers, associated wiring, and related devices/peripherals). Other duties of simulation technicians include: interface with vendors regarding troubleshooting and system problems, conduct routine equipment maintenance and inventory updates, train faculty, facilitators, and other staff in the different simulation technologies, and the operational aspects of simulation as well as the operation of AV equipment and technologies used in simulation lab trainings. They will also assist faculty in monitoring student and manikin safety, and restore lab to pre-scenario conditions. In a mobile simulation laboratory operation, some of the technicians must also have skills in vehicle operation and distant electronic communications and equipment support. The staff in this role should also be Certified Healthcare Simulation Education (CHSE) certified by the SSIH.

Instructional Designers

An instructional designer is an individual who systematically designs, develops, and delivers instructional products and experiences, both digital and physical, in a consistent and reliable fashion toward an efficient, effective, appealing, engaging, and inspiring acquisition of knowledge [1, 2]. The process consists broadly of determining the state and needs of the learner, defining the end goal of instruction, and creating some "intervention" to assist in the transition of learning. The outcome of this instruction may be directly observable and scientifically measured or completely hidden and assumed [3]. There are many instructional design models but most designs are based on the ADDIE model with five phases: analysis, design, development, implementation, and evaluation.

Standardized Patient Coordinator

The standardized patient coordinator works with the standardized patient program. They need to be educated in the use and training of standardized patients for simulation learning. The standardized patient coordinator performs employment interviews and suggests to the simulation coordinator who should join the simulated patient cast. Additionally, the standardized patient coordinator monitors individual compliance and employment requirements for any standardized patient. Additionally, the standardized patient coordinator is responsible for the assignment of cases based on the education case needs for each standardized patient. They are also responsible for the tracking of each standardized patient work load, training, and payroll. Most importantly, the standardized patient coordinator needs to understand the role which the standardized patient plays in a simulation and should be able to recognize the need for specific training for each specific case. Most importantly, the standardized patient coordinator is the voice for each standardized patient. This person needs to be aware of every standardized patient's well-being and ability to perform multiple characters for multiple learners. The standardized patient coordinator must be aware of the mental, physical, and emotional status of each standardized patient while the standardized patients are completing their work.

Standardized Patients (SPs)

Standardized patients (SPs) are individuals trained to portray a patient with a specific health related problem in a realistic, standardized (every learner gets the same performance) way. They are generally part-time employees. The SP's background is important dependent on the role they need to play. Many simulation labs hire actors or artists while others hire retirees, especially retired professional clinicians who would want to help support the mission of the lab. Generally speaking, the SPs are paid employees. Retired clinicians who are hired as SPs need to understand the role of the SP and what roles they play in evaluation. They can evaluate medical processes of the learner but must understand that they have a role to play and will be assessing the learner; however, they must understand that they are not the educator.

The SP can be used for demonstration, teaching, and skills rehearsal; if trained properly, they can assess leaner outcomes based on a valid, reliable evaluation instrument for at least communication skills. SPs generally do not evaluate learners on clinical topics. Some programs allow the SP to provide feedback on a written evaluation form whether a leaner has done a step, but no SP, unless clinically trained, can evaluate any learner on the clinical aspects of the case.

SPs can provide additional fidelity to a given simulation. Some skills training opportunities can be made into a hybrid situation using SPs. The SPs provide the communication pieces to the simulation while the skills aspects of the simulation can be performed on a task trainer either attached or next to the SP.

SPs have to be highly trained to portray specific details of simulation cases in addition to being versed in family background, emotions, and physical findings of the patient they are trying to portray. Often, SPs experience emotional issues like their characters and need emotional breaks from difficult or challenging cases.

When SPs are used for assessment, they need to have small breaks between multiple users to eliminate the erosion of accurate reporting.

Mobile simulation programs may find it efficient to recruit SPs in communities served repeatedly by the mobile simulation units.

Subject Matter Experts

Also referred to as SME, the subject matter expert is a person who has special skills or knowledge on a particular job or topic. SMEs are highly accessed by instructional designers to extract intelligence and knowledge when developing courseware and learning programs.

Evaluators/Assessors

These individuals are not usually provided by the simulation lab. Most education simulation lessons have an SME who works with the instructional designer to design an evaluation process. This evaluation process may take many forms and can be completed by SME clinicians and/or senior students.

Feedback Coordinator

All individuals who oversee the development and operation of a simulation should be instructed in the area of giving feedback. It is generally assumed that the clinician, faculty member, or SME would lead the feedback section of any simulation, but some entities have trained individuals who provide appropriate feedback to the learners in partnership with the simulation SME. Feedback must follow all simulations from skills training (learners need to know if they did the procedure correctly) to high-fidelity simulation.

Scheduling Coordinator

This individual will develop the clinical and simulation lab teaching schedule. The scheduling coordinator is key to the success of a mobile simulation training program and is often the point of first contact for the mobile program. Matching the schedules of learners and instructors while monitoring the status of equipment and weather/road conditions can be daunting. The person in this position is also often tasked with maintenance of the various certification and training documentation required by monitoring and accrediting agencies.

Very few mobile simulation programs will have an individual filling each of these positions; however, the tasks outlined for each position will likely need to be completed in order for the program to function. Successful mobile simulation programs have focused on cross training of staff members to allow for session completion in the event of absence of one or more staff members due to leave or illness. Cross training involves staff members learning the basic functions of other staff members, thus allowing staff to serve as emergency "fill ins" for their colleagues.

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Educational Strategies for Mobile Simulation Units

13

Christina M. Jackson

Key Points

1. Applying adult learning theory when planning and conducting mobile simulation training exercises will enhance the learner experience.
2. Adult learners like to take an active role in their learning, preferring problem-centered learning.
3. A pre-simulation audience analysis will determine the educational needs of the audience and help guide the instruction during a simulation exercise.

The primary usage of mobile simulation is for professional development opportunities for working medical professionals. *Mobile simulation units take the learning environment directly to the learners; providing outreach training within local communities that, likely, do not have access to advanced training facilities.* This chapter will focus on working with the *adult learner* as many of the individuals who will participate in mobile simulation experiences will be adult or non-traditional learners with prior *experience and established professional identities*. The standards of best practice in simulation education build upon the foundational work of constructivist theory and adult learning theory. The point of this chapter is not to make readers experts in constructivist and adult learning theory, but to provide foundational knowledge so educators can better facilitate learning by applying these theories in a practical way.

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Creating quality learning experiences involves understanding how adults learn. Adult learners bring a wealth of knowledge, ideas, and experiences into the learning space. Effective teaching involves helping these learners make connections between new experiences and old, transferring and reinforcing classroom knowledge to practical application. Understanding what drives the adult learner to seek out learning opportunities is also crucial when working with them. Adult learners are typically self-directed. They experience different types of motivation including goals, activities, and learning. They have learning needs and are seeking out ways to meet them.

Adult Learning Theory

Learning is described in many ways. Drawing upon learning theories can help educators better plan and execute effective strategies. Much of educational theory focuses on domains for learners young and old. These domains are behavioral, cognitive, and constructivist. The behavioral domain changes a learner's experiences in how they perform various tasks, while the others focus on the cognitive processes, or how the learner thinks. Other learning theories are comprised of a mix of the two, behavioral as well as cognitive processes, taking into consideration how the learner synthesizes and applies new content. Key learning theories include behaviorist orientation, cognitive orientation, and constructivism.

In the behaviorist orientation, the learner is considered successful when he or she exhibits a change of behavior. The changed behavior is something that can be observed. The behavior change is due to the learner's environment, not the learner himself.

The cognitive orientation focuses on thought processes and patterns rather than environment and behavioral change. Cognitive thought processes are mainly internal. Many of the cognitive theories include the ability of the learner to relate experience to the new material learned.

Constructivism is based on students creating meaning from what they have learned in the past and what they are learning currently. They are not "empty vessels waiting to filled, but rather active organisms seeking meaning" [1]. Theorists propounding constructivism include Piaget, Dewey, and Vygotsky. Piaget surmised that learners are better prepared to construct meaning at more sophisticated levels as they mature. Dewey looked at the transactional nature of learning based on the learner's needs in relation to the learner's environment. Vygotsky looked at how sociocultural context could influence how individuals construct meaning. It is necessary for the learner to take an active role in his or her own learning. Learning that takes learner experience and environment into consideration will be the most effective when working with adult learners. It is how individuals construct meanings from their experiences and their social environments; this differentiates them as learners, as well as members of a community. Accepting how people make sense of their worlds is an effect of constructivism. The instructor's role is as a facilitator, helping the learner explore new ideas and applications to connect new to previous knowledge.

There is a wealth of knowledge regarding how adults learn best. Learners best learn. Learning is often situational, based upon the learner's current job or environment. Adult learning theory goes beyond these descriptions to acknowledge the unique needs of the adult learner. While there are several adult learning theories in existence, this chapter builds on the conceptual model of andragogy which provides certain assumptions regarding the adult learner and considerations in approaching their learning. In the late 1960s, Malcolm Knowles introduced andragogy, defined as the "art and science of helping adults learn" to distinguish adult learners from pre-adult learners [2]. He later recategorized it as a model of assumptions. Andragogy is based on the following assumptions:

1. Adult learners have a vast wealth of knowledge from which to pull.
2. Adult learners are intrinsically motivated.
3. Adult learners need to know why they should learn.
4. Adult learners are more willing to learn when they understand how the learning is relevant to them.
5. Adult learners respond well to task-oriented learning. Hands-on application of materials helps them synthesize new knowledge with the old.

These concepts are presented throughout this chapter to demonstrate how the theory of andragogy closely aligns with best practices in simulation. Applying constructivist and adult learning theories to practice in mobile simulation can enhance the educational experience.

Preparing for the Adult Learner

Learner Needs

Before the learners enter the simulation space, time should be spent analyzing the learner and learner's needs as well as designing a simulation experience appropriate for the learners. An audience analysis will provide the educator a background regarding the learner's current level of knowledge, skills, abilities, as well as scope of practice; the educators will then have a basic understanding of their learner and what the learner is seeking through the educational training session.

Educators need to have an understanding of why the learner is seeking out the training to be able to provide the best design and experience that meets their learners' needs. Once the educator has this information, it is beneficial for them to share these findings with the learner. Learners need to understand the rationale behind the learning even when they are intrinsically motivated to seek out the learning. When learners have a deeper understanding of the rationale behind the learning experience, they will be better able to see how the learning is relevant to them and recognize how they can directly apply the learning. Otherwise, they may dismiss the new information as irrelevant or contrary to prior learning.

Setting the stage for learning by sharing leaning objectives and intended outcomes will help frame the learning and create learner buy in. Discussing how the training experience will help prepare emergency personnel to be better prepared to respond to a specific case in which response time and quality of care are crucial, is helpful. Services may have already worked on a similar case, so having additional knowledge and expertise may help improve response time and quality of care.

Learner Motivation

Adult learners will have different motivational factors than their younger counterparts. These motivational factors will often influence the level to which adult learners seek and gain knowledge. They are often more motivated, seeking out the information they want to learn. They may be looking to gain knowledge for the sake of gaining knowledge or trying to better themselves in some other manner. They may be trying to get a promotion or earn more money. By the very nature of their role, emergency responders are addressing community and societal needs. They are choosing what they learn and seeking out the best options and environments which to learn. These choices will include formal and informal options. They may seek certifications or a degree to document and quantify their learning. Grades and other forms of assessment may not motivate their performance. In addition to the intrinsic motivational factors, there will still be extrinsic motivational factors. Educators can help learners identify extrinsic motivators, explaining how the educational experiences will help the learner. Acknowledging these motivators can help add another layer of motivation for participating.

Adult learners are not limited to formal education and may seek out informal learning environments to meet their needs. They look for convenience while also meeting job, family, and societal obligations. Barriers to learning often include time, cost, distance, lack of training, personnel, and pedagogical knowledge, and equipment. The mobile simulation unit can help eliminate several of these barriers.

Learner Self-Direction

Self-directed learning is important to an adult learner because it embraces the prior knowledge a learner has; it also acknowledges that knowledge is socially constructed and that the learner constructs many interdependent relationships. The acknowledgment of prior knowledge is important when working with adult learners as prior knowledge is very important in and of itself.

Task-Oriented Opportunities

Adult learners learn best when they "do." Creating relevant, engaging educational experiences is more than just bringing up a scenario and running it. Careful planning prior to running the simulation is needed. Design with the end result in mind. What does the educator want the leaner to accomplish? How will the learners tie their previous knowledge to the current experience?

During the pre-simulation briefing, the trainer should explain the process, rationale, etc. to facilitate learner understanding and reinforce their personal need to acquire the knowledge and skills that the simulation is aimed to teach them. This ensures that this critical step in the adult learner experience is carried out in a proper way. The briefing is necessary not only in simulation education but also in educating the adult learner.

Incorporate opportunities for the learners to explore their problem-solving abilities in addition to specific tasks. Having the opportunity to problem solve will help the learners more readily recognize an issue when they are faced with it.

Consider the low-frequency, high-intensity scenario. As the learner has prior exposure to a case such as this, they will be able to recognize the signs and symptoms when they present in the real-world environment and the training they have had will kick in. They will be able to make decisions regarding care quickly because they have already been exposed to such situations and thought out the steps of care. The results may not be immediate. Many of the cases used are put forth in the hopes that they will never be needed; but the training will kick in when the situation calls for it.

Mistakes as a Learning Tool

Some of the best learning occurs as a result of mistakes. When a learner makes a mistake, provide them with the opportunity to walk back through the scenario and break down their actions. They need to examine what they were thinking in the moment. Making a mistake may stand out more than something that comes together easily; the learner making the mistake will remember what they did wrong and the steps they took to correct the action.

Classroom Management

Classroom management issues are common. Due to the confined space in which mobile simulation occurs, there will be additional space-related classroom management issues beyond the regular classroom. Space-related issues in the mobile simulation unit include a limited number of learners, noise issues, as well as issues of flow. There can only be a limited number of learners in the space at one time. Move learners from one space to another to alleviate bottleneck. Fortunately, emergency responders are already accustomed to working together in confined spaces with noise issues, so these issues are not insurmountable. The challenge is being aware of how these issues will impact learning as opposed to being experienced in real-life situations and compensating for them.

Consider the number of individuals; you may have to do shorter, more intense sessions with fewer people or reduce the number of competencies you are trying to assess in a given time. You have to make the decision regarding what is best pedagogically unless you are specifically running the mobile sim working with EMS (emergency medical services) personnel who are accustomed to working in a confined environment under stressful conditions. As with anything, establishing the outcomes and objectives will be the first step.

It may be necessary to put equipment and supplies in an easily obtainable area so that they can be accessed as needed rather than expecting the learner to search through drawers to find what they need. They are already accustomed to their own ambulance so expecting them to spend precious time searching for supplies in an unfamiliar environment may cause frustration.

Increased tension and pressure can occur because the educator is taking them out of the lab environment or, in the case of pre-hospital providers, you are putting them in a place under conditions that are already familiar. The layout and accessibility of supplies may differ from service to service. The core competencies of teamwork, communication, care, etc. will remain the same.

Reaction time is important. A team that is not coming together may have more trouble communicating and caring for the patient. The time in the scenario elapses and the patient dies, walking through what happened—what went well and what didn't in the form of a debrief—will help the team improve. Allowing the team to run the scenario again will help the team. They are able to work through issues; they are able to make decisions (sometimes different, sometimes the same). They will come back and approach the case. Working harder. Working faster. Working together to save the patient and improve the patient's outcomes.

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14 Scenario Design

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Abbreviations

INACSL International Nursing Association for Clinical Simulation and Learning
SMART Specific measurable achievable relevant time-bound

Key Points

1. Scenario design should be guided by educationally-sound design principles.
2. Needs assessment and well-crafted learning objectives should guide the process of scenario design.
3. Design templates can help ensure that important steps and design considerations are incorporated.
4. Storyboards are a useful tool for understanding and determining the flow of a simulation scenario.

Introduction

Today's health professions educators have a variety of modalities to choose from, including traditional didactic teaching sessions, bedside teaching in an apprenticeship model, team or problem-based-learning, online resources, and others. The choice of teaching method should be driven by the learner's needs as well as the learning objectives. Simulation is particularly useful for practicing teamwork and

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communication skills as well as the biomechanics of procedural skills. Nuanced, well-designed simulations can come to life for learners and immerse them in a realistic learning experience, which would otherwise only be possible while working with real patients.

Simulation allows medical learners to practice clinical skills under safe, controlled, forgiving conditions, undergo formative assessment, and receive focused feedback with the goals of acquiring and maintaining clinical competence [1]. This is particularly important for skills required in high risk, low volume clinical settings, such as medical codes or procedures [2]. Because these situations occur infrequently, healthcare trainees frequently have little or no exposure to such events during their clinical training, and even when they do, they are often observers rather than active participants.

Caring for real patients involves much more than memorizing biochemical pathways or recognizing patterns on an X-ray. Patient care requires a set of knowledge, skills, and attitudes that must be learned through practice and experience. However, this poses a challenge, as it is difficult to ensure that our trainees will consistently be exposed to the same pathology or clinical scenarios when they leave the classroom and enter the clinical training environment.

Simulation can help to address this gap by providing additional opportunities for exposure to realistic scenarios and time for the deliberate practice that is necessary to progress toward not only competence but expertise. Chickering and Gamson [3] wrote about the seven principles of good practice in education. Simulation by its very nature encourages each of these seven characteristics when it is designed in a thoughtful, systematic way.

The biggest drawback of simulation is that constructing complex scenarios is time consuming, and high-fidelity equipment is often expensive. In addition, simulation is not the best choice for every educational objective. However, there is growing evidence that simulation techniques which include deliberate practice may be superior to traditional clinical education [1]. Simulation clearly has a role to play in the education and preparation of health professions trainees. Ensuring that educational objectives are met starts with thoughtful scenario design.

Background/Theory

Educational theorists would suggest that hands-on, real-world participation is the best way for learners to construct their own understanding of important concepts and content. While simulation often occurs in simulated spaces with simulated patients, it does allow a degree of realism that adds to the students' learning. In addition, because the instructor controls many of the variables in a simulated scenario, instructional scaffolding techniques can be used to focus the learner on key components of a task or situation.

Another guiding educational concept is situated learning – the idea that the physical and social context where learning occurs is important [4]. This concept is particularly germane when discussing mobile simulation, where we literally bring the simulation experience to the learners in their own clinical environment. This contextual learning creates an experience that is more realistic and immersive for the learners.

Glavin [5] suggests that simulation is a superior educational technique to use if the learner is required to show or demonstrate a skill. Simulation allows the instructor to assess the learner's clinical competency – something that simply cannot be done with other teaching modalities. In particular, simulation is a good strategy when it is necessary to assess the learner's response to high-risk and complex situations in clinical care [6].

Most participants in healthcare simulation are adult learners. As such, basic assumptions of andragogy apply. These assumptions include: adult learners become increasingly self-directed as they learn, they draw on their prior life experiences, they are problem-centered and want to apply new learning to real-world situations, and they are internally motivated [7]. Clearly, providing our learners with authentic, meaningful and engaging educational experiences will enhance their learning.

Though well-designed simulation experiences often require a significant up-front investment of time and capital, they deliver educational experiences that would otherwise be impractical or pose too great a risk to real patients. Given the stakes involved, ensuring that our learners receive the most effective training possible is certainly worth the investment.

Educationally Sound Design Principles

Like any educational strategy, simulation experiences must be constructed thoughtfully, and with the end in mind in order ensure that the objectives of the activity are met. Sound simulation design can be guided by the fundamental assumptions of adult learning theory, including: adults learn by doing, adults will only learn what they feel they need to learn, adult learning focuses on problem solving, and adults learn best in collaborative situations [8]. These assumptions help to guide our educational interventions, and more specifically, lead directly to the key concepts of proper simulation design.

One of the most widely used standards for simulation design is the International Nursing Association for Clinical Simulation and Learning (INACSL) Standards for Best Practice [9]. These criteria include the following:

1. Conduct a needs assessment
2. Construct measurable objectives
3. Structure the format of the simulation based on the purpose, theory, and modality for the simulation
4. Design a scenario or case to provide context for the simulation
5. Use various types of fidelity to create the required perception of realism
6. Maintain a facilitative approach that is participant centered and driven by the objectives, participant's knowledge or level of experience, and the expected outcomes

7. Begin with a prebriefing
8. Follow the simulation with a debriefing or feedback session
9. Evaluate participants, facilitator, simulation experience, facility, and support team
10. Provide preparation materials and resources to promote participants' ability to meet identified objectives and achieve expected outcomes of the simulation
11. Pilot test simulation experiences before implementation

A good education design is driven by the needs of the learner, not the preconceived ideas of the educator. This step is often forgotten, even by experienced instructors. In order to create learning objectives, we must first define what the learner needs. With this in mind, conducting a needs assessment becomes the basis for not only creating your learning objectives but also the justification for the entire endeavor.

Well-written, specific, and measurable learning objectives are the foundation upon which any simulation experience is built. Learning objectives guide design of the simulation, and if they are measurable, the instructor can ensure their learners are meeting these objectives at the completion of the simulation experience. Similarly, any simulation should take into account the competency and baseline knowledge of the learner. If the simulation is too advanced, the learner will struggle to keep up and become overwhelmed. If the simulation is too basic, the learner will lose interest.

Design Templates

A common feature of almost all models for educational design is that they follow a roadmap for development. Following a standard blueprint for scenario design helps ensure that all the necessary components of educationally sound design are met. Many such checklists or blueprints exist [10–15].

Table 14.1 is a summary of the common key components of such templates.

Needs Assessment

Sound simulation design starts with a needs assessment. This needs assessment will allow the identification of learning objectives that will drive the creation of the simulation experience. Before learning objectives can be created, we must know what competencies the participants have, and what competencies are necessary for optimal patient care. In other words, what problem is being addressed with the simulation exercise. Once the gap is identified, the educator can move on to deciding the best methodology for addressing it [16]. In some cases, this will involve simulation, but in other cases, other educational modalities may be more appropriate.

Table 14.1 Scenario design template

Component	Description
Title	Descriptive title of the simulation experience
Needs assessment	Evaluation of participant needs – this can include a survey of the participants and other stakeholders, or review of published standards
Learning objectives	A list of specific, observable, and measurable learning objectives
Cognitive and psychomotor skills	A list of observable skills to be incorporated into the scenario
Participants	A description of participants and their baseline knowledge and skills
Case summary	A narrative description of the case and how it will unfold
Background	Additional details about the case including clinical setting, patient information, and room or location setup
Roles of participants	A description of what role each participant will play, particularly when the case involves an inter-professional team
Equipment needs	A list and description of any simulation or patient care equipment and supplies needed to run the scenario
Scenario setup	Description of how the room or setting should be arranged and prepared before the scenario begins – this may include initial high-fidelity simulator settings, moulage, and monitor settings
Anticipated duration	An estimate of how much time will be required to carry out the entire simulation, including a breakdown for setup, prebriefing, and debriefing
Personnel	A list of individuals needed to help run the scenario – this may include a facilitator, simulation technician, debriefer, and others
Prebrief outline	Outline of information to be provided to the learners before the scenario begins – this may include a brief description of the objectives of the scenario, how the learners will be evaluated and what their roles will be
Debriefing facilitator guide	An outline of content to be discussed in the debriefing session – this should include creation of a safe environment for debriefing and questions to prompt discussion and reflection.

Learning objectives should always be measurable and appropriate for the learners that will participate in the simulation [9].

One important question that must be asked before embarking on simulation design is what knowledge, skills, and attitudes are necessary for the topic one wishes to cover [17]. The development of learning objectives is a tremendously important step for any educational activity. Learning objectives should drive the selection of the teaching methodology.

Learning Objectives

Learning objectives are a key component of any educational activity. Well-written learning objectives describe in specific and measurable terms what participants will master when they complete the simulation. They serve as a signpost to keep the educational activity focused on what is important and provide a measuring stick to determine whether the participants achieved the goals of the activity. They also provide the participants with clear expectations about what content will be covered and what they are expected to be able to do.

When identifying learning objectives, the instructor should refer back to the needs assessment. What must the learner truly master? How can that be stated in terms that allow objective assessment of the learner's success? Instructors may find it helpful to use resources such as Blooms taxonomy [18, 19] or the Specific Measurable Attainable, Relevant, and Time-bound (SMART) model [20].

Goals: Formative Versus Summative

Practically speaking, simulation has two main goals. One is to provide the participant with a learning experience. The other is to assess their ability to apply or demonstrate what they know or have learned. Formative assessment in simulation is focused on monitoring student learning with the goal of improving both the student's performance and learning, as well as our instructional methods. Formative assessment is generally low-stakes and the focus is on improved performance rather than grading.

In contrast, summative assessment in simulation is focused on comparing the learner against benchmarks such as a set standard or peers. It is often high-stakes, meaning that it typically has an impact on the learner's grade, progression through a course, or certification.

In general, formative simulation will be used when the goal is improved performance or application, while summative simulation will be used when the focus is on grading or creating narrative descriptions of participant performance. The reality is more nuanced and complex. Typically, there is overlap between summative and formative methods. In fact, the summative components often inform the content for the formative portion of simulation exercises. Our choice of formative vs. summative (or a combination thereof) feedback should be guided by the goals of our simulated activities.

Assessment Tools

Assessment is an integral part of any educational activity. It has been defined variously, but Popham [21] described it aptly as "a formal attempt to determine students' status with respect to educational variables of interest." By assessing our learners, we are able to measure the effectiveness of our educational interventions and ensure that each unique learner is progressing toward competency.

These principles apply to the use of simulation in education. Simulation is designed to provide the learner with an experience that in some way mirrors a real-world scenario or task. In health professions' education, the goal is often to provide the learner the opportunity to practice, and even make mistakes, without causing harm to patients.

Assessment allows both the instructor and the learner to understand what the learner knows, how they are able to apply that knowledge, and identify where gaps might exist. Without assessment, it would be impossible to ensure that our learners are progressing toward higher levels of understanding and competency [22]. Every simulation activity should be assessed in some way, regardless of whether the simulation is geared toward formative or summative goals.

Assessment in simulation can take different forms and focus on one or several areas of a particular task, performance of a team, or a host of different measures depending on the nature of the simulation and the associated learning objectives [23].

As educators, our ultimate goal is to produce learners who are prepared for the fields they enter and also have the critical thinking skills to handle unforeseen challenges. Ideally, they should be able to deal with the ambiguity that often exists in real clinical situations. We are interested in the ability to apply knowledge and systematic thought processes more so than the simple act of "knowing" the information.

Assessment tools can be simple checklists of actions or behaviors, or more complex narrative summaries of performance. Regardless of the form the assessment tool takes, it should be based on observable events or skills. Simulation designers may consider using published, validated assessment instruments if they are applicable to the scenario and learning objectives.

Participants and Interprofessional Simulation

Changes and advances in healthcare and its delivery are occurring at an ever-increasing pace. In any rapidly evolving system, the key to success is good communication and teamwork. This is especially true in healthcare, where the consequences of poor performance can be severe. Most errors in healthcare can be traced back to some combination of poor leadership, breakdown in communication, lack of situational awareness, or poor use of available resources [24].

For years, other high-risk industries, most notably aviation, have embraced the need for training to achieve high levels of reliability. Over the past two decades, the healthcare industry has begun to recognize the importance of such training as well. Specifically, interprofessional training attempts to break down the natural silos that are created by the traditional, specialty-specific training programs. Research has demonstrated that simulation activities that involve interprofessional teams can increase all participants' awareness of the skills and expertise of disciplines besides their own, and improve teamwork and communication skills [25].

Real care delivery involves a wide variety of professionals from different fields. Quality care can happen when all these professionals know their roles and have expertise and experience performing the tasks that are required of them. However, excellent care happens when these team members also recognize the roles of others and their areas of expertise, as well as understand how these disparate skill sets complement each other and how to work efficiently as a team. Formal teamwork programs such as TeamSTEPPS seek to build clear communication and teamwork skills to form the foundation for high-reliability teams [26].

Well-designed interprofessional simulation experiences can reinforce and highlight the importance of teamwork and the roles of various team members [27]. Many trainees over-estimate their team-based behaviors, underscoring the need for formal training in interprofessionalism [28]. Simulation exercises are an ideal modality for teaching these team and communication centric skills [25].

Prebriefing

Most educators are familiar with the concept of debriefing, and its central role in simulation-based education. Prebriefing is another strategy to enhance the learning that occurs during the simulation session. It occurs with the learners before the simulation scenario has started and typically includes an orientation to the simulation environment, identification of team member roles if the simulation involves a team-based activity, case introduction, identification of expected outcomes to facilitate later self-evaluation, and instructions on time allotment [29].

Prebriefing helps ensure that the participants understand the basic premises before they are asked to apply this material in the simulation. It also provides the participants with an educational scaffold to build upon during their simulation experience. Prebriefing serves to provide the students with context before they start their simulation. This context orients the learner toward the learning objectives of the simulation, even if these objectives are not specifically stated. Prebriefing sets the stage for effective experiential learning. Most learning models include three phases; plan, act, and evaluate. Prebriefing enables the planning phase to occur before a simulation activity starts [30]. By prompting the participants to think about and establish some expected outcomes and objectives, the stage is set for both the simulation and the debriefing that will follow.

Timeline of Events and Storyboards

Most simulations begin with a clinical scenario. This scenario sets the stage for the events that will follow. Typically, after the participants are oriented and the simulation begins, they will be presented with the simulator at a baseline state. This could include the initial vital signs or clinical findings described by the scenario.

As the simulation progresses, this initial baseline state will begin to change, either due to the passage of time or the actions of the participants. Many scenarios can be broken down into mini-scenarios called states. The scenario progresses as the participants perform actions or "triggers" that prompt progression to the next mini-scenario [15]. Each mini-scenario is associated with its own clinical findings, vital signs, and events.

When designing a complicated scenario that involves many mini-scenarios, it is important to list these changing states, along with the triggers in an organized, sequential way. This will allow the facilitator and the simulation technician to follow the progression of the scenario.

Table 14.2 Example of a storyboard

Scenario state	Patient condition	Scenario events	Trigger to move to next state	Associated learning objective
State 1	Baseline status	–	–	Objective 1
State 2	–	–	–	Objective 2
State 3	–	–	–	Objective 3

A storyboard can be a useful way to organize a complicated simulation scenario. Storyboards illustrate the progression of a simulation scenario as it progresses. They can take multiple forms including a written step-by-step account of events, a diagram, or a table. Table 14.2 is an example of a simple table-based storyboard.

Programming Versus On-The-Fly

The power of high-fidelity simulation is that is allows the reproduced scenario to incorporate more life-like elements that could not otherwise be captured using low-fidelity simulation equipment. Closely mimicking real patient care scenarios is advantageous because learning is contextual, and learners are more engaged when they have authentic experiences. In fact, high-fidelity simulation may offer improved learning outcomes when compared to low-fidelity technology [31].

Adding an additional layer of complexity is the ability for many high-fidelity simulators to be pre-programmed with responses that will be activated if a learner takes certain actions. Programming can be particularly useful if there is a need to ensure that all participants have an identical or similar simulation experience. For example, when high-fidelity simulation is used for high-stakes summative assessment, it is necessary to control as many variables as possible to ensure that the participants are on an even playing field. A well-designed simulation algorithm can be employed to accomplish this goal [32].

However, it is not necessary (or practical) to create a thorough program for every simulated experience. While the use of programmed simulators allows the team running the simulation to focus more on how the learner is performing, on-the-fly operations allow a greater degree of flexibility to adapt and change the simulator's responses as the scenario unfolds. The drawback is that each learner, or group of learners, will have a somewhat different experience. In many situations, this is acceptable, particularly when the simulation is focused on formative assessment.

On-the-fly operations also have the advantage of being quite adaptable if programming is unavailable or simply not working as expected. Such simulations will require greater focus and involvement by the supervising facilitator in order to ensure that the simulation equipment provides timely and appropriate responses as the scenario unfolds.

If on-the-fly operations, or a blended model of on-the-fly and programmed scenarios are used, it will be impossible to ensure that every learner has exactly the same experience. Learners are unique and have differing learning needs. Having some flexibility to adapt to these needs may be beneficial to support optimal learning. With this said, there are steps that can be taken to standardize the experience. First, when the simulated experience is designed, and the storyboard is created, the program should take into account the likely and less likely responses that learners will provide and outline the responses to these actions. In addition, having clearly written learning objectives along with a facilitator guide can help to standardize the experience.

Unfortunately, along with increased features and capabilities, high-fidelity simulation equipment also requires more training and expertise to use. This can be a hurdle for adoption if faculty and support staff are unable or unwilling to invest the time need to familiarize themselves with the equipment [33]. Most manufacturers of high-fidelity simulation equipment provide technical support as well as documentation about how to create programs if their equipment support this feature.

A completely programmed scenario would lose some of the flexibility and variability that is reflective of real practice (e.g., different providers may perform interventions in different sequences) and may actually be less realistic than the scenario created using a blended approach to programing [33].

Fidelity and Realism

Despite the general consensus that realism enhances the learning experience, there is little evidence to define how much realism is necessary or the true impact of realism on learning outcomes. Dieckmann et al. [34] took a deeper dive into the components of realism and the role of social practice in simulation learning. They defined three "modes" for thinking about realism, including physical, semantical, and phenomenal. The physical mode is measured in the fundamental physical and chemical terms using measurable dimensions. The semantical mode concerns concepts and their relationships. This includes theories, meaning, or information presented by different means. The phenomenal mode includes emotions, beliefs, and self-aware cognitive states of rational thought.

There are several consequences of thinking about realism from this perspective. Viewed through this lens, the degree of realism needed for a particular simulation should be based on the learning objectives, the specific task or tasks involved, and the needs of the individual learners. There is no one-size-fits-all solution. A simulation focused on suturing might involve a task trainer, rather than a complete high-fidelity scenario. From a physical mode perspective, the supplies used for the experience should be the same or similar to those used in a real patient care scenario, but the material being used to simulate human skin/flesh does not need to be perfectly realistic. It should have mechanical properties that are similar to human skin so that it "feels like the real thing" to the learners. Other scenarios will call for a greater degree of phenomenal realism, if the learning goals involve evoking emotional and cognitive responses.

Moulage is the art of applying mock injuries or other visual cues to increase the degree of realism in simulation. Pywell et al. [35] demonstrated that moulage can effectively increase the degree of fidelity in simulated activities. In addition, low cost materials can be employed as effectively as high cost materials for many simulations. One example of moulage is applying artificial lacerations or bruises to standardized patients, or a simulator. This simple step can help simulation participants become more immersed in the simulation experience, which may lead to deeper learning. Ultimately, the need for realism and what realism actually means in a particular context is dependent on many factors. These factors should be considered at the design phase of a simulation rather than added on after the experience has been created.

Video Recording

Video recording of simulation activities was covered in Chap. 9. However, it should be emphasized here that while video-assisted debriefing is a powerful tool for formative feedback, the use of video recording should be considered in the scenario design phase. For video recording to be most effective, it is important to plan for how the video will be captured (from one angle or multiple, camera placed in a position that will not hinder the participants, will audio need to be captured as well), and to consider whether you should obtain consent from your participants before the scenario begins. You will also need to plan for where the video will be stored and for how long. These considerations are best dealt with at the time of design. In addition, audio-visual equipment must be available, and the debriefers must know how to use it effectively [36].

Debriefing

Debriefing is a critical component of nearly all simulation exercises, and in many cases, it is the most important piece of the overall experience. Debriefing allows learners to reflect on their experience, which facilitates unpackaging of the emotional response to stressful simulations. In addition, debriefing is an opportunity to reinforce the learning objectives of the activity, enhance learner's self-evaluation of their performance, and promote critical thinking skills.

The approach and role of the individual who facilitates the debriefing session should be dependent both on the objectives of the simulation as well as the needs and performance of the learners. Harden and Crosby [37] defined six roles for the debriefing facilitator. These include: information provider, role model, facilitator, assessor, planner, and resource developer. The prevalence of each of these roles during a particular debriefing session should be tailored to the needs of the learners [38].

A facilitator debriefing guide is a written document with instructions for the facilitator that outlines how to approach the debriefing session. It should be created at the time the scenario is written. It often includes creating a safe environment for open discussion and providing open-ended questions to prompt discussion about topics relevant to the learning objectives for the case.

While there is some evidence that structured self-debriefing can be effective [39], in general, debriefing relies on a facilitator to guide the discussion. For the simulation experience to be maximally effective, the facilitator should assist the learners in analyzing, interpreting, and assimilating events in an attempt to bridge the gap between "experiencing" the simulation and actually "making sense" of what happened. This facilitates the participants' ability to generalize their learning and apply it to real clinical scenarios in the future [40].

Validation, Reliability, and Trial Runs

Validity and reliability are important concepts in medical education. Validity means that the assessment we are using measures the concept or task it was intended for. Reliability means that an assessment will have the same results if repeated. Simulation assessment tools should be valid and reliable, even for experiences that are formative in nature [41]. Validity can be broken down into multiple subcomponents including content and construct validity amongst others. Content validity can be achieved by ensuring that the assessment maps to the intended content. Similarly, construct validity links the assessment to the learning objectives. The extent to which an individual assessment needs to be validated depends on what it will be used for and how it will be applied. While in-depth discussion of the process of proving validity is beyond the scope of this text, many resources for achieving this exist [42–44].

Similarly, proving inter-rater reliability and test-retest reliability would be very important if an assessment is intended for high-stake summative purposes or for research. Both of these forms of reliability are best tested through trials runs of the simulation scenario. Once the scenario has been created, it can be trialed with experts as well as peer participants to ensure that measured assessment outcomes are similar. Trial runs are also useful to ensure that a scenario proceeds as predicted, equipment works properly, any high-fidelity programming is working as expected, and to work out any unforeseen issues prior to use in the field.

Ethical Concerns

Health professions educators infrequently think about the ethical implications of their work. The term "high-stakes" is often used to describe formal assessments that have important implications for learners. This term can take on a different meaning when applied to health professions education. The knowledge, skills, and attitudes that we impart to our learners have the potential to impact the patients that those learners will eventually care for [45]. What happens if the only person to teach a learner a key competency fails to achieve their educational goals? What are the consequences if learners misunderstand ambiguous learning objectives and feedback? These questions have real-world meaning, and, if taken to the extreme, could have life-or-death implications.

The concepts of nonmaleficence and beneficence are part of the Hippocratic oath that every physician must take upon matriculation into medical school. They are a guidepost for the way we practice medicine. Applied more broadly, these foundational principles can guide our approach to medical education as well.

Simulation is a powerful educational tool, at least in part, because it transforms the practice environment into a realistic patient care experience. High-fidelity simulation can immerse the learner to the point of inducing authentic physical and emotional responses. This can also be true for others involved in the simulation including the standardized patients and the simulation support staff. Given the real responses of those involved, we must ensure that any possibility of lasting negative impacts is minimized [46]. Ethical considerations should be considered at the outset of simulation design.

Conclusions

Simulation is a powerful educational modality. When well executed, it immerses the participants in the learning environment and allows deliberate practice and experiences that are otherwise impossible due to lack of realism or patient safety concerns. In order to realize the promise that simulation offers, scenario design must be guided by sound educational practices. Needs assessment should drive the creation of learning objectives, which in turn determine the structure and nature of the scenario.

There are many important considerations during the design phase including: what is the background and expertise of the participants, will the focus of the scenario be formative or summative, will the participants be from one discipline, or will there be a interprofessional team, and what degree of realism is appropriate? Design templates and storyboards are useful tools to ensure that these and other questions are considered at the time of scenario design.

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Session Debriefing and Use of Recording

15

Shaye E. Krcil

Key Points

1. Debriefing is a two-way interaction during which self-reflection and sharing occur to increase the knowledge transfer gained from the hands-on/experiential learning offered during simulation sessions. Mobile simulation provides unique challenges and opportunities during the debriefing process.
2. The use of audiovisual equipment can enhance or detract from the debriefing process in mobile simulation.

Debriefing as a component of high-fidelity simulation has been shown to increase knowledge gained and improve the performance of technical and nontechnical skills [1–3]. Debriefing encourages participants to engage in reflection and sharing so that hands-on skills and events experienced during simulation sessions can be integrated into practice and improve future performance [1]. The purpose of debriefing is "to engage learners in a reflective discussion about the participants performance in relation to the learning objectives around which the simulation experience has been designed, enriched by other important points or events that may have occurred" [4]

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(Springer). Fanning and Gaba defined debriefing as a facilitated reflection encounter based on an experiential learning episode [5]. Debriefing and feedback are often used interchangeably; however, there are differences between the two concepts. Feedback is generally one-way communication provided to participants, it is more a "telling" of information and if self-reflection occurs, it generally is not shared. Whereas debriefing is defined as a "discussion between two or more individuals in which aspects of a performance are explored and analyzed with the aim of gaining insight that impacts the quality of future clinical practice" [6]. Sawyer et al. noted that "Debriefing conversations may occur between simulation participants and facilitators or among participants themselves, or some combination thereof" [4].

Audiovisual recording of simulation sessions can be utilized to facilitate the debrief by providing objective evidence of the actual performance. The use of audio–video review during debriefing has generally been favored and recommended in debriefing literature; however, a recent meta-analysis of the literature conducted by Cheng et al. concluded that video-assisted debriefing had similar outcomes to debriefing without the use of video playback [6]. The purpose of this chapter is not to provide an exhaustive review of the literature related to debriefing models, concepts, and the use of audiovisual recording, but rather to provide a brief overview of debriefing concepts and further resources and then discuss the challenges and opportunities within debriefing in a mobile simulation environment.

Types, Components, and Standards of Effective Debriefing

Debriefing can occur during the simulation, immediately after the simulation, at a later time, or as a combination of any of these three [7]. In addition, debriefing is described in the literature as being self-led, facilitator-led, or can be led virtually [4, 7, 8]. There are seven components that are listed in the literature as essential for an effective debriefing (see Box 15.1).

Box 15.1 Essential Components for Debriefing [4]
- Psychological safety
- Debriefing stance or basic assumption
- Establish debriefing rules
- Shared mental model
- Address learning objectives
- Open-ended questions
- Using silence

In addition, The International Nursing Association for Clinical Simulation and Learning has published standards for best practice in simulation debriefing that the reader is encouraged to utilize [8]. Finally, there are multiple other resources that the reader is encouraged to utilize for specific debriefing techniques [4, 7, 8] and debriefing models such as PEARLS and TeamGAINS [9, 10].

Our experience with mobile simulation has involved participant-led and facilitator-led debriefing that ideally occurs immediately after the simulation session. We utilize a 3-phase debriefing structure described by Rudolph et al. that includes: reaction, analysis/reflection, and summary [11]. We have experienced challenges with debriefing that are unique to mobile simulation; they are categorized into (1) instructor-specific opportunities, (2) site-specific challenges, and (3) learner-specific factors with mobile simulation.

Instructor-Specific Opportunities During Debriefings in Mobile Simulation

Psychological Safety With mobile healthcare high-fidelity simulation, we travel to various hospitals, EMS services, and volunteer first-responders in a 250+ mile radius of our home base. We may only get to provide a simulation session for them once or twice a year and we do not routinely work with many of the participants, so establishing a psychologically safe environment can be challenging for the facilitator. Facilitators approach this as an opportunity to develop strong communication skills and establish trust and rapport quickly. We arrive early whenever possible, so that there is time to talk to any participants and begin to build rapport as they are showing up, rather than being busy with set-up right until the start of the session. The facilitator “pre-briefs” all participants regarding confidentiality, that there is no score or test, that the goal is to create an environment where it is alright to make mistakes and learn from them, and the core belief that everyone is capable, wants to learn, and do their best. Depending on the number of participants present, we explain that everyone will have the opportunity to be “hands-on” as well as observe a simulation and all will participate in the debriefing. Mobile simulation facilitators have to become skilled at establishing rapport and psychological safety quickly and effectively.

Anticipate Problems With any simulation, it is important to know your participants in order to assist in anticipating any problems. With mobile simulation, because we do not have the same participants in multiple sessions over time, it is important to ask questions about participants when setting up the simulation session (see Box 15.2). These questions help the facilitator understand the roles, years of experience, and titles of the participants that are expected. Before the simulation begins, it is also beneficial to ask who usually works together and confirm what the “usual team makeup” looks like what you had been told and can be accomplished with the participants who are present at this session.

Follow-up One of the challenges of simulation for facilitators is that the scenarios may not always go as planned because of choices that participants make during the scenario. There may also be clinical questions that arise during the debriefing that are unexpected. Facilitators need to be comfortable with saying “I don’t know” and then following up either by finding out and getting back to the participant or providing a resource for the participant to contact. In the case of mobile simulation, follow-up can be challenging if good contact information is not obtained and a plan established for the method and timing of follow-up.

Site-Specific Challenges with Debriefings in Mobile Simulation

Physical Space Simulation literature generally recommends that debriefing is better away from the "scene of the crime" per se as well as in a space where participants can be comfortable and preferably seated in a circle where all participants can see each other and any position of authority is removed. Most mobile simulation vehicles have limited space and resources for debriefing in order to be "mobile" vehicles. In our vehicle, we have two spaces for simulation/debriefing, both are no more than 12 × 12, and if two sessions are occurring at once unless there is room inside the building, the debrief by necessity has to occur "at the scene of the crime." We mitigate this challenge, by not cleaning up or resetting the scenario during the debrief and encourage participants to put any equipment they may have away from themselves in order to focus on the discussion. This immediate debriefing does, however, allow for initial reactions and feelings to be shared quickly and not missed while transitioning to a new location. In addition, if there were questions about skills or opportunities to discuss technique, it is convenient to have the high-fidelity simulator and equipment readily available for use after the debriefing. At which time, the vital signs and physical assessment can be recreated to allow practice of skills or assessment techniques.

In some cases, we are able to utilize space within the building/facility or in a second section of the mobile vehicle for the debriefing. While it is beneficial to move away from the simulation scenario and it assists participants to focus on the debriefing, the space in the vehicle is still minimal and not always conducive to comfort. It is beneficial to arrive early for the simulation session in order to assess potential spaces for the debriefing, choose the area, and/or rearrange the space to be most conducive for sharing and comfort within the limitations. Mobile simulation facilitators also need to be adaptable and skilled at conducting the debriefing in a timeframe that allows for reaction, reflection, analysis, and a summary of application to practice without being prolonged so that participants are restless or uncomfortable while in less-than-ideal surroundings such as standing or sitting in close quarters.

Time The amount of time to spend on debriefing varies depending on the type of simulation scenario, objectives of the simulation, number of participants, and debriefing model utilized. In mobile simulation, the time allowed for debriefing may be prescribed by the constraints of the physical location of the session. As with any simulation session, organizers have to balance time for the simulation scenario itself, the pre-brief, and the debrief. However, in the case of mobile simulation, you are also balancing the time it took to drive to and from the site against the length of the simulation session itself and the number of scenarios the planners want shared to make it “worthwhile” and meet learning objectives. This requires a mobile simulation facilitator to be skilled at time management and guiding the debrief to conclude within the allotted time frame without impeding the analysis and summary phases of the debriefing.

Learner-Specific Challenges with Debriefings in Mobile Simulation

Trust In order for participants to take risks during the simulation and engage in verbal reflection, they need to feel safe and trust the facilitator and other participants. Building trust takes time that, as already discussed, is at a premium during mobile simulation sessions. Facilitators can build trust more quickly by asking the site planner ahead of time what the organizational structure is – who reports to whom can help avoid potential situations of asking a new employee to give instructions to a superior during a scenario. Knowing if there are any particular scenarios that are sensitive for participants (e.g., a team member who recently lost a spouse to a cardiac arrest or a recent child abuse case, etc.) can prevent participants from feeling vulnerable. We have found that it also helps to establish trust if the simulation scenarios build in difficulty during the session. Therefore, the first scenario utilizes skills and concepts that the participants should be familiar (if not proficient) in, so they can be successful and it reinforces the concept that this is learning environment. We also attempt to repeat skills or critical decisions in future scenarios so that participants have an opportunity to reinforce learning and then add new skills, and build on learning objectives and critical decision-making later in the scenario.

Varied Levels of Learners Varied knowledge and experience levels of learners is not unique to mobile simulation; however, it does occur frequently with mobile simulation where in trying to “make it worth our time” site coordinators may invite volunteer first-responders through physicians to participate since the mobile simulation vehicle and team are here. Although we ask the number of participants and their roles before we arrive, we also try not to discourage participation by anyone who is interested and wants to improve even if they sign up late or show up as a substitute for someone else who could not make it. During introductions, we ask for roles, years of experience, and any concerns or objectives they may have for the simulation session. Mobile simulation facilitators become skilled at adjusting on-the-fly to ensure that the simulation remains within the scope and capabilities of the participants. It is also advisable to send a pair of facilitators with varied clinical backgrounds and licenses so they can more easily debrief a multiprofessional team [7].

When we first began mobile simulation, the literature supported that debriefing should occur after the simulation so that the learner could be “fully immersed” in the simulation experience as it occurred. It was felt that interrupting the “reality” of the high-fidelity simulation would decrease the experiential learning. Over the course of the past 8 years, we have found that we do not always have the level of learners we were anticipating show up for mobile simulation. For example, we planned scenarios based on ALS paramedics on the team, but only EMT-Bs are present. Or we were anticipating RNs to be part of the team. Because of the variation in the experience level and scope of practice of the learners, we have found that debriefing occasionally needs to occur during the simulation in order for the participant to progress through the simulation. Some facilitators utilize a formal "time-out" where the participant may call a time-out if they are not certain how to perform a specific procedure; time is then taken during the simulation to demonstrate the skill needed appropriately so that participants do not practice incorrect techniques. At other times, facilitators will either perform the skill themselves (especially if it is out of the scope of practice for a specific group of learners) or verbally acknowledge that the learner has identified that a specific intervention needs to be performed at this time; however, the learner is not proficient or qualified to perform the skill. The facilitator will then progress the simulation to the next stage if there are objectives, skills, assessments, or critical decisions that can still be experienced by the learners appropriate for their licensure and level of experience. Flexibility in scenario design and timing of debriefing is needed for successful mobile simulation when participants with varied levels of experience and/or unanticipated scopes of practice are unexpectedly present.

Audiovisual Recording of Simulation

Recording of the high-fidelity simulation process has been seen as a "gold standard" to facilitate debriefing; however, in a recent meta-analysis of the literature by Cheng et al., their analysis showed that video debriefing had negligible benefit to learners when compared to non-video debriefing [6]. Although limited evidence suggests that video-assisted debriefing results in outcomes similar to non-video debriefing, there are potential benefits in mobile simulation for the use of audiovisual recording. In addition, there are also drawbacks to the use of audiovisual recording in the mobile simulation environment.

Benefits of Audiovisual Recording in Mobile Simulation

- Increase the number of participants who can observe the simulation – with space limited in mobile vehicles, having the option of audiovisual recording can allow more participants to observe the scenario in another location in the vehicle or allow for participants to see the simulation scenario on playback.
- Increase the visibility of the facilitator – due to the design and space constrictions of most mobile vehicles, even when two-way windows are utilized, there are frequently locations in the vehicle that are not visible from the control room. Use of audiovisual equipment can assist the facilitator and simulation operator in being able to see all participants and their actions.

- Assist to develop trust – as we identified developing trust quickly is essential for effective debriefing in mobile simulation. The use of video playback for selected portions of the scenario can assist to develop trust if it is presented as "objective" evidence of performance/skill without interpretation or judgment.
- Staff development – one of the potential benefits of audiovisual recording in mobile simulation is the ability to record the debriefing sessions (with participant consent) so that other simulation personnel can review and learn from each other. It allows for evaluation of debriefing techniques as well as coaching and mentoring to occur.

Drawbacks to Audiovisual Recording in Mobile Simulation

- Time – as previously discussed, time management can be a challenge with mobile simulation, given the drive time on either side of the simulation session. Using audiovisual playback during the debriefing may increase the time needed to complete the debriefing. However, becoming skilled in the use of annotation during the scenario can minimize the amount of wasted time watching the entire scenario or finding key moments.
- Psychological safety – it is important to note that the use of audiovisual recording might impede psychological safety by inducing fear and apprehension in participants. The fear of being recorded and "looking stupid" or being seen in an awkward position or angle could be some participants' worst nightmare.

Box 15.2 Sample Prep Questions for Mobile Simulation Sessions

1. Point person's name and contact information.
2. Address and directions to location.
3. Estimate of the total number of participants.
4. Roles/Titles of participants (i.e., EMT-B, Paramedic, RN, Physician, etc.) and number of years of experience.
5. What is your usual staffing pattern? (i.e., EMT-B and Paramedic at all times, 2 RNs at night with physician on-call, etc.).
6. How many learners have participated in high-fidelity simulation scenarios previously?
7. We have adult, children, infant, and pregnant simulators as well as a variety of scenarios dealing with medical, trauma, and obstetric emergencies. What preferences do you have?
8. Are there any scenarios/topics that we should avoid at this time? (poor outcome from a pediatric arrest recently, or staff member who lost a son in a MV crash, etc.)
9. Do you have a space available that will comfortably seat your expected number of participants? If so, please describe it.

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Mobile Simulation Unit Models, Facilities, and Logistics

16

Jeff Adams

Key Points

1. There are many different types of mobile simulation units (MSU) in the United States.
2. Several factors including using a custom-made simulation vehicle and stationing multiple vehicles throughout the service area contribute to the success of a mobile simulation program (MSP).
3. Ongoing funding and staffing are universal problems for MSPs.

Introduction

This chapter contains information gained from a national survey of MSPs concerning the facilities and logistics of MSUs. Information for this chapter was derived from literature and website review, pilot studies, and phone interviews with 43 existing mobile programs throughout 22 states. Information is also based on the author's personal experiences derived from creating and managing four MSPs.

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Background

Medical simulation has been around for many years and has grown from optional training to mandated simulation training in hospitals, medical schools, and nursing schools. Paul Bradley wrote in his article, The History of Simulation in Medical Education and Possible Future Directions, that: "Clinical Simulation is on the point of having a significant impact on health care education across professional boundaries and in both the undergraduate and postgraduate areas. The use of simulation spans a spectrum of sophistication, from the simple reproduction of isolated body parts through to complex human interactions portrayed by simulated patients or high-fidelity human patient simulators replicating whole body appearance and variable physiological parameters" [1].

With the expansion of simulation programs in medical schools, hospitals are learning that simulation can improve providers' Continuing Medical Education (CME) programs as explained in the Chest Journal: "The goal of deliberate practice in a CME mastery-learning context is to require constant improvement of skill and knowledge rather than maintenance of a minimal level." Ericsson sites data that underscore a "4/10 rule" about development of expertise in any field, as follows: it takes 4 hours of deliberate practice every day for 10 years to become a world-class performer like an Olympic athlete, cutting-edge scientist, chess master, patient-care provider, or writer. Even Michael Jordan took 500 free throws every day throughout his professional basketball career to maintain and improve his professional edge" [2]. With medical simulation-based CME, hospitals are able to require minimum amount of practice times to ensure that their providers are maintaining and improving their performance and ultimately improving patient care and decreasing hospitals' liability claims.

According to a New England Journal of Medicine Catalyst article: "Nationally, 323 hospitals operate 387 FSEDs (freestanding emergency departments) a 76% increase from 2008 to 2015" [3]. These FSEDs have allowed hospitals to decrease wait times and led to faster interventions of heart attack and strokes in rural areas.

An article posted in the Joint Commission Journal on Quality and Patient Safety notes that: "Increasingly, health care providers, hospital administrators, and quality and safety professionals are considering simulation as a strategy to improve quality and patient safety" [4]. This trend has led simulation centers to ask questions about how to expand simulation training throughout hospital networks, colleges, standalone centers, and rural clinics. As these training needs grow, administrative staff at simulation centers should evaluate the potential value of expanding, or replacing current brick and mortar labs with mobile simulation units.

Information for this paper was gathered by conducting a literature review using the common search terms: mobile simulation lab, mobile lab, simulation unit, and mobile simulation unit. When additional info was needed, a request for information about Mobile Simulation Programs was placed on the International Society of Simulation in Healthcare website. Results yielded over 20 different programs throughout the United States and Canada.

Mobile programs that were contacted covered 8 different states and ranged from 1 to 7 years of experience in mobile simulation. Analyses of the gathered information resulted in common concerns, issues, and recommendations that should be addressed when evaluating the needs and value of a mobile simulation unit.

My personal experience consists of the following: design, construction, managing, and educational training of Wright State Universities Mobile RV and Mobile ambulance, limited Ohio State University's EMS outreach training, Project Lead and Designer of Mount Caramel Hospital Mobile Simulation Unit, and as a Salus Group contracted Simulation Coordinator for Dayton Veterans Hospital VISN 10 Mobile Rotation Program.

Throughout this paper, I will refer to the simulation centers that have active mobile units as the experts and define individual centers by name when appropriate. All simulation centers located within hospitals and universities will be referred to as a fixed center.

What Is the Biggest Benefit of Having a Mobile Simulation Unit vs. a Brick and Mortar?

Many of the experts stated that equipment mobility led them to a mobile platform and was the biggest benefit of having a mobile unit. With hospitals and schools opening more and more locations to support rural area patients and students, the staff at simulations centers found that, while the hospitals and schools were growing, the space and equipment needs were being limited. This led the centers to find ways to transport simulation equipment throughout cities, states, and across the country to support educational needs.

The equipment mobility topped the list of benefits from over two-thirds of the experts. The mobile unit allowed for equipment to be gathered, set up, and transported to locations without damage. Safety of the staff also fell into this category since a mobile unit allowed for lifts and transport devices such as tables, cots, beds, and dollies to be used. Many of the experts said that they started by placing manikins and equipment into trunks of cars or the back of vans to transport from location to location. This created excess wear and tears on the manikins and created concerns for staff safety because of the additional bending, lifting, and turning needed to load and unload the manikins.

Environment was next on the list for benefits of the mobile unit. Experts stated that aside from the physical demand of transporting the equipment, they also had issues with finding space and transport devices at the training sites. Educators were finding it difficult to dedicate a patient room or office space to simulation once they arrived with the equipment.

Additional benefits consisted of the ease and consistency of room setup, equipment, video recording, and supplies; it also decreased the possibility of mixing simulation equipment and medication with real patients. They also noted that a mobile unit decreased the time needed for setup and teardown at each site, allowing them to travel to multiple sites in 1 day.

What Is the Biggest Issue With Your Unit?

The biggest issues for a mobile unit ranged from continual funding to staffing and mobile unit design. Continual funding was the top reason most mobile units failed or never got off the ground. With the cost of mobile units ranging from half a million to over 1 million at start-up (Appendix 16.1, question 14), most simulation units were purchased with grants. Once the grants are depleted, the centers often had to decrease in size or close programs altogether.

Workforce was also an issue. Most funding was designed to cover only the unit and did not include the staffing costs. This led to programs to use existing staff which took them away from other projects within the fixed lab when the mobile unit was on the road. Others chose to use contracted employees which they could only work on the mobile unit and not within the fixed lab when the mobile unit was not in use.

Since many of the experts were founders of mobile units within their state, they had no design to go by which led to fixed units. Fixed mobile units consisted of floor plan layouts, effectively limiting the flexibility of the unit. An example of a fixed unit is a simulation truck with part of the unit designed as an ambulance and the other part as emergency rooms. While the ambulance setup was good for training pre-hospital, half the unit was rendered useless when only hospital staff were being educated. Fixed units could consist of permanent surgical towers, booms, debriefing areas, tables, cabinets, and even doorways that were too small for equipment to fit though.

Education

When the experts were asked about who they trained, and what procedures or skills were taught, the spectrum became very wide. Answers consisted of nurses, doctors, paramedics, hospital staff, clinic staff, rural area clinics, public school officials, surgical teams, and the general public. A lot of the education was constrained by the participants mentioned in the grants, limiting the flexibility of the staff. With no clear answer, the follow-up strategy was to ask more direct questions such as: (1) What type of training do you do? (2) How many learners do you train? (3) Who builds the educational program?

The state of Indiana has a mobile simulation ambulance that is accessible to any fire and EMS station with in the state. It was funded through a homeland security grant. However, the training programs rely directly on the Fire and EMS stations that request the unit. This educational strategy was also observed in Carolina's simulation mobile unit that was designed for training hospital staff. The Carolina mobile unit was funded by a collaboration of state wide hospitals.

The Dayton Veterans Administration (VA) Hospital in Ohio has a mobile unit that travels throughout the state providing training to rural VA clinics and is funded through a Women's Health Grant. The training is developed by a contracted team of simulation coordinators and approved by clinical experts. Training consists of palliative care, diabetes, mental health, and women's health. Pennsylvania and Florida have similar programs in which simulation experts built the programs that are subsequently approved by teams of experts for both EMS and hospital staff.

A mobile unit in Pittsburg trains EMS throughout the state. All education has to be approved through a board of clinical experts made up of doctors, nurses, paramedics, and administrators. The program is funded by a local hospital outreach program.

Aside from stipulations in the grants, other limiting educational factors related to the number of learners who could be trained inside the mobile unit. The average number was 5–10 learners, depending on the size of the mobile unit. The limitation on learners created daylong training events opposed to a fixed simulation lab where four or more simulation rooms could be set up allowing more learners to train at the same time. Experts partially resolved this by adding audio and video components that could be streamed to an adjacent room allowing additional 10–20 learners to view the simulation as they rotated through a series of simulation. This would allow one team to complete one simulation and then watch the other team's complete different simulations.

Some mobile units chose only to run certification programs like Advanced Cardiac Life Support (ACLS), Basic Life Support (BLS), Pediatric Advanced Life Support (PALS), Advanced Trauma Life Support (ATLS), or they had predesigned courses that the users had to choose from. All simulation units issued some type of certification, competency check off, Continuing Medical Education (CME's) or Continuing Educational Units (CEU's) for the training they provided.

Mobile units that relied on the receiving faculty to provide and run the simulation got less use than units that had a dedicated staff or prebuilt programs and educators who traveled with the unit. Experts did agree that having a dedicated mobile simulation team was key along with an expert panel for approving simulation content and administration rules increases the chances of success with a mobile unit.

How Was Your Mobile Unit Funded?

Funding consisted of grants, donations, and homeland security. However, the experts agreed that initial funding was easier than continuing funding. The simulation unit in Missouri charged for the use of their mobile unit with funding going to support the unit. A group in Florida had to downsize to a van after grant funding ran out and they were unable to maintain the cost of their large mobile bus.

When it came to philanthropy, there were mixed feelings. After posting a mobile simulation question on SSH website, I was contacted by a simulation coordinator from Texas who just said, "Don't do it." Further investigation indicated that the simulation unit was a donated mobile home modified from a personal recreational vehicle (RV) to a mobile simulation lab. This created many issues such as: thin walls allowing sound to interfere with the training, heating/cooling issues, and high repair cost from lack of durability, leading the simulation coordinator to his conclusion that mobile units are not worth it. Another issue with donations is the funding of the staff. Most donations support the purchase of the unit but not the staff. As a result, many centers have to rely on current overworked simulation staff to run the mobile labs.

The successful simulation units produced funding from a hospital or university with staff at multiple locations who needed training. In the Carolinas, the cost is divided among hospitals and the unit travels throughout the states. Mount Carmel hospital in Columbus Ohio obtained part of the funding by tying advertisement to the unit. They found that they were traveling over 4000 miles a year to five network hospitals and multiple firehouses throughout the Columbus area. After contacting the marketing department, they found that their $700,000 unit would pay for itself in just less than 10 years from advertising alone.

The VA in Dayton Ohio was grant funded; however, they are able to show benefit of the unit by charting the amount of "time away from patient care" and "total mileage saved." For example: Let's say, you had 4 different outpatient clinics located within 20 miles around the Cleveland Ohio Veterans Hospital that had 40 nurses that needed simulation training. It is roughly 200 miles and a 4-hour drive from Cleveland to the Dayton Simulation Center. For the 40 nurses to drive to the Dayton Simulation Center for a 4-hour training, the VA would have to pay for over 8000 miles (40 nurses × 200 miles), the cost of 40 motel rooms, and the nurses would be away from patients care for a minimum of 16 hours (2 days) each. This means, the VA would have to cover over 640 patient care hours with additional staff. To save time and money, the Dayton VA could set up their mobile simulation unit with 2 trainers at the Cleveland Hospital and have 40 nurses travel to the Cleveland location for the 4-hour training. This would decrease the total miles from 8000 to around 1400 (2 trainers + 1 driver × 200 miles = 600 + (40 nurses × 20 miles to Cleveland) 800 = 1400). It would also only take the nurses away from patient care for 8 hours, saving over 340 hours away from patients (40 nurses × 8 hours) and instead of 40 motel rooms, they only would have to pay for 3 motel rooms.

This VA mobile simulation model could work well when hospitals had mutual locations in smaller geographical areas. Hospitals could use a mobile unit to decrease the time their staff is away from patient care. The mobile unit could also save the high cost of staffing, manikins, space, and equipment if the hospital tried to set up a simulation center at each location. Example: if you have 5 locations, you would need 5 manikins. If you placed one high-fidelity mannequin at an average cost of $80,000 at each location, it would cost you $400,000. With a mobile unit, you would only need to buy one mannequin at $80,000, a cost saving of over $320,000 on manikins alone.

When it comes to funding, some of the best-selling point for administrators was some combination of the following: advertising cost savings, decreased time away from patient care, total mileage saved from learners, safety of the staff, better educational experience, decreased chance of simulation equipment being mixed with real patients, money and space saved by not needing to build simulation labs at multiple locations, cost savings on equipment (because it can be used at all locations) and resources to staff multiple locations.

From a Training Standpoint, What Would You Have Done Differently If You Could Rebuild Your Mobile Unit?

Design issues with the mobile units came up when the experts were asked the above question. Most of these design issues were created because the simulation unit did not meet the requirements of the training or the mobile unit platform was not fitted correctly for the area where it was going to travel to.

The first design issue was the chassis or frame on which the unit was built. Some mobile units had chassis that were revamped from used ambulances, recreation vehicles, mammogram trucks, and commercial trucks. Many of the revamped units came as donations to the simulation center. While the donated units can decrease the overall startup cost, it resulted in problems that did not always outweigh the savings. Example of issues that outweighed the saving: some had walls that were too thin and had to be refitted with sound proofing, limited space for the learners created longer training sessions when training large groups, some walls were not removable so they had to be torn out and reconstructed when adding audio and video equipment, inability to recreate training environments, and regular engine or mechanical repairs.

Mobile units built on new chassis consisted of vans, ambulances, box trucks, buses, RVs, and tractor trailers or fifth wheels. Building the unit on a new chassis, while expensive, had many benefits. New units allowed recording equipment to be built in, flexible walls that could be changed if needed, generators could be sound proofed, equipment storage could be built in, and the units were less likely to suffer from mechanical breakdowns.

Other design issues included the floor plan of the unit. Many of the experts had floor plans that mimicked their learner's environment. If they were going to train paramedics, then the unit would be built on an ambulance chassis or part of the unit would be designed to look like the inside of an ambulance. However, having the floor plans designed for specific environments often limits the types of practitioners you can train.

Mount Carmel Hospital in Columbus Ohio had their unit designed with an open stage approach. Their 45' Box truck has two simulation rooms with a control center in the middle. The two pop-outs (extensions) in the back can be closed to form an ambulance setting, but when the pop-outs are extended, the benches can be raised up so the space can be turned into an emergency room setting. With no fixed equipment, tables can be arranged to accommodate task skills training, debriefing rooms, hospital rooms, classroom, or a collapsed building for disaster training. This allows the most flexible use of the unit and does not restrict the modeled educational setting.

A unit in Pennsylvania was designed for paramedic training with the option of doubling as a command center during a mass casualty event. The director of the program explained, shortly after they received the unit, that before they could use it, it was needed for a command center on a plane crash in Pennsylvania during the 9/11 attack. Other simulation centers indicated that their mobile unit was set up to be used for real patient treatment centers if needed.

Along with flaws in the floor plan, other issues centered on who could drive the unit and problems related to getting the unit from site to site. To fix some of the mechanical and layout issues, experts learned that larger chassis such as 30′ to 40′ box trucks or semi-trucks, where the tractor could be removed from the trailer, were better. The larger units were designed more for the heavy use of a mobile simulation lab. Recording equipment could be built into the unit and most had enough space for two simulation rooms and a control room. Simulation mobile unit suppliers stated that a dual rear axle allowed for better handling and increases the life of the unit [5].

One problem with the larger units is the weight. Once the box truck's weight reaches 30,000 lbs. and the semi-truck unit grew past the weight of a standard pickup truck, a commercial driver's license is required. This created the problem of who would be able to drive the unit. Even if this could be addressed, there are additional problems such as the ease of getting around busy downtown areas, finding parking at the training locations, and getting in/out of low or high entrance ways.

Other issues were storage of the unit and weather conditions. Most experts did not drive during winter months or had rules in place based on weather conditions or temperatures. They found that hydraulic and electronics did not function properly in different weather conditions. The ability to store the unit in a climate-controlled area was another recommendation made by many of the experts; however, it added additional cost to the program.

Consolidation of the expert questionnaires did not identify one chassis that was better than another; it only showed that a center should look at all of the above factors before choosing a chassis. Additional information can be found in Appendix 16.2 through Appendix 16.6 where the different chassis were broken down into the following areas: unit cost, educational benefit, safety of staff, simulation, space, training location, floor plan design, recording systems, driving requirements, and advertising benefits.

Staffing a Mobile Simulation Unit

Staffing is one of the main issues with mobile units. Experts say that treating the mobile unit as an extra space in a fixed lab will solve the issues of scheduling, program designs, simulation building, and mannequin programming. However, since the unit is mobile, staff will be removed from a fixed center during the training, and multitasking or using the staff to help with other events within the fixed center is not possible.

Most of the experts said that when the mobile unit was added to their simulation center, there was additional help brought in. On average, an event would take the educators and one simulation technician away from the fixed lab for the entire day, regardless of the length of the training. This was due to drive time, setup time, event time, tear down time, return drive, and restocking of any equipment and supplies. They also said that most events took two staff members. In smaller units, such as a van or an ambulance, staffing would consist of a one educator and one simulation tech to help move and set up equipment at the training site. In the box truck, or larger simulation units, staffing consisted of one or two educators, one or two simulation technicians to run the simulation and recording equipment, and one driver depending on the unit driving requirements.

Experts agreed that with any size unit, a minimum of two additional staff members should be added and allotted to budgets and grants. For bigger units that require a commercial license, drivers can be hired on an "as need bases"; in larger facilities, a driver's position can be added to a job in another department so when the driver was not being used to move the simulation unit, he could be used in the other department.

Cost of the Mobile Program

When asked about the major cost of a mobile program, answers ranged from the cost of the unit itself to storage, staffing, maintenance, and insurance. When analyzing the answers, it was easier to divide the cost into two categories: startup cost and continuing cost.

The biggest expense during the startup is the unit itself. When the experts were asked how much they paid for the unit, they ranged from nothing (donated units) to over a $1,000,000. The experts recommend a new custom-built unit over remodeled units. Remodeled units can create ongoing issues that can impact the continuing cost to maintain the unit. Experts also agreed that the more expensive chassis units, such as the box truck or semi-truck, were preferred over fifth wheel or RV (recreational vehicles) units. The rationale for this was best described during an interview with Al, the driver of the Dayton VA hospital MSU, who stated, "The biggest issue with an RV or fifth wheel trucks is that they are designed to be used by families once or twice a year for vacations not every day 8 out of 12 months a year." New custom-built units also allow for the recording equipment such as cameras, audio, TV, monitors, outlets, and computer ports to be placed to match the training needs.

Additional costs included supplies such as manikins, task trainers, and medical equipment. Most experts had purchased these items and dedicated them to the MSU to decrease the need to load and unload equipment. Internet connection was another expense during startup. Some units chose to use satellite dishes, but found issues with connection due to poor line of sight. Satellite dishes need to be pointed directly at a satellite with nothing blocking the line of sight. Inner-city training sites had issues with buildings, trees, and even clouds blocking the line of the sight. Experts in the western part of the United State seem to have better luck due to the open areas and less dynamic weather.

Continuing cost of an MSU was the top reason most centers cut or decreased programs. Experts listed insurance, continuing maintenance, mechanical issues, storage, and available staff as the main reason for the decreased use of the MSU. To help decrease the cost, most MSUs could be included into the center's motor pool insurance policies. Continuing maintenance and mechanical issues depend on whether the unit was new and under warranty or if it was a remodeled unit where repairs had to be paid out in full. How the unit was stored can also have an impact on the maintenance and mechanical issues. In states with heavy winters, units that were stored outside and exposed to the elements tended to need more repairs and electrical equipment and manikins were damaged from exposure to the cold weather.

In North Dakota, MSUs have rules in place that restrict the use of the unit when temperatures reached 30 °Fahrenheit or in high winds. Other MSUs were stored in garages and buildings and attached to electricity via shorelines (electrical lines designed to give power to the unit without the unit running) to prevent damage to the unit or equipment. While the garages can limit maintenance and mechanical issues, there is an increased cost of renting the building.

Conclusions/Recommendations

In summary, after reviewing the results of the data collected, the following findings worked the best:

MSU programs with multiple existing locations were more successful. Examples of multiple existing locations are: hospital networks that have hospitals or clinics spread throughout an area, colleges or universities that collaborate with each other, or established outreach training programs where simulation enhanced current training.

At least two or more full-time employees must be dedicated to the MSU to maintain equipment, develop curriculum, and provide educational training. Units that did not have staff dedicated to the MSU were used less and had declines in educational activities once the initial funding was completed.

Grants are great ways to fund the startup of an MSU; however, they can have restrictions that prevent the future expansion needed to meet the ever-changing educational training. In addition, it can be difficult to find continuing funding once the grant ends. Always look 5–10 years past the startup funding source when developing MSU programs to ensure that funding sources will be available.

Buying the larger new custom-built units aided in the success of a program. The larger units allowed better visibility of advertising, increased the space available, decreased staff time, provided a safer environment, and allowed for an overall better training experience for the learner. Box truck chassis seem to allow the most flexibility and durability of all the MSUs. They were big enough to allow two training sessions, had a durable chassis, and are easier to move around busy streets when needed.

With MSUs, every situation is different, and this research illustrated that there is no one perfect program; however, understanding the experts' past success and failures can help new programs match their current training needs to an MSU that will offer the best outcomes.

Further recommendations include bringing the simulation experts together as an expert panel to review the findings of this study, sending the results of this questionnaire of MSUs' recommended results for expert's approval, contacting additional programs, and expanding each section of the paper into individual studies, allowing a more focused evaluation of the data.

Time limitations prevented many of these recommendations, but with the expansion of simulation in healthcare field, more research on mobile units will be needed to allow for more appropriate needs and assessment tools to be developed.

Appendix 16.1

Mobile simulation questionnaire		
Name:		
Organization:		
1	How long have you had your mobile lab?	
2	Do you have an ambulance, RV, trailer?	
3	How much did you pay for the mobile lab?	
4	How many training sessions do you do per year?	
5	How many students do you train per year?	
6	How did you decide on the size of your mobile lab?	
7	Who drives your mobile lab?	
8	How was your mobile unit funded?	
9	Do you charge for training?	
10	What would you say your yearly cost for the mobile unit?	
11	What do you wish you had done differently in building the lab?	
12	What features would you add or take away from the unit?	
13	What is the biggest issue you have with the unit?	
14	What recommendation would you have for someone building a new simulation lab?	

Appendix 16.2

Van chassis	
Cost	\$20,000–\$40,000 great for small budgets and designed to last 5–10 years
Educational benefit	The van allows educators to move the equipment from location to location decreasing staff time away from patients. Environments are only as good as the space the educators find within the facility.
Safety of staff	While cots, dollies, and carts can be loaded into the van, the staff is still required to load and unload at each site.
Simulation space	Since the van chassis is only designed to transport equipment, the simulation space depends on the space that can be found within the training facility. At most, facilities' space is dependent on room availability and if a facility had a lot of patients, training can get bumped to different days or canceled altogether.
Location of training	The van can be taken to almost any location.
Floor plan design	Floor plan design is to ensure that all needed equipment will fit within the unit.
Recording system	All video and audio equipment will need to be transported and set up at each location. Many experts with vans stated that due to the complexity and time, most simulation was not recorded, regardless if the equipment was available.
Who can drive the unit	No special license is needed to drive a van.
Advertising benefit	Experts did not show a great advertising benefit to the van. They believe that, for the small-sized van, the return on investment was not as high as expected.

Appendix 16.3

Ambulance chassis	
Cost	$80,000–$150,000 – The low cost is great for prehospital providers or transport units. Ambulances are designed for heavy use and last around 5–10 years
Educational benefit	Limited to only pre-hospital training. Experts with ambulance chassis unit question the need since most patient interaction is within a home, field, or hospital setting. The benefit of having the mobile unit is the ability to move from location to location without a lot of setup or teardown needed.
Safety of staff	Since ambulance is designed to transport patient, a lot of safety devices are built into the unit for both the learners and the educators.
Simulation space	Space is limited to 3–4 learners at a time. Some experts incorporated video feeds or TV monitoring on the outside to increase the numbers of learner per simulation.
Location of training	Ambulances are durable and have a rugged design for all types of training environments.
Floor plan design	The floor plan is fixed to only hospital settings.
Recording system	While audio and video recording can be easily inserted into the ambulance, the small space restricts and forces the need for expensive wide-angle and fisheye cameras to view the entire area. Camera views are easily blocked if there are more than 3 learners or excessive movement during a simulation.
Who can drive the unit	No special license needed to drive an ambulance; however, you have to look at state laws on functionality of the emergency lights. Some states require the lights to be nonfunctional unless they are used as an emergency vehicle.
Advertising benefit	Most experts that use ambulances do not use the unit for advertising only to train local fire and EMS providers.

Appendix 16.4

RV chassis	
Cost	54,000–$80,000 unit built to last 10 years
Educational benefit	Can accommodate 3–5 learners at a time, Floor design consists of one simulation room and control room. Some expert was able to place a second simulation room and gained extra space for 8 learners.
Safety of staff	Difficult to put lifts and ramps onto. Most equipment would need to stay on the truck to minimize safety concerns of the staff.
Advantage	Lowest cost of all the unit options. No special license is required to drive the unit. Staff can drive the unit, limiting the need to hire a driver.
Logistic issues	Easier to move around busy city streets. The design allows the driver to park in most parking lots and the mobility around town is average for a skilled driver.
Size	Max length of RV = 35′ including driving area. Pop-outs can be added to extend room size from 8′ to 10′.
Recording system	All recording systems can be installed. Debriefing area can be set up for video playback.
Who can drive the unit	No special requirements to drive vehicle.
Disadvantage	Restricted on size of simulation room and number of learners. Difficulty moving equipment on and off unit. Any engine repairs render the unit unavailable. Chassis not designed for heavy use, creating more downtime for possible repairs.

Appendix 16.5

Box truck chassis	
Cost	\$400,000–\$1,000,000. Truck lasts 15–20 years
Educational benefit	The box truck chassis allows educators the opportunity to create real learning environment for the learners. Equipment can be set up and left throughout any training event. Space can accommodate more learners and many units have more than one simulation room.
Safety of staff	The best safety for the staff and learners because lift devices can be placed on the units to minimize manual lifting.
Simulation space	Box trucks can come in 35′, 40′, and 45′ allowing for up to two rooms and plenty of space for storage.
Location of training	The larger the truck, the more problems with finding parking at training locations. The heavy-duty design allows for travel in different environments.
Floor plan design	Experts had mutable floor designs to choose from. Most of the units had two simulation rooms with a control room in the middle. They also allow for pop-outs to extend the side of the truck, making the rooms up to 14′ wide. With the extra space, learners can be extended to 10–15 between the two rooms.
Recording system	All the major simulation video recording systems can be installed within the box truck. Experts consider the use of the major simulation video systems because most unit builders have video and audio systems they can build in at a cheaper price.
Who can drive the unit	Trucks under 30’ and that have only one rear axle do not require a class B commercial license in most states. While dule rear axles allows for more stability of the truck while driveing
Disadvantage	Harder to drive in tight areas, any engine repair renders unit unavailable. Weight can restrict who can drive the unit. Storage of unit can become expensive.

Appendix 16.6

Tractor trailer or fifth wheel chassis	
Cost	\$400,000–\$1,000,000 for trailer \$80,000–10,000 for truck built to last 20–30 years
Educational benefit	Can accommodate 16 learners at a time. Floor design consists of two simulation rooms, one control room, and a debriefing room. Floor designs can consist of debriefing area, dual control rooms, ambulance settings, or open floor design. Allows easy setup of any training environment.
Safety of staff	Lifting devices and ramps can be placed on the unit without affecting the learning space. Most equipment would need to stay on the truck, to minimize safety concerns of the staff.
Advantage	A lot of flexibility with design that will allow for changing educational goals. Doors, windows, ramps, and lifts can be moved around to allow access of equipment and learners.
Logistic issues	Very hard to move around city streets. Difficult finding parking space at training sites.
Size	Length can vary from 40′ to 53′ space for training. Multiple pop-outs can extend the side of the unit from 8′ to 12′.
Recording system	All recording systems can be installed. Debriefing area can be set up for video playback.
Who can drive the unit	Driver requires a Class A driver’s license.
Disadvantage	Difficult to make turns when driving in busy city streets. Availability of parking space for the unit at training sites. Finding drivers with class A license.

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Needs Assessment

17

Priscilla V. Loanzon, Susannah L. Kurtz, and Joseph P. Mathew

Key Points

1. The first step in curriculum development for an effective mobile simulation program should be a general needs assessment, with identification of the problem and analysis of relevant performance and practice gaps.
2. A targeted needs assessment evaluates the specific needs of the learners and their learning environment and guides the development of curriculum with available resources.
3. Utilizing the appropriate qualitative and quantitative methods of conducting a thorough needs assessment will allow for collection of relevant assessment data.

Introduction

As the value of healthcare simulation is increasingly recognized, mobile medical simulation programs are in high demand. Mobile programs can bring state-of-the-art, high-fidelity simulators and other advanced training equipment to the learner. To best serve the needs of the learner, the patient, and community, a mobile

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simulation program must have a curriculum with clearly articulated goals, objectives, and measurable outcomes.

The first step in designing an effective mobile simulation program is to perform a needs assessment. A needs assessment is a systematic process of gathering and utilizing information to design instructional solutions to close practice and performance gaps. Programs that are based on well-conducted needs assessment lead to changes in learner behavior [1]. In this chapter, a "three-phase needs assessment model" is presented. The discussion is organized using theoretical and practical information about each phase with related figures and tables, followed by a form to serve as a template for carrying out the assessment. Case studies are used to illustrate the application of each phase.

Background

Definition

A needs assessment is a systematic process of gathering information to identify performance gaps in the learner's knowledge, skills, and attitudes and using this information to determine instructional solutions to close these gaps [2]. It addresses the discrepancy between a current state of "what is" and a desired state of "what should be." This will help determine the appropriate educational intervention and aid in curriculum design.

Purpose

The purpose of conducting a needs assessment is to identify a problem and perform a critical analysis of any and all associated issues. This may relate to a specific disease, a population at risk, a procedure, particular clinicians, or the needs of a community at large. Identifying the details and tailoring the mobile simulation curriculum to maximize the learning for a variety of learners will pave the path for a successful program.

Learners are often not able to fully understand and assess their own performance gaps [3]. Therefore, a needs assessment methodology must go beyond a survey of the learners' interests. Similarly, without a structured assessment of practice and performance gaps, simulation programs are less likely to be effective educational tools.

A well-executed needs assessment can provide timely answers to varying needs [3]. A Joint Commission paper strongly recommends using a systematic approach to drill down the root causes of a problem before implementing solutions [4]. The overarching purposes of a needs assessment can be summarized as: (1) articulate specific gaps between current practice and ideal practice; (2) find solutions to close the gaps; and (3) identify available and needed resources, as well as barriers to implementation.

Needs Assessment in Mobile Simulation

Needs assessment in healthcare simulation follows a logical premise that improved performance can lead to positive patient outcomes. The fundamental metrics in evaluating improved performance are changes in knowledge, skills, and attitude (KSA) that lead to desired patient outcomes. A purposeful needs assessment can provide insight into whether a mobile simulation program is the best educational intervention. It can also provide valuable information about which simulation method would be most effective in realizing the objectives [5].

Importance of Performing a Needs Assessment

Like other types of simulation, mobile-based simulation addresses the same triad of behavioral domains that requires education and learning for maximum desired patient outcomes: technical skills, teamwork, and communication. The information gathered from the needs assessment drives the evaluation process. Methodology for conducting a needs assessment, whether formal/planned or informal/unplanned, can yield expected as well as unexpected results. For example, formal methods are more likely conducted to identify group needs, whereas informal methods are more likely to uncover the concerns of an individual [6].

Simulation programs that are implemented without conducting a structured needs analysis run the risk of not utilizing simulation to its fullest. Unstructured programs are often designed for presumed performance gaps based on faculty or institutional assumptions. The education may be in an area where the learners are already competent or on a topic or procedure which may not be relevant. Additionally, needs assessments can reveal barriers to education such as low volume of performing high-risk procedures, lack of necessary equipment or instructors, or lack of a credentialing pathway to practice what was taught. Figure 17.1 illustrates an example of a mobile simulation program on intubation that was implemented with and without a structured needs assessment.

Performing the needs assessment is an ongoing process and often evolves from the initial needs assessment. The needs for a particular course can shift based on changes in practice or resources. Furthermore, performance gaps identified during formative or summative assessments or during post-course feedback can serve as the needs assessment for future education.

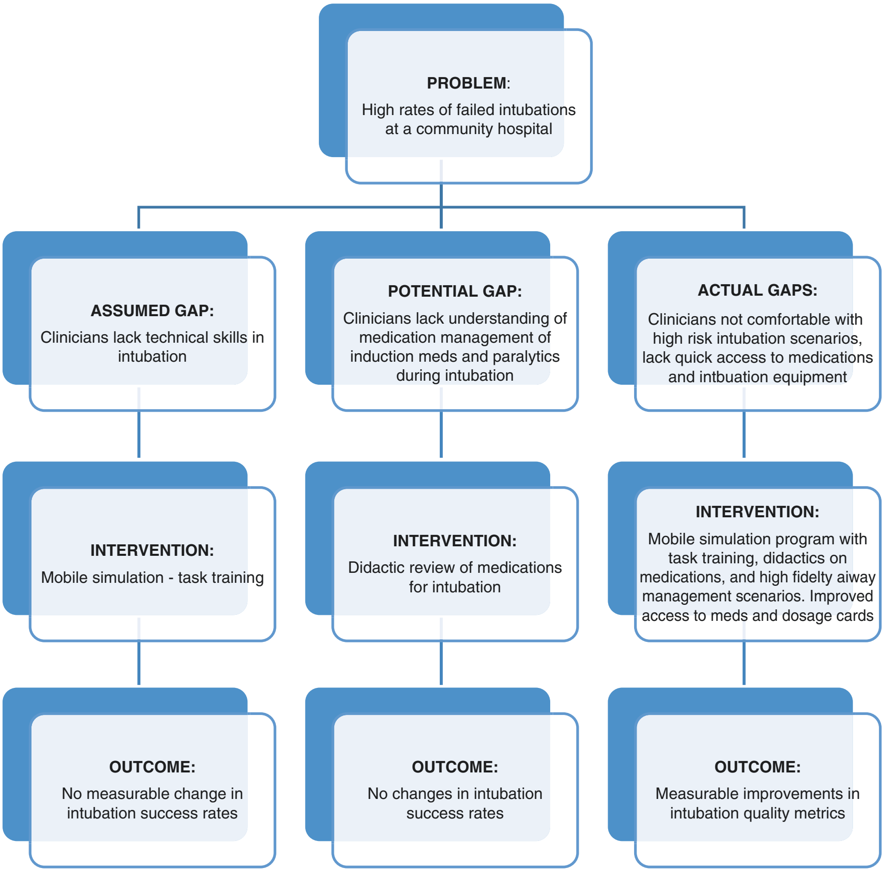

Fig. 17.1 Outcomes of simulation curriculum design with and without a structured needs assessment

Rapid Needs Assessment

In healthcare, time is often of the essence when implementing urgent and critical educational interventions. Hence, conducting a needs assessment often has time urgency and requires educators who have a strong foundation in needs assessment methodology. Triggering incidents can be an acute emergency or an escalation of an ongoing crisis [7]. An example is the large-scale threat of the Ebola virus outbreak in 2014–2016 which resulted in over 11,325 deaths worldwide [8]. Along with implementation of policy measures, the education of healthcare workers was a huge component of the intervention. In fact, the United States Centers for Disease Control (CDC) trained 24,655 healthcare workers during the Ebola outbreak; this is not including the thousands of healthcare workers throughout the United States and elsewhere who were trained at the local level [8]. A rapid needs assessment, including information collection and generation of findings, can be done in a few days or few weeks. It is completed in a shorter time in order to develop a preliminary understanding of the problem and situation at hand, and to devise an educational strategy [7, 8]. A rapid needs assessment has to be dynamic and change as the planners learn more about the situation. A more in-depth comprehensive needs assessment must follow the rapid needs assessment.

Often, the triggering incidents are caused or exacerbated by gaps in maintenance of professional knowledge and skills. This can be due to lack of access to training, especially in rural areas, or scarcity of opportunities in high-risk low-frequency cases. Time, distance, and cost can contribute to widening the gaps between "what is" (present state) and "what should be" (ideal state). Mobile simulation programs can close these gaps, bringing cost-effective training programs to the learner.

Application of a Three-Phase Needs Assessment Model in Simulation

The literatures describe many shared steps and processes when performing needs assessment. The three-phase processes of a needs assessment model (Fig. 17.2) are interconnected as depicted by the arrows with the assessment planning and data management overlapping and culminating in the application of the findings phase. This model was adapted from the 2014 work of the United States Agency for International Development (USAID) guide to rapid needs assessment [7]. *Phase1* is assessment planning, which includes forming an assessment team, formulating critical questions with assessment parameters, and identifying key resources (personnel and non-personnel). *Phase 2* is data/information collection and management using the acronym CARE: **C**ollecting and organizing data, **A**nalyzing qualitative and quantitative data, **R**eviewing and **E**valuating the data. *Phase 3* is application of findings which includes generating and sharing the report, and utilizing the findings to plan the simulation curriculum.

Phase 1: Assessment Planning

Before starting the planning phase, it is important to carefully study the situation or behavior that triggers a needs assessment. This is followed by a validation of the problem with supporting data. Data validation is important in order to achieve sustained significant improvements as opposed to merely implementing change [4]. Assessment planning uses a systematic process that begins with forming a needs assessment team, formulating the critical questions with assessment parameters, and identifying the resources as shown in Fig. 17.3.

A systematic step-by-step process to guide phase 1 needs assessment planning includes the following:

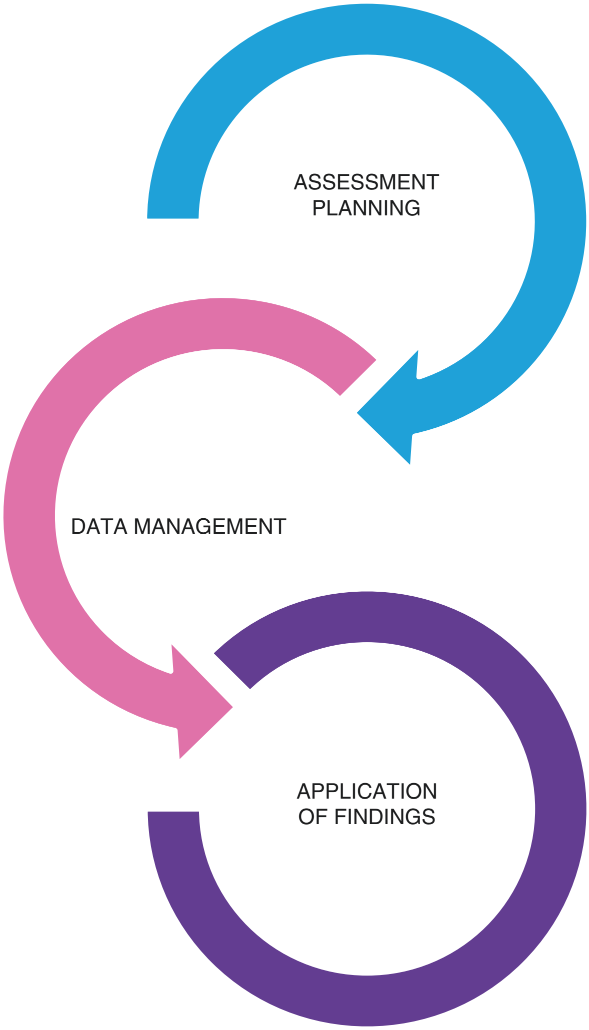

Fig. 17.2 Three-phase processes of a needs assessment model in simulation

1. Collect the facts about the "root causes" to the problem through internal dialogue (such as observations, interviews, focus groups, survey questionnaires, or meetings).
2. Form the needs assessment core team (e.g., administrator(s), manager(s), content experts, simulation educator, and care provider staffs). It is important that this team is diverse and has stakeholders who represent different facets of the problem at hand.
3. Formulate a tentative problem statement using team consensus.
4. Identify the goals of needs assessment based on the "root cause(s)."
5. Formulate a list of critical questions with assessment parameters. Table 17.1 provides an example of an assessment parameters checklist.

Fig. 17.3 Needs assessment planning

- What needs are to be addressed? (Gaps in knowledge, skills, and attitude)
- Who are in need? (Targeted Learners)
- Why is the need significant? (Expected Outcomes)
- How are the needs to be addressed? (Action Plans)
- Which needs have priority? (Timelines)
- Where are the needs situated? (Setting/Situation)
- When is the right time to conduct a needs assessment? (Critical Schedule)

6. Identify the resources for conducting a needs assessment (personnel and non-personnel).

Quality and safety issues in healthcare are complex from one facility to another and even within the same facility [4]. Understanding and articulating the root cause(s) to the problem require a systematic process of collecting information. One problem may have many causes and may not necessarily be a gap in knowledge, skills, or attitude. For instance, in the example shown in Fig. 17.1, an airway management course was designed with the implication that behavioral gaps (KSA) were the root cause of high intubation failure rates. Needs assessment performed through focus groups, survey questionnaires, and direct observations revealed to the planning team that the learners not only needed training in technical skills in intubation, but also patient assessment, medication management, and how to approach suboptimal intubation conditions. A comprehensive simulation program was designed utilizing task trainers as well as high-fidelity manikins. Additional barriers such as suboptimal access to intubation medications and intubation equipment were revealed through the needs assessment process.

Two sources of data collection, primary and secondary, can complement and supplement each other. For the purposes of mobile-based simulation needs assessment planning, primary data sources are most useful to study root causes. Data gathering from primary sources provides information directly from clinicians and non-clinicians who perform hands-on patient care and services. After clearly identifying the root cause(s) to the problem, the planning team is formed. The team should consist of individuals at the leadership and staff levels who are familiar with the clinical issue and knowledgeable about current and ideal practice. Timing between conducting a needs assessment and providing supporting data can be evaluated according to urgency.

Participatory engagement to arrive at a team consensus is the best approach to articulate a hypothesized or tentative problem statement. A "shared mental model" or being on the same page directs the team to stay focused on the behavioral gaps (KSA) and to identify the goals for conducting a needs assessment. For needs assessment planning, Table 17.1 provides a list of critical questions with descriptions of the assessment parameters. The planning stage helps in determining resources (personnel and non-personnel) to conduct an efficient and effective needs assessment. Personnel resources include individuals with assigned roles and responsibilities such as a team leader to coordinate the team efforts, a simulation educator with experience in mobile-based simulation, and a staff with knowledge and skills in performing needs assessment. This core group is sufficient for conducting a small- to medium (usually 50 or less number of learners)-scale needs assessment. Non-personnel resources can be grouped into physical space for training, simulation equipment (e.g., task trainers, high-fidelity manikins), medical equipment, information technology, and consumables.

The proceeding case study on shoulder dystocia illustrates the application of phase 1 – assessment planning (Table 17.2). Once the specific behavioral gaps have been identified, a team formed, and resources determined, the next step is phase 2 data management.

Phase 2: Data Management

Like phase 1 assessment planning, data management involves creating a work plan. As shown in Fig. 17.4, data management can be divided into three manageable tasks using the acronym CARE: (1) collecting and organizing the data, (2) analyzing the data (qualitative and quantitative), and (3) reviewing and evaluating the data for accuracy and relevancy. A work plan starts by breaking down the data into manageable tasks. Data mapping begins with laying out the goals or objectives of the needs assessment relevant to the behavioral gaps, connecting those with the current behavioral gaps (KSA), and stating methods of data collection.

Before choosing the method of data collection, it is important to ask whether *subjective* or *objective* measures will be used and whether *quantitative* or *qualitative* data is preferable to address the problem [2]. Although important, subjective assessments such as survey questionnaires and interviews are subject to learner bias

Table 17.1 A Needs assessment checklist

A sample checklist with explanations of the critical questions and their assessment parameters for each phase of the three phases of the needs assessment model		
Critical questions & assessment parameters	Answers to the critical questions	Additional notes
Phase 1 assessment planning		
1) What is the purpose of the needs assessment? (Why)		
2) What needs are to be addressed? (Specify the gaps in knowledge, skills, attitude)		
3) Who should be the members of the needs assessment team?		
4) Who are in need? (Targeted Learners) (Specify the number and characteristics of the learners)		
5) What are the expected outcomes at 3 different levels: patient outcomes, learner's outcomes, and system's outcomes?		
6) Where are the needs situated? (Describe the setting or location the needs are occurring)		
Phase 2 data management		
7) What type of qualitative and quantitative data should be collected?		
8) What methods of data collection should be used?		
9) When should the data collection start and end? What is the timeline for generating findings?		
10) What themes arise out from the data collected? (Data Analysis)		
11) What are the findings? (Review the findings for accuracy and evaluate for relevancy)		
Phase 3 Applying the findings		
12) What should be included in the report? (purpose of the needs assessment) (findings with supporting data) (recommendations)		
13) What education intervention(s) is appropriate for the identified needs?		
14) What is the budget model for the education intervention(s)?		
15) What indicators should be used to evaluate the effectiveness and efficiency of the needs assessment conducted?		

Table 17.2 Case study: assessment planning

Case study: Needs assessment for reducing the incidence of shoulder dystocia (SD) in a small community hospital setting
Situation:
Rate SD at 1.4% of vaginal births, increased from last year's 0.6%
Background:
The incidence of SD is generally reported to be between 0.3% and 1.5%. Twenty percent of infants at risk for SD suffer brachial plexus injury. A small community rural hospital, 100 miles from the nearest urban area, with higher rates of uninsured patients and teenage pregnancies, received its annual Municipal Health Department Report. The report showed that the incidence of SD had increased significantly over the last year.
Assessment:
The recent report reveals an alarming increase in the rate of SD within a year in this small community hospital.
Recommendations:
1) Conduct a needs assessment to find out the root cause(s) of any performance gaps among the care providers in the deliveries of newborn infants at risk for SD.
2) Based on the findings, make recommendations to help reduce the current incidence of SD.

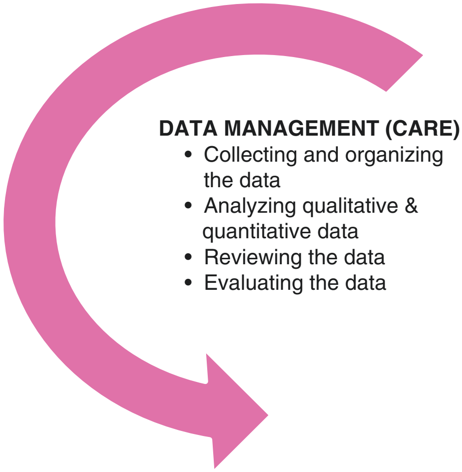

Fig. 17.4 Phase 2 – Data management (CARE)

and may only represent a small sample of learners. Objective comprehensive assessment tools such as audits, tests, and structured peer observations may limit self-assessment bias. Quantitative methods use numbers for obtaining data and utilize statistics to measure performance gaps. Quantitative assessments require questions that can be answered in a measurable way. The questions are pre-specified with a specific objective and the answers are measurable. Examples include multiple-choice survey questionnaires, case vignettes, and in-training exam scores. Qualitative assessment methodology involves detailed descriptions of events, situations, and behaviors and can offer insight into the root cause of the problem or the performance gap. It is open-ended and process-oriented and is not intended for generalization. Examples include interviews, focus groups, observations of clinical practice, and written responses in questionnaires. Qualitative methods such as interviews can be helpful in designing questionnaires to collect quantitative data. Effective needs assessments utilize a multi-modal combination approach of both qualitative and quantitative methods. Table 17.3 contains a comprehensive list of various methods and their advantages and disadvantages [2]. It is always helpful to pilot the data collection instrument or method to learners and faculty to get feedback and further refine the tool. If educational research is planned with the collected data, it is important to plan ahead and consult with the local institutional research board.

Data can be collected using a manual approach such as "paper and pencil" and electronically via online survey companies (e.g., www.surveymonkey.com), cloud computing, mobile devices, and other applications. The latter are more effective in terms of time, distance, and costs. Well-organized and concise data facilitates discovering patterns and making insightful analysis. Data is reviewed for accuracy and evaluated for relevancy using the identified root causes of the behavioral gaps (KSA) as criteria. Timely data collection and analysis should generate accurate and relevant findings. See Table 17.4 for example of utilization of the needs assessment checklist using the shoulder dystocia case study.

Table 17.3 Methods for performing a needs assessment[a]

Method	Description	Advantages	Disadvantages
Informal discussion	Conversations with learners, their instructors, program directors, departmental leadership.	Easy and convenient Time efficient Good qualitative information Useful after morbidity & mortality meetings, root cause analysis Stepping stone to more formal process First step in engaging stakeholders	Learners and faculty members biased about true needs Lack of measurable information
Questionnaires	Electronic or paper survey administered to selected or random sample of learners, instructors or other stakeholders, with specific objectives for each question	Easy to administer Cost effective Obtain quantitative data Can also obtain qualitative data Can target wide range of responders (e.g., international societies, national organizations) Assess measurable parameters such as knowledge, skills, attitude, prevalence, performance Online survey companies provide flexibility and basic statistics	Writing effective questionnaire requires skill and time Difficult to develop questions that show need Survey development, collection, and analysis time consuming Response rates variable Responder selection bias Qualitative answers often need clarification
Formal interviews & focus groups	Interviews can be conducted individually or as a small focus group to understand gaps and come up with creative solutions	Efficient if multiple people interviewed Useful qualitative data and insight into individuals and groups Clarification of responses Obtain useful qualitative data from learners and experts, leaders Engage stakeholders for program development and implementation	Time- and labor-intensive Requires skilled interviewer and/or facilitator to obtain desired information Dominant participants may bias results May not capture intended target learners No quantitative data Time delays with regard to availability of individual/group
Tests/Audits of current performance	Tests of current knowledge can include case vignettes or factual questions. Alternatively, in-training exam or evaluation data can be utilized. Can also include electronic medical record audits and chart reviews to assess performance.	Objective measure of knowledge gaps and psychomotor ability In-training exam data offer comparison to national sample Medical record data reflect actual clinical practice (e.g., procedures, patient management)	Constructive questions and clinical vignettes require time and skill EMR sampling requires standardized process and institutional clearance In-training exam scores may not reflect true knowledge gaps

(continued)

Table 17.3 (continued)

Method	Description	Advantages	Disadvantages
Direct observation	Observation of learner in practice or a process	Can obtain qualitative or quantitative data on both skills and performance Can be time and cost efficient if sampling a group Often can be done in practice by faculty supervisors	Not standardized Can be time consuming if large sample size Observer bias Learners may feel uncomfortable when being observed
Delphi process	Survey iterations over multiple rounds of a group of experts to narrow down educational needs. The threshold to reach consensus can potentially increase with each round (e.g., ≥60% to ≥70%).	Able to sample experts at local, national and international levels Gathers consensus among different disciplines/ practices Subject anonymity Suppress dominant thought leaders	Time- and labor-intensive Questionnaires require skill and time Response rates from panel Attrition of participants Potential lack of consensus
Claims/Risk management databases	Able to accurately show gaps in knowledge, skills, and communication with regard to morbidly and mortality. Utilized by hospital risk management companies.	Large sample size at state or national level Identifies hazards to public health Able to accurately show link between risk and morbidity/mortality Segue to partnerships with risk management department/companies	May not be easily accessible Isolated events may not be correlated to actual knowledge or practice gaps May not be relevant to all learners Expensive to maintain, access

[a]Adapted from Thomas [2]

Table 17.4 Completed needs assessment checklist

A sample needs assessment checklist using the three-phase needs assessment model for high incidence of shoulder dystocia (SD) in a rural community hospital	
Critical questions & assessment parameters	Answers to the critical questions
Phase 1 Assessment planning	
1) What is the purpose of the needs assessment?	Identify the performance gaps and matching interventions to reduce the rate of SD
2) What needs are to be addressed? (Specify the gaps in knowledge, skills, and attitude)	Based on the informal discussions and meetings, performance gaps were identified in early recognition of SD intrapartum, technical skills in performing common maneuvers, and team work including crisis resource management
3) Who should be the members of the needs assessment team?	Obstetrics (OB) Attending Departmental Quality/Safety Champion Nurse Midwife OB, Labor and Delivery (L&D) Nurse Manager Mobile-Based Simulation Educator OB & L&D Staff RNs

Table 17.4 (continued)

A sample needs assessment checklist using the three-phase needs assessment model for high incidence of shoulder dystocia (SD) in a rural community hospital	
Critical questions & assessment parameters	Answers to the critical questions
4) Who are in need? (Targeted Learners) (Specify the number and characteristics of the learners)	OB Attending physicians, nurse midwives, OB & L&D Nurse Manager and Maternal-Child services staff RNs from all shifts
5) What are the expected outcomes at 3 different levels: patient outcomes, learner outcomes, and system outcomes?	Patient outcomes – safe and quality care during L&D Learners outcomes – Early recognition of SD, competent performance of common maneuvers, and application of TeamSTEPPS during OB emergencies System outcome – reduced rate of SD
6) Where are the needs situated? (Describe the setting or location the needs are occurring)	SD has been reported during both home and hospital deliveries
Phase 2 Data management	
7) What type of qualitative and quantitative data should be collected?	Qualitative – root causes of performance gaps among the targeted learners Quantitative – statistical data supporting performance gaps
8) What methods of data collection should be used?	Interviews, focus groups, and electronic questionnaires
9) When should the data collection start and end? What is the timeline for generating findings?	Complete needs assessment within next 2 weeks
10) What themes arise out from the data collected? (Data analysis)	Survey results: N = obstetricians (12); Nurse Midwives (6); L & D RNs (34) Inability to recognize SD 50% Common maneuver skills decay 60% Inability to recognize needs for help 80% Poor interprofessional communication 65%
11) What are the findings? (Review the findings for accuracy and evaluate for relevancy)	The statistical data were reviewed and were accurate. Survey compliance among targeted learners was 80%. All questions were answered by all respondents. Average scores: Knowledge = 6/10 points Skills = 6/10 points Attitude (questions on leadership, communication, crisis resource management) = 5/10 points
Phase 3 Applying the findings	
12) What should be included in the report? (purpose, findings, recommendations)	Purpose was to identify specific performance gaps related to SD. Findings from interviews, focus groups, and survey results. The statistical graphs for survey results are included. Recommendation: mobile-based simulation
13) What education intervention(s) is appropriate for the identified needs?	Didactic review, deliberate practice of the common maneuvers; and case-based simulation integrating TeamSTEPPS, knowledge and skills.
14) What is the budget model for the education intervention(s)?	Dedicated time for the OB care providers Released time for RN staffs – one-day simulation-education session per group of 4–6 learners)

(continued)

Table 17.4 (continued)

A sample needs assessment checklist using the three-phase needs assessment model for high incidence of shoulder dystocia (SD) in a rural community hospital	
Critical questions & assessment parameters	Answers to the critical questions
15) What indicators should be used to evaluate the effectiveness and efficiency of the needs assessment conducted?	Indicators for effectiveness and efficiency of conducting a needs assessment on SD: Identification of specific performance gaps and root causes Rate of survey respondents Accuracy of the data collected Relevancy of the data collected Total costs of conducting the needs assessment

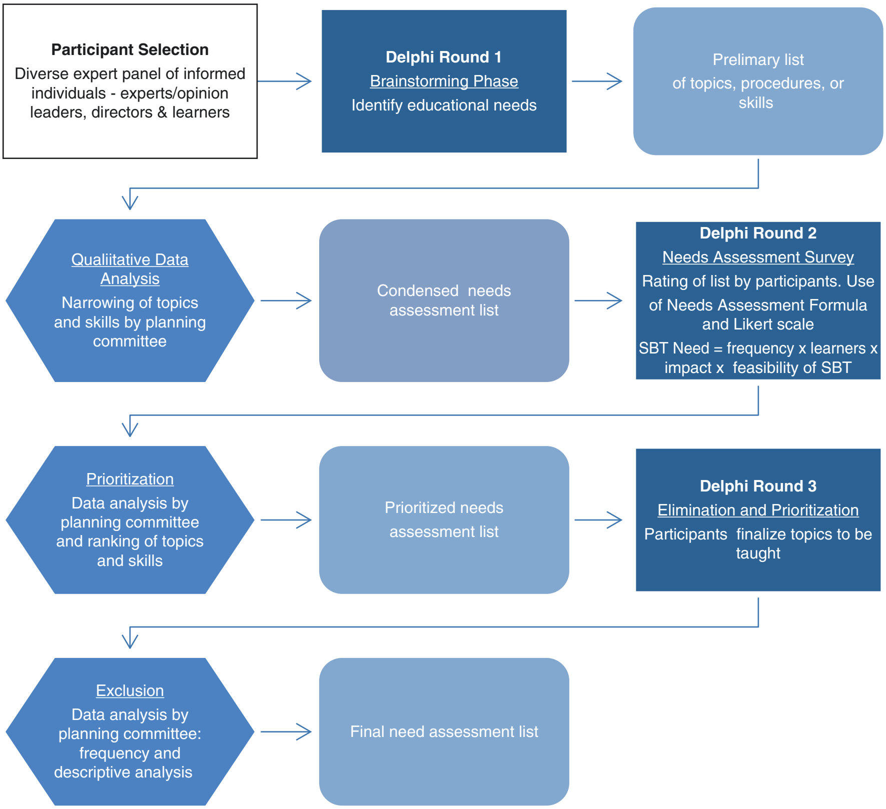

Fig. 17.5 Illustration of utilizing a modified Delphi process for needs assessment. (∗Adapted from Nayahangan et al. [9])

The Delphi technique, a widely used approach to gather and refine judgments from a group of experts or opinion leaders, is an example of a useful method for identifying and prioritizing learning needs to bridge and close behavioral gaps. Figure 17.5 provides a general overview of the Delphi process as utilized in simulation needs assessment. Nahayangan and associates reported conducting a general

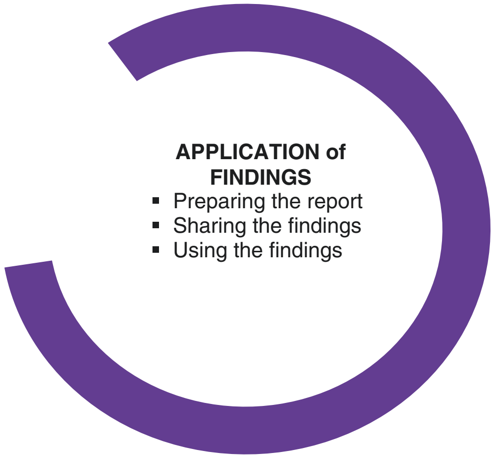

Fig. 17.6 Phase 3 – Application of findings

needs assessment using a three-round Delphi process and a needs assessment formula [9]. The use of expert consensus was effective in systematically assessing the needs for simulation-based training (SBT) of technical procedures among resident-doctors encompassing the entire nation of Denmark.

Phase 3: Applying the Findings

Phase 3 application of findings follows a sequence: (1) preparing the report, (2) sharing findings, and (3) using the findings as shown in Fig. 17.6. The needs assessment report must contain the following three key elements: (1) purpose and methods of conducting the needs assessment, (2) findings with the specific behavioral gaps (KSA) among the targeted learners with supporting qualitative and quantitative data, and (3) recommendations and rationale for using the type of simulation-based education/training. Application of Phase 3 in the shoulder dystocia case study is illustrated in Table 17.4.

It is important to ask whether useful information was collected and what was learned during the process. Once performance gaps are identified, it is important to ensure that curricular objectives and assessment measures are developed as part of simulation curriculum development. The needs assessment serves as the foundation and the guide to the remainder of the curriculum development process. It is important to note that the needs assessment data serves as a "pre-course" baseline measure when assessing the impact of the simulation.

Conclusions and Recommendations

Needs assessment is the first step in designing an effective mobile-based simulation program. The growth and expansion of mobile communications makes it possible to reach isolated and remote places and bring simulation-based education to the learners. Based on the three-phase need assessment model, three lessons can be derived when conducting a needs assessment: (1) trigger events that compromise patient safety and quality care require multifaceted examination of the root cause(s) of the problem; (2) although gaps in knowledge, skills, and attitude (KSA) are the leading contributory factors among clinicians and non-clinicians as direct providers of patient care and services, needs assessment can uncover deeper causes such as organizational complexities (e.g., workflows, resources) and geographical barriers to learning; and (3) simulation-based education and training remains an efficacious educational intervention in creating a safe learning environment to bridge and close the performance gaps and achieve the maximum desired outcomes [10]. An effective needs assessment is one that is conducted immediately after the event, combines different methods of collecting qualitative and quantitative data in identifying and prioritizing learning needs, and is well organized and coordinated. Best practice in integrating needs assessment with appropriate educational interventions and quality improvement is an open field for mobile-based simulation research.

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Scenario Development

18

Christina M. Jackson

Key Points

1. Creating a quality educational experience involves careful planning. Prior to creating an educational experience, educators should take time to determine the needs of the learner(s).
2. Following a process will help educators better plan and execute learning, as well as assess learner performance.
3. Begin with the outcome in mind when designing training scenarios.

Creating quality training is a time-consuming and costly endeavor. It takes careful planning and execution. Before expending time and energy creating training materials that may not solve the issue at hand, allocating time for exploration and investigation is advisable. Following a process can be helpful while developing and evaluating scenarios. The purpose of this chapter is to present a series of steps one may use while creating scenarios and assessing the success of the scenarios. The cyclical process starts with conducting a needs assessment and writing learning objectives and ends with assessment. The Scenario Design Checklist in Fig. 18.1 outlines the process.

When a situation occurs, one of the go-to solutions is training. But what if training is not the best solution? Before embarking on creating educational experiences and developing scenarios, it is necessary to identify if education is truly needed to correct the problem at hand. Other interventions may be more valuable, especially at a particular moment in time. Additionally, other factors affecting the situation

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Scenario Design Checklist

Needs Assessment

Collecting information from multiple data points will provide a clearer picture of the situation at hand.

Are there internal or external factors that need to be addressed?
Who are the learners?
What is known about the learner? Existing knowledge, context, motivation
Learner's scope of practice
What do they know?
What do they need to know?
Are the changes knowledge-based, skills-based, or emotional?
What's the timeline for project completion?
Are there any additional concerns?

Learning Objectives

Learning objectives provide a blueprint for a learning intervention.

Develop learning objectives
- Define goals using S.M.A.R.T. attributes
- Incorporate action verbs based on Bloom's Taxonomy [2]
- Determine how you will assess learning.

Designing the Learning Intervention/Scenario

Tying back to learning objectives
Creating the setting/environment
Identified desired learner actions or outcomes
Determining most appropriate modality
- Human patient simulation or mannequins
- Standardized Patients (SPs)
- Tabletop exercise
- Full-scale exercise
- Other

Determining Scope of Scenario
- Small
- Large
- Multi-agency

Other Considerations
- Available resources
- Equipment and Supplies
- Timeline

Documentation/forms
Ancillary/Support Items
Learner Roles
Pre-simulation activities

Delivering the Learning Intervention/Scenario

Pre-simulation preparation
Pre-simulation orientation
Simulation
Post-simulation debrief

Assessment

How will you assess?
What will you assess?

Fig. 18.1 Scenario design checklist

should be addressed before the learning intervention is used; otherwise, the learning intervention may not be successful or even necessary.

- Are there other external or internal factors that could be impacting the situation?
- Are there changes in organizational requirements or legislation that could be impacting the situation?
- Are these or other external or internal factors present?
- Starting with a careful needs assessment will accomplish several tasks including determining if training is, in fact, the best intervention.

Needs Assessment

Learning events often start with a catalyst. This catalyst could be the result of a near miss or sentinel event. It is not enough to jump in and start training. The root cause of the event needs to be identified. Conducting a needs assessment will help the organization identify the root cause and the extent to which training is needed. The organization may misidentify an issue as a training issue when it is actually an issue that needs to be addressed in another way—changes to communication, teamwork, processes, etc.

When conducting a needs assessment, collect data from multiple data points. Is there a gap in the knowledge, skills, or abilities of the learner or team? How will education fill in the gap? This process will also inform/direct learners to the best tools to use to evaluate learner outcomes. If training is needed, the needs assessment will help identify the why, what, how, and to what extent training is needed. It will also help determine if other internal or external factors are present. Those factors should also be addressed or any training conducted could be ineffective and lead to undesirable outcomes.

Once the issue has been correctly identified as a training issue, it is time to start designing the training intervention.

Review:

- What do you want the learners to do?
- What do you hope to accomplish?
- What are the learners currently doing?
- Are there external or internal factors that could be affecting the situation?
- How will education meet the needs or fill the gap?

Allow yourself ample time to conduct a needs assessment and develop your scenarios. Developing quality learning materials and supporting documents takes time.

Learning Objectives

The next step in the process is to identify learning objectives. A fully developed set of learning objectives will help provide a clear direction of what the educator intends for the learner to take away at the end of the learning intervention. Start creating learning objectives with the end in mind. Consider the needs of your learners. What does your learner need? What do you want your learner to know upon completion of the training? Is there specific knowledge you want them to be able to recall? Are there certain competencies you need to measure?

Bloom's Taxonomy [1] categorizes learning into cognitive (knowledge), affective (emotions and attitudes), and psychomotor (manual or physical skills) domains. It was based on a hierarchy that moves from less to more complex levels of knowledge. The original levels were: Knowledge, Comprehension, Application, Analysis, Synthesis, and Evaluation.

In 2001, Anderson and Krathwohl [2] introduced a revised model incorporating advances in educational knowledge and re-categorizing the hierarchy into action verbs. The revised levels are: Remember, Understand, Apply, Analyze, Evaluate, and Create. At the lower levels of Bloom's, learners recall knowledge and simple facts. The learner's cognitive skills and ability to interact with knowledge become more meaningful and complex as they move up the hierarchy. Lists of action verbs associated with each level of Bloom's can be utilized when writing learning objectives [1].

While writing learning objectives:

1. Consider how the participants will demonstrate that they have learned. Are they demonstrating specific knowledge, mastering a skill, or showing a change in attitude?
2. Incorporate action verbs based on Bloom's Taxonomy [1].
3. Determine how you will assess learning. What are specific ways for the learners to demonstrate a change in attitude or behavior? How can they demonstrate critical thinking as opposed to mere recall?
4. Use S.M.A.R.T. attributes.
    (a) Specific: well-defined statements of what the learners will be able to do.
    (b) Measurable: use action verbs that can be observed.
    (c) Attainable: students should have the appropriate level of knowledge and skills to be able to achieve the objective.
    (d) Relevant: the learners' knowledge and skills are appropriate.
    (e) Time-Bound: timeframe in which the learners will demonstrate the knowledge or skill.

Learning objectives are the touchstone from which all other scenario development decisions can be made. Starting with the end in mind will help those who are planning the learning development road map to determine if it was a success. Simulation is no exception.

Modality

Your learning objectives will drive the modality you chose. Select the modality that will help you best meet your learner's needs. Following is a list of modalities and considerations for use:

Human Patient Simulation Human patient simulators or mannequins can be programmed to respond physiologically to set conditions. As learners make decisions regarding care, the mannequin responds accordingly. Scenarios are programmed such that that the mannequin will respond in a predictable manner making it easy to replicate a situation and run it the same way each time it is run. Advantages of using a human patient simulator or mannequin include ability to replicate situations and deliver a scenario consistently. Disadvantages include the high cost and availability of mannequins, having trained personnel with the ability to conduct simulation training, technical aspects of programming and running scenarios. There is also the fact that mannequins are somewhat sterile in their presentation as opposed to the unpredictability of a human being.

Standardized Patients Another type of human patient simulator to consider is a standardized patient. Standardized patients are individuals who receive training on how to present cases and provide feedback from the patient's perspective. Advantages include giving learners the ability to interact with an actual human being. Disadvantages include costs, quality of training, and the fact that standardized patients present with their own vitals, as opposed to a set of pre-programmed vitals, making it difficult to present various types of cases.

Tabletop An exercise in which participants discuss the case and what may happen. The participants can talk through how they would handle a specific case or situation. The benefits of tabletop exercises include the ability to conduct a large-scale event. The disadvantages of tabletop exercises include that learners may be able to drill on how they may respond to and make decisions in a situation, but there are limitations.

Full-scale Depending on the scope of your scenario, it may be necessary to bring together mutual aid agencies and drill together. The full-scale exercise is resource-intensive but allows various groups to come together and work like they would in a real-life situation. These drills allow agencies to see how the agencies work together, determine if resources are, in fact, sufficient, and identify issues. The advantages include the ability for diverse organizations to come together and drill. The disadvantages include cost, time, and scale needed to conduct such an event.

Size Consider the number of participants to include when running the scenario. Based on the number of participants, you may need to run the scenario multiple times.

Planning/Checklists

Anticipating learner needs will go a long way in determining what you need to successfully run a scenario. Brainstorm potential learner needs, actions, and the decisions they may make as they complete the scenario. Has the scenario captured the essence of what you want to accomplish? Do you have what you need on hand to equip the learners?

Checklists serve as a ready reference when trying to capture information on commonly used equipment and supplies. Using planning documents and checklists can provide touchpoints throughout the planning process. A lot goes into planning even in a small simulation scenario. Supporting documentation should be developed, whenever possible, to heighten the fidelity of the simulation experience for the learners.

Roles

Identifying these roles will help you as you build the scenario. What types of roles do you want your learners to perform? Are you looking to bring in someone as a distractor (confederate)? Are you planning on having your learners switch roles or will they remain in a designated role throughout the exercise?

Consider how switching roles may help individuals better understand the roles of their peers. This may not always be possible when interacting interprofessionally or with other agencies. At the very least, having a better understanding of and appreciation for what others do may aid in professional respect.

Creating the Scenario

Scenarios can be off-the-shelf or built from the ground up. Whatever method is used, it is necessary to run through the scenarios to determine their flow and if they measure what they measure. If creating a scenario from the ground up, have the scenario vetted by stakeholders and pilot the scenario. There are several templates available for use. Work out the bugs before introducing to the learners. Consider the methods you'll use to tie prior knowledge with how you want your learners to perform.

Start by creating a brief summary of your patient. This should include a description of your patient. What condition(s) is the patient presenting with? What are the patient's current vitals? What background information would be helpful to the learner? This information can be presented in many ways including a SBAR report, handoff report, or SAMPLE report.

Determine the length of time you want the scenario to run. Chunk the scenario into five-minute increments to make planning more manageable. Each five-minute increment should include a short description of the state the patient is currently in. Additionally, vital signs, expected learner actions, as well as operator actions and prompts should be listed. The learner actions often follow the learning objectives and address what would you like the learner to be able to complete within the allotted time. The operator actions include possible prompts and scripting the operator can use. Once you have written on section or state, move on to the next, working through the scenario until you are done.

Identify what pre-simulation preparation the learner should complete. Pre-simulation activities may include readings, videos, looking up drugs, and possibly creating drug cards, practicing skills or whatever is determined to be beneficial to help the learners prepare. It may also include a pre-test to test learner knowledge.

On the day of the simulation, orient the learners to the simulation. Explain how long the simulation will run and what you expect the learners to do in that time. Show learners where they can locate equipment and supplies. Give them an opportunity to find pulses and listen to the mannequin's vitals. Let them know how they can call a "time out" to receive assistance during the simulation. Setting the stage and explaining expectations will help learners focus on what they need to accomplish instead of second guessing themselves wondering what they need to do to complete the scenario successfully.

Debriefing

After the learner has completed the scenario, debrief. Debriefing allows the learner to reflect upon what went well and what they need to improve upon. Provide the learners the opportunity to discuss the decisions they made and determine what they would do differently if given the opportunity to run through the scenario again.

Assessment

One of greatest challenges in learning is determining if the learning intervention was successful. Did the learner learn what you wanted them to learn? To what degree? Starting with a careful needs assessment and determining learning objectives in advance will inform how learners and learning will be assessed. Assessment is aided by the learning objectives. You have already determined what you want the learner to learn. Now you have to decide what you are going to measure and how you are going to measure it. The nature of a learning objective is that it must be quantifiable. They can be objective or subjective. When you have written the learning objectives properly, the assessments should follow fairly easily because you are already determining subjective or objective assessments.

Learners gain information in a variety of ways. One common way is through didactic learning. Didactic learning is commonly from the book, classroom, or a similar experience. It is often abstract or theoretical at this point in the learning process. Learners may know information and be able to recall it. At this point, they have likely not applied the learning.

Giving learners the opportunity to demonstrate what they have learned will help reinforce didactic learning and give them an opportunity to transfer and retain the knowledge more effectively and efficiently because they are actually doing what they learned. This kinesthetic applied learning is an essential component of simulation in which learners have a safe environment in which to practice skills and make critical decisions impact their learning, specifically patient care. Learning in the kinesthetic domain aids in reinforcing didactic knowledge, application, and retention.

Objective learning objectives can be observed. Examples of observable learning objectives include the following: was the learner able to recall specific knowledge on a quiz or exam, or did the learner perform a specific task in the prescribed manner. Subjective learning objectives are more difficult to measure because they are tied more to feelings, decisions, and beliefs. Not all learning is observable or measureable. Subjective learning objectives may need to be measured in other ways including self-reflection or debriefing in which the learner discusses how they derived at certain decisions.

Formative assessment is typically conducted to provide feedback on where the learner currently is and where they need to go. It often involves looking at competencies using dichotomous or scaled choices. Did the learner complete the task? To what level did they complete the task? The types of assessments needed for emergency responders will typically be formative. Determine if checklists or other observational tools should be used to assess the learners.

Summative assessment is often more associated with whether or not the person will pass on or fail. These come in the form of high-stakes assessments and other examinations. Examinations such as OSCEs are high-stakes to determine whether or not students will be passed on to the next level.

Consider using one of the many simulation evaluation tools available to help assess learning. Whatever evaluation tool you use, assess student's learning and overall success of the simulation scenario by determining to what extent the learning objectives have been met.

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Suggested Readings

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Education Methods

19

Sachit A. Patel

Key Points

1. Several modalities are available for simulation training.
2. Simulated patients have the highest level of fidelity to actual practice.
3. Training needs and curricula should drive the selection of equipment for simulation training.

Introduction

Healthcare simulation has seen tremendous advancement since the foundational work of Asmund Laerda [1]. In this chapter, we present the primary modalities and technologies currently available for healthcare simulation-based educational activities. We review these modalities including generalized applications, specific advantages, disadvantages, technical limitations, and elements of successful implementation.

Although the idea of simulation fidelity is not a universally accepted term, nor are there universally accepted definitions, it remains an important framework when describing a simulation platform. In general, fidelity refers to the level of reproducibility toward a desired real-life environment or situation [2, 3]. Low-fidelity simulators lack interaction and provide very little realism to the learner, but serve the purpose of providing a basic understanding, such as the Rescuci Anne used for basic life support, or partial task trainers for intravenous access placement or nasogastric tube placement. Medium- or moderate-fidelity simulators can add increased interaction by

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the user both in intervention and in response such as palpable pulses, or audible heart sounds, but lack features that add situational realism for the learner. Examples could include the Laerdal Advanced Life Support manikin. High fidelity represents simulation platforms that closely approach a true "real-life" situation and is an area that is continually advancing due to rapidly advancing technologies that include full-body automated manikins to virtual reality environments with multiple interfaces.

Standardized Patients

First conceived in the early 1960s by Dr. Howard Burrows and termed the "programmed patient," standardized patients (SP) have served as the foundation for modern simulated medical education [4]. The purest definition of an SP is any individual specifically trained and selected to replicate the patient experience for a learner in order to objectively teach, educate, evaluate, and provide direct human feedback to that learner. The use of SPs is nearly universal across medical education. A recent survey of US-based medical schools and teaching hospitals performed by the Association of American Medical Colleges (AAMC) reports that nearly 95% of medical schools incorporate the use of simulated patients in their educational curriculum. In 2011, the Liaison Committee on Medical Education (LCME) in association with the AAMC reported that approximately 50% of medical school clerkships utilize SP exams to determine a portion of a final grading [5]. Moreover, many licensure and board certification agencies such as the National Board of Medical Examiners have incorporated SPs into their final certification assessments.

The incorporation of simulated patient platform utilization into medical education stems from several distinct advantages. Once trained, SPs have the ability to be available at various times and locations. One SP can replicate various clinical case situations and disease presentations in an effort to "standardize" the testing environment for a number of learners. The SP has the ability to truly replicate the human interaction and communication dynamics of difficult diagnosis. Examples include the emotional response to a cancer diagnosis or receiving a diagnosis of a terminal illness. The SP has the ability for genuine human expression of joy, anger, frustration, and misunderstanding, which are all critical and invaluable to high-level medical education. Moreover, this replication of highly emotional or sensitive scenarios can be performed with multiple learners without compromise or risk to actual patients. An SP can provide real-time feedback based on human interaction and experience targeted toward a curriculum's established core competencies. Lastly, an SP, by their very nature, can allow for a controlled, reproducible, decreasingly biased, equitable platform for examination.

Despite several advantages, the use of SPs carries disadvantages as well. A successful SP program must be able to recruit the required number of individuals that allows for efficient throughput of trainees. Equally important to recruitment, is the retention and avoidance of SP attrition over time. Many programs rely on volunteers, and perhaps larger communities can sustain a regular volunteer pool. However, it is increasingly common for a sustainable SP program to provide some amount of financial compensation to the SP for time spent learning scenarios, time spent portraying their roles, and time spent evaluating learners. Often, standardized patients are individuals interested in healthcare education, but with no formal healthcare education.

As a result, the time required to prepare the SP could be significant and rate-limiting. Education must include the understanding of the student course objectives which is often different for resident-level physicians, medical students, nursing students, physician assistant or physical therapy students, and so on. In order for the SP to accurately portray the specific case scenario, one must obtain an understanding of the disease itself including, but not limited to, the clinical disease presentation, pathophysiology, natural history, and how this can affect the physical, emotional, or spiritual response by an actual patient. Beyond medical understanding, the SP must have an understanding of the overall education model, how it relates to the evaluation of trainees, and be able to give feedback objectively, constructively, and consistently. Lastly, challenging is the simulation of disease-specific exam findings. For example, a patient with complicated pneumonia with effusion may have audible crackles due to pleural fluid on lung exam. An SP would not be able to recreate that sound. Accessing a cardiac patient with a heart condition in which a characteristic audible heart murmur is required would be difficult. Other examples include disease-defining eye movements, oral sores, rashes, bone deformity, or wounds. Many of these limitations can be overcome by creating hybrid simulations or alternative simulators (discussed below).

Web-Based Computer Simulators

As discussed in the previous section, live human interaction as a training method utilizing simulated patients has become mainstay. However, as technologies advance, trainee time constraint increases, and financial support decreases, computer or Internet/web-based models are increasingly incorporated into healthcare education (Fig. 19.1). Several advantages to these models exist. Perhaps the most prominent is access by learners regardless of geographic location. Trainees can

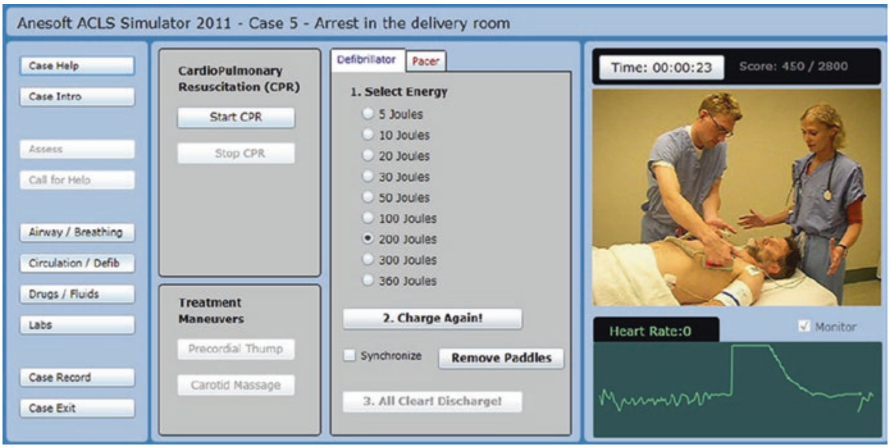

Fig. 19.1 Anesoft ACLS simulator 2011. Dynamic images show the patient and resuscitators (portrayed by actors). The user enters commands by clicking the available choices. The resultant action is demonstrated in the video along with the corresponding cardiac waveform. (Reproduced with permission of Anesoft)

Fig. 19.2 Anesoft ACLS 2011 for mobile devices allows much of the same user interaction as the full-scale computer-based version with the obvious advantage of increased user mobility. (Reproduced with permission of Anesoft)

simply "log in" to a training session and complete the course, assessment, and often obtain objective real-time computerized feedback (Fig. 19.2). Tracking metrics such as completion rates, number of attempts, post-test scores, and user satisfaction surveys are readily available with this platform (Fig. 19.3). Difficulty arises when using web programs, in that there is no human interaction, no real-time discussion, and the onus of benefit and engagement rests on the user's level of interest.

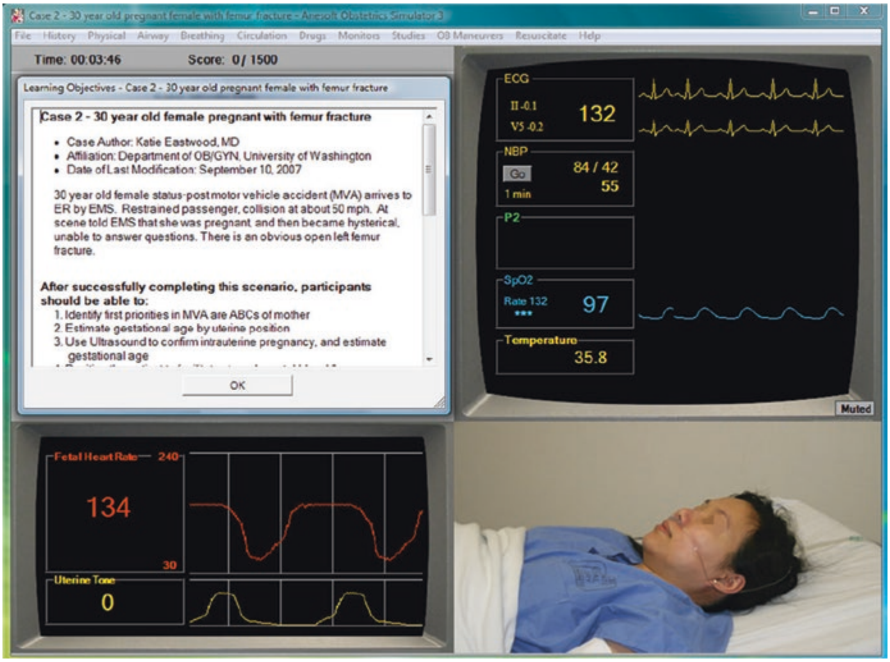

Fig. 19.3 User interface for Anesoft Obstetric Simulator. Case scenario and user commands are displayed on the upper left. Resultant cardiac and respiratory waveforms are displayed in the upper right, as well as the fetal and uterine tracing in the lower left. Cumulative time to completion and instructor-determined scores can be tracked. (Reproduced with permission of Anesoft)

Manikin Simulator

Manikin-based simulators can be a valuable tool in today's healthcare education. Sometimes referred to as full-scale simulators or high-fidelity simulators, the manikin itself is only a small component to the greater success of manikin-based simulation. The role of the operator to design the program for the scenario is critical. A thoughtful program must consider the ideal output, such as vital sign changes, physical appearance changes, or other automation to fully recreate the desired scenario, and, perhaps more importantly, have a realistic effect on the learners' mental, physical, and emotional experience within the simulation.

Manikins of varying fidelity are currently available. For instance, American Red Cross Prestan manikins used in some BLS courses can be considered low-fidelity, but provide sufficient re-creation of head, neck, and torso positioning of adults, pediatrics, and infants to educate toward lay person certification (Fig. 19.4). Alternatively, high-fidelity manikins are available that recreate heart sounds such as murmurs or changes in rate, breathing sounds indicative of obstruction, skin color changes alerting to inadequate chest compression or insufficient perfusion, eye

Fig. 19.4 Prestan Manikin Family Pack. (Reproduced with permission of Prestan Products, LLC)

movements, and whole body moving simulating seizures. Advanced features such as these are alluring but come at increased financial investment, not only for initial purchase but also for maintenance and utilization. Furthermore, there is insufficient data to suggest that high-fidelity manikins are universally better than low-fidelity manikins. Published studies indicate that the use of high-fidelity manikins improves clinical performance [6]. Fraser et al. showed increased identification of murmurs [7]. Mayo et al. showed improvement in airway skills [8]. Studies also showed improved clinical performance in ACLS courses [9]. Conversely, other studies have concluded no difference in learner performance when high- and low-fidelity manikins were used [10]. Despite these conflicting results, additional studies show that learners consistently value and report higher satisfaction with high-fidelity models [11]. Ultimately, the successful utilization of manikin-based simulation rests on a thorough understanding of the target learners, the commitment of instructors to fully understand the scenarios as it related to manikin programming, and the established goals of the education program.

Unique Considerations

Manikins can be obtained with variable additional features suited to the specific educational objectives. Some term these platforms as "partial-trainers," in that they focus on a specific learning objective, such as venipuncture, umbilical catheterization, chest tube placement, or intraosseous placement. Some of these features have been described in the text that follows, and these features, when combined, can assist in creating a successful simulation program.

Neurologic

Manikins can simulate very specific neurologic changes. Alertness or consciousness can be displayed though automated eye blinking or closing. Unilateral or bilateral pupil dilation, either normally reflexive or "fixed," can be programed to a learner's external light source (Fig. 19.5). Abnormal eye movements or tonic-clonic shaking by the manikin can portray seizures.

Cardiovascular

The most basic manikins generally include features simulating chest compressions. The plastic material of these manikins is pliable enough to teach learners efficient and effective delivery in regard to depth and location of compressions. However, options are available to coordinate compressions with pulse strength as well as location of the pulse (carotid, brachial, inguinal, etc.). Others can simulate heart sounds through a computer interface or changes in heart sounds, given a certain intervention by the learner or baseline systolic or diastolic murmurs. Many high-fidelity manikin simulators provide a pre-programed library of common rhythms from normal sinus to ventricular fibrillation (Fig. 19.6).

Fig. 19.5 SimMan® 3G with interactive eye features. (Reproduced with permission of Gaumard Scientific)

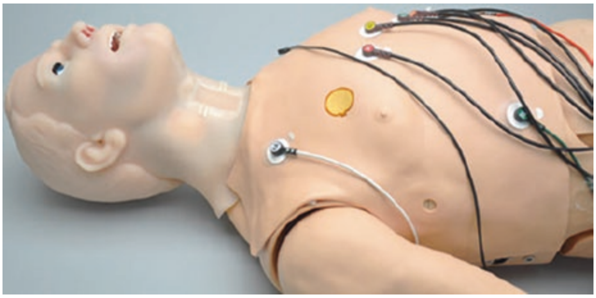

Fig. 19.6 HAL®, S3201 which can be connected to real-time ECG monitor. (Reproduced with permission of Gaumard Scientific)

Respiratory

Combined with cardiac, respiratory features in simulation are the most utilized. Manikins have the obvious feature of a visualized airway and ability to deliver breath effectively, but many high-fidelity manikins go beyond the basics. Many modern features include ability to apply effective bag-mask ventilation, placement of endotracheal or nasotracheal tubes, with the consequent chest rise of a successful attempt. Models can have audible changes in breath sounds simulating upper or lower airway obstruction. Moreover, recreating inflammation with features such as tongue or glottis swelling can further simulate obstruction. Some can inflate and deflate lungs asymmetrically, mimicking inadequate positioning of an endotracheal tube or collapsed lung. Some models can expel varying physical substances intended to demonstrate increased airway secretions, bleeding, or emesis, while others can release increased carbon dioxide. Many manikins have sensors that can be programmed to detect these changes and produce outputs such as changes in vital signs, peripheral oxygen saturations, or apnea. Additional more sophisticated manikins targeted for anesthesia or ICU care can integrate mechanical ventilation devices and simulate changes based on a user's choice to change tidal volume, peak end expiratory pressure, inspiratory–expiratory ratios, etc.

Extremities

Although most high-fidelity manikins are equipped with upper and/or lower extremities, the degree of user interface can vary. Simple articulation of joints to recreate positioning is almost universally available. Some manikins can change limb coloration or strength of pulse in situations where cardiac decomposition or inadequate resuscitation is occurring (Fig. 19.7). However, more targeted learning environments, particular military training, have utilized limb amputation features to simulate battlefield trauma.

Fig. 19.7 Newborn HAL® S3010 demonstrating cyanosis and ability to palpate brachial pulses. (Reproduced with permission of Gaumard Scientific)

Virtual Reality, Virtual Environments, and Haptic Simulation

As seen in the previous section, advances in technology have resulted in a wide variety of technology-based integration in simulation-based education platforms. Modern educational theory has proven that today's learners benefit from increasing integration of technology. Moreover, in healthcare education, increasing emphasis on work hour limitations has led medical education to rely on advanced simulation. "Virtual Reality" refers to the utilization of computer-simulated environments that can accurately replicate presence in the real world. Tremendous advantages are presented with this form of simulation. "Haptic" simulation refers to the ability to not only recreate the physical environment but also the "feel" of the environment through sense of touch and proprioception. Procedural training best utilizes this platform. For example, an abdominal surgery for appendectomy via laparoscopic technique would have a physical interface that replicates the actual instruments. The user can then learn the handling of the instrument, the weight of the instrument, the pressure needed to produce an effect, etc. This physical interface for the user is experienced through a virtual on-screen interface (Fig. 19.8).

Fig. 19.8 (**a**) Simbionix LAP Mentor™ with haptic feedback and LAP Mentor Express™ from 3D Systems. (**b**) Simbionix LAP Mentor VR™ with Inguinal Hernia module from 3D Systems allows work on the simulator in a fully interactive immersive operating room setting. (Reproduced with permission of 3D Systems)

Fig. 19.8 (continued)

Additional advantages to virtual and haptic simulation include the ability to program various pathology across disciplines. An abdominal laparoscopic simulation may be able to reproduce an appendectomy as mentioned previously, but also abdominal exploration, various tissue biopsies, suturing or ligation, gynecological tubal ligation, cyst removal, or other disease pathology. Various simulators exist across disciplines as well including those for bronchoscopy training, endoscopy training, and colonoscopy. The primary limitation to this platform is cost, portability, and volume of users at a given location.

Conclusion

In this chapter, we have summarized several methods utilized in simulation training. Although the list of examples given is not exhaustive, it highlights the modalities most often used in a successful training program. Moreover, there should be an emphasis made that the level of fidelity does not always correlate with mobility. Small focused trainers are easily moved but have limitations on breadth of education. Conversely, the wide range of applications and variety of targeted audiences that can be reached by virtual training platforms may be outweighed by limitations in mobility. Careful planning, an understanding of available tools, and an understanding of learning objectives can lead to a successful mobile simulation program with the greatest benefit to its learners.

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How to Prepare for a Simulation Session (Instructor and Learner)

20

Jon W. Allen

Key Points

1. Preparing instructors and learners for a mobile simulation experience has unique challenges compared to preparing for a simulation experience in a static facility.
2. Providing materials and instructions to learners and instructors in advance of the simulation activity.
3. A dry run (rehearsal) of a mobile simulation exercise will often expose areas of needed improvement in a mobile simulation activity.

Introduction

Integrating simulation into a health professions education must complement the existing curriculum, be well planned and include specifics for each learner type and level [1]. With adequate instructor preparation and appropriate briefing of the learner, the simulation team may significantly enhance the skills necessary to provide high-quality care, not just provide an "interesting" experience. One must also answer some difficult questions to arrive at the "best" educational experience. Originally proposed for research, these questions are equally applicable to the clinical educator. For example, how do we assess the skill, what aspects of performance are most subject to skill decay, what learning strategies do we need to utilize? [2] With these questions in mind, the instructors can begin to prepare a well-designed simulation experience. Knowing how they are assessed and what skills are improved by simulation, the learners too will have

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a beneficial experience. Finally, understanding the disproportionate concentration of providers in metropolitan areas as opposed to more rural areas in some states [3] and the larger, aging population, healthcare shortages, and unique challenges healthcare delivery in rural settings assists the simulation team in preparing the instructors and learners to get the most out of the simulation experience [4, 5].

Uniqueness of Mobile Simulation

The literature is void of much information comparing mobile and permanent simulation labs, but realistically, the comparison is obvious. Both mobile and permanent simulation labs share the following similarities: the simulators, task-trainers, audio-video recording and playback systems, and support equipment (beds or gurneys for the simulated patient, medications, cardiac monitors, crash carts, etc.). Some labs whether mobile or permanent can replicate an emergency room, intensive care unit, hospital room, or ambulance settings.

Adequate preparation for simulation in a mobile simulation vehicle requires knowledge of the uniqueness of the mobile setting. These include being smaller, having limited supplies immediately available, often functioning off-line (not connected to the home-based audio-video system). The most obvious difference (or uniqueness) though is the ability to take simulation to the learner. These unique characteristics must be taken into consideration when preparing for a mobile simulation event.

This uniqueness was highlighted in a needs analysis done in a rural Midwest state during the development of a statewide mobile simulation program [6]. Surveys of Emergency Medical Services and Critical Access Hospital personnel around the state highlighted the overwhelming need for procedural skills updates, training in low-frequency–high-risk scenarios, low-cost training and the ability of the training to come to their location. With increasing aged population, decreasing number of healthcare institutions, long distances in rural travel, and inability for providers to leave their communities often, mobile simulation programs can play a needed and vital role in maintaining the healthcare of the population.

Having successful mobile simulation programs in multiple states, *Simulation in Motion* has been able to develop an instructor and learner preparation method that is efficient, effective, and quite thorough. It takes a dedicated team support to put together. This chapter will address our suggested administrative, instructor and learner preparation for simulation sessions. Our goal is to provide health educators with the tools necessary to institute their first mobile simulation session, improve upon an already developed simulation program, and evaluate current and new methods of education to expand the knowledge in the field of mobile simulation. We also desire to have the learners receive the best education possible gaining knowledge and information they can use in their respective practices.

Administrative Preparation

Administrative oversight is a necessary item for a well-run busy mobile simulation program. It must be clearly defined and appropriately empowered to carry out the responsibilities necessary for efficient functioning. It is with this kind of support that the best preparation can be made by all personnel, including the instructors and learners. A brief review of those personnel we have found vital to successful mobile simulation programs follows.

Personnel

Administration of a mobile simulation program is highly variable between organizations, although a key factor in all programs is a leader with the authority to direct a team to carry out a well-run mobile simulation session.

The leader in charge of ensuring efficient and quality mobile sessions usually has a team of two or more personnel with duties and responsibilities related to operational, technological, logistical, medical, and educational aspects of the session.

Examples of organizational charts of well-run programs are found in Figs. 20.1, 20.2, 20.3 and 20.4.

The personnel in a mobile simulation program will depend on numerous factors. University-based systems and academic medical centers have very different structure, organization chart (Figs. 20.1, 20.2, 20.3 and 20.4) and job descriptions than hospital-based and independent programs. Listed here are several positions that

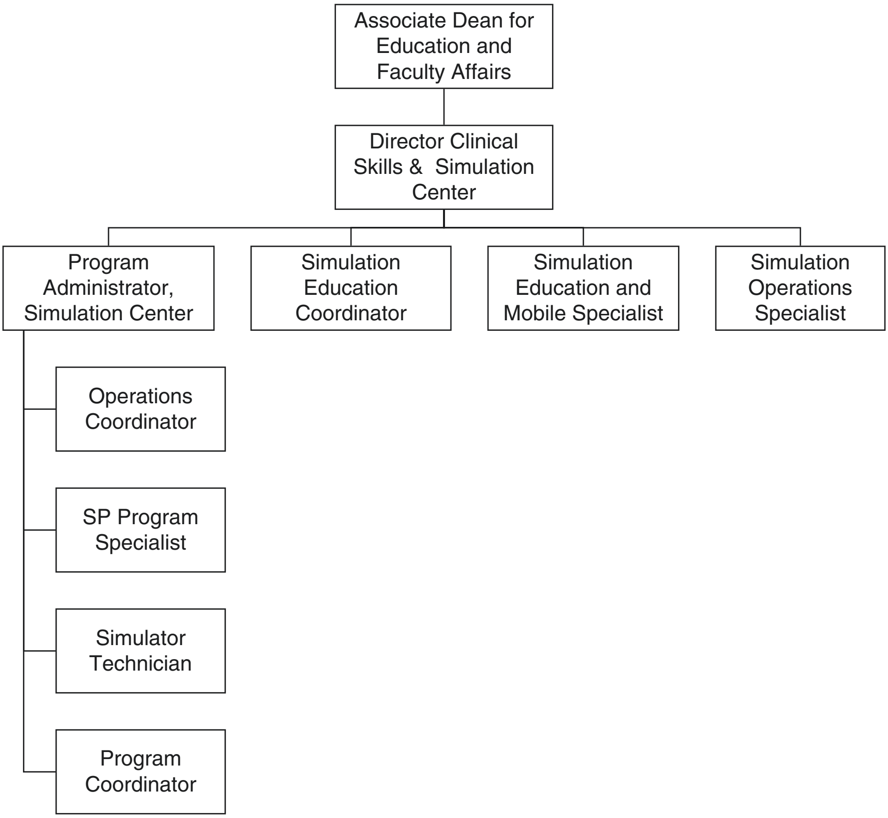

Fig. 20.1 Organizational chart, Example 1

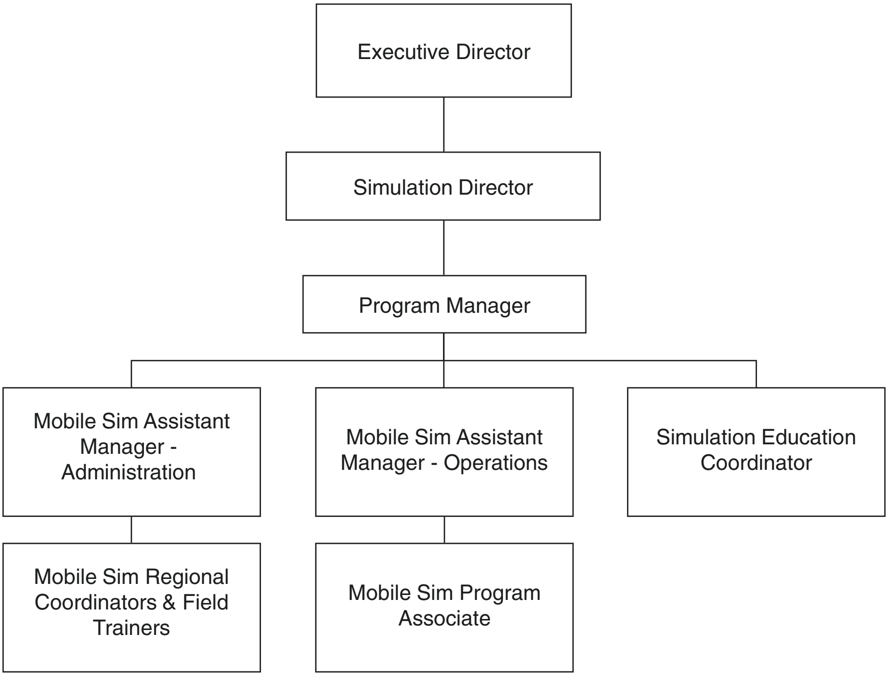

Fig. 20.2 Organizational chart, Example 2

may have different titles depending on the organization, but the descriptions identify their duties.

- The *administrative director* (or AD) [e.g., *program manager* or *program administrator*] has the greatest oversight and empowerment. The AD maintains awareness and ultimate control of the master calendar and schedule, plans faculty and staff development, session reviews and more. Canceling or postponing sessions due to weather or other unforeseen circumstances is also the responsibility of the AD.
- There may be a *Medical Director* who provides content expertise whether from experience in practice or having a portfolio of content experts from various specialties to call upon. The medical director often also participates in the session as a facilitator, educator, and/or debriefer and oftentimes is the overall program director.
- An *Education Coordinator* is usually in charge of writing and adapting simulation scenarios for the various learners (physicians, mid-level providers, nurses, and EMS personnel) as well as facilitating the education and debriefing.

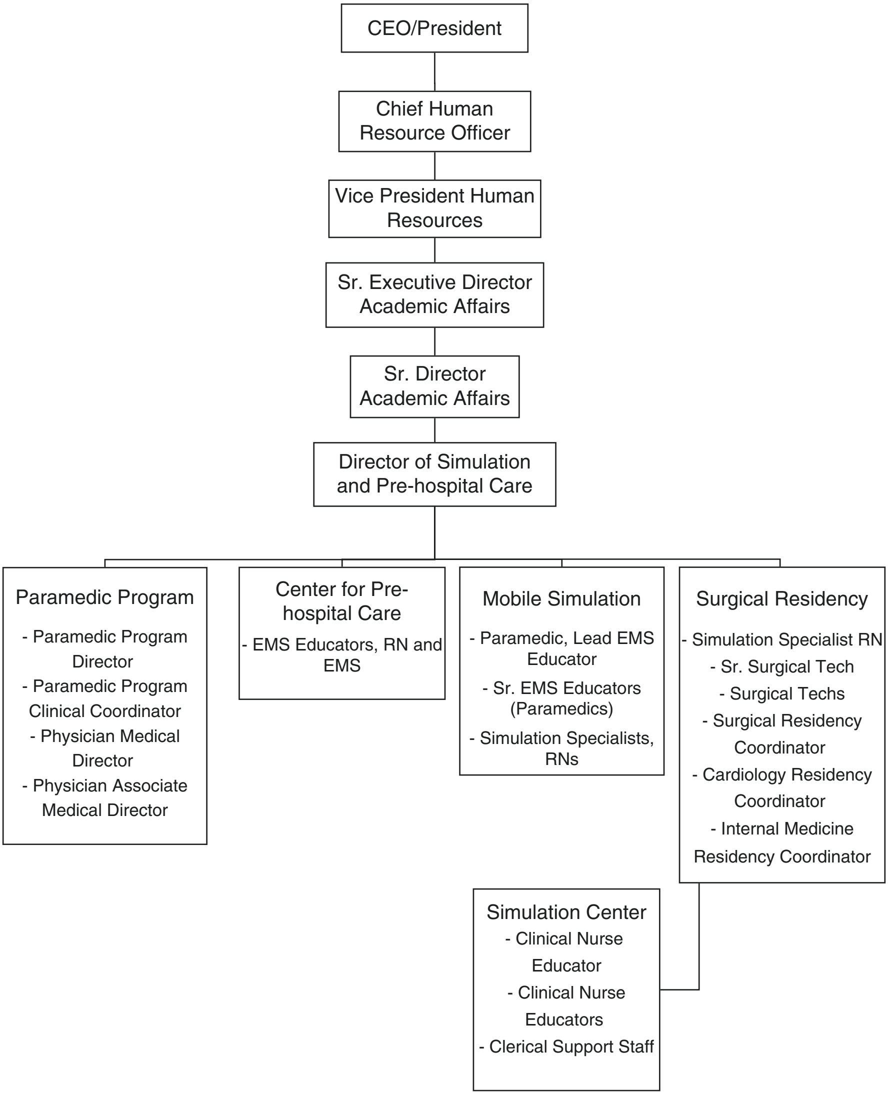

Fig. 20.3 Organizational chart, Example 3

- The *Operations Manager* or *Mobile Specialist* is the person in charge of the major equipment, such as the vehicles serving as the mobile simulation lab but can also participate in the education process if the job description requires EMS or Nursing background. This position may also oversee the regulatory issues associated with intrastate or interstate travel.
- The *Simulator Technician* is critical to the smooth functioning of a simulation event. The Simulator Technician not only ensures proper functioning of the simulators and computers but also is responsible for programming the scenarios

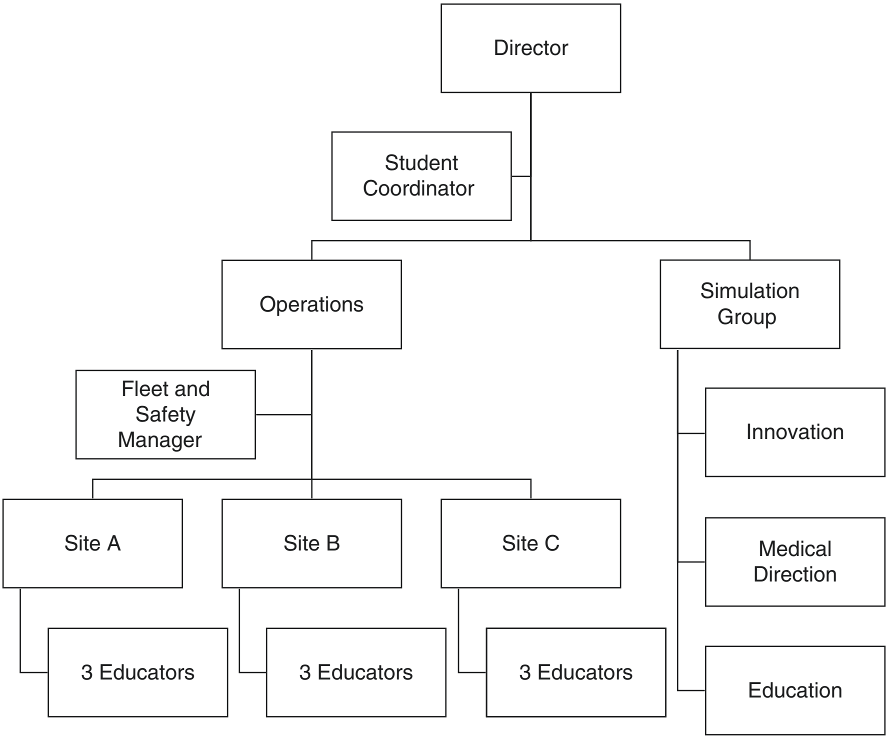

Fig. 20.4 Organizational chart, Example 4

into the simulator for the individual sessions. Simulation is a highly technological field that requires a high amount of maintenance. Without a well-trained person in this position, simulations tend to be basic and utilizing only a small portion of the available programming. If multiple mobile simulation labs are part of your program, it is wise to have someone on each site trained to provide the basic maintenance and trouble shooting and these technicians have access to the lead simulator technician or the manufacturer's service personnel.
- Certainly, *Administrative Support* personnel cannot be forgotten. Their role in assuring smooth functioning is valued by all members of the team.

These are not the only positions possible in a mobile simulation program. Titles and job descriptions vary and necessarily must fit the institution and size of the program. What is described earlier will hopefully provide suggestions for new and reorganizing programs.

Intake Information

Now let us focus on the tasks required in the preparation. It begins with the request for your program's services which may come via a website, phone call, e-mail, or social media site, whichever suits your program best. The request stimulates a process of planning that involves several parts. Even though this is not part of the instructor's or learner's responsibility, it is important to understand what information is needed and how to gather it so that it is most appropriately compiled for instructor and learner preparation.

A standardized form or template keeps the planning process organized, thorough, and efficient. Figure 20.5 (Mobile Simulation Event Planning Worksheet) is an example of a template that includes the intake information as well as the internal planning and event day checklists.

REFERRING FACILITY	DATES REQUESTED

CONTACT INFORMATION	
NAME:	TITLE:
PHONE:	
EMAIL:	
EVENT ADDRESS:	

SIMULATION LAB PARKING (need a flat area approx. 25 by 50 with ingress & egress; diesel generator use, so not near hospital air intake)

NUMBER OF LEARNERS					
	Number		Number		Number
Physicians		LPNs		EMRs	
Mid-Levels		Paramedics		Fire	
RNs		EMTs		Other________	

SCENARIOS REQUESTED
LEARNING OBJECTIVES

EQUIPMENT NEEDED: Ours or Referring Facility Equipment (ex:pumps/monitors/medications/processes)

Fig. 20.5 Mobile simulation event planning worksheet

SPECIFIC REQUESTS (ex: Moulage, etc.)

CONTINUING EDUCATION CREDITS/UNITS		
AMA Category I PRA CME	Application (date)	Complete (date)
CEUs, Nursing		
CEUs, EMS		
Other		

INTERNAL PLANNING	
Event Scheduled on Calendar?	☐ No ☐ Yes → If so, Date & Time:
Team Members Required:	
Scenarios:	
New Scenario Needed?	Yes ☐ No ☐
Scenario(s) from Library?	Yes ☐ No ☐
Modifications Needed?	Yes ☐ No ☐
Dry Run Scheduled?	☐ No ☐ Yes → If so, Date & Time:
Pre-Test Created?	Yes ☐ No ☐
Post-Test Created?	Yes ☐ No ☐
Learner Sign-In Log Created?	Yes ☐ No ☐
Consent Forms Created?	Yes ☐ No ☐

DAY OF EVENT			
Departure Time:		ETA:	
Pre-Event Equipment/Supplies Checklist Completed?		Yes ☐ No ☐	
On Site:			
Pre-Simulation Documentation:		Post-Simulation Documentation:	
	Sign-In Log Completed?		Post-tests Completed?
	Consent Forms Completed?		Evaluation Forms Completed?
	Pre-Tests Completed:		Education Certificates Given to Learners?
			Post-Event Equipment/Supplies Checklist Completed?

Additional Notes:

Fig. 20.5 (continued)

Request

Once the request for services is received, several important bits of data must be obtained and recorded. Following a Mobile Simulation Event Planning Worksheet will help prevent loss of important data.

The requesting facility name, date, time, and location should be set as early as possible to allow planning for both the education team and the learners. A centralized calendar or schedule allows easy access for all parties involved. Maintain communication with the requesting facility's contact person, the one who can coordinate the process at their end.

Learners and Objectives

Knowing in advance how many learners from each specialty are expected aids in allocating the appropriate amount of time needed to complete the simulations and in the development of the objectives.

The requesting facility may have their own learning objectives or sometimes ask your team to develop the objectives. In the latter case, having developed solid learning objectives with scenarios you develop will save significant time in the future. As in any simulation, knowing whether the learners will be of a single educational level or a team of different skill levels participating in the simulation enables the simulation team to prepare the scenario to meet the learning objectives of each skill level. With objectives set, scenarios can be chosen from your portfolio of simulation scenarios or developed based on your institution's guidelines for creating them.

Creating the appropriate objectives facilitates learning and evaluation. There are numerous resources to use, although some of the best are based on Bloom's Taxonomy (the University of Arkansas has a detailed and easy-to-follow guide on their website: https://tips.uark.edu/using-blooms-taxonomy/ and the Harvard Medical School has created a 3-page guide: https://meded.hms.harvard.edu/files/hms-med-ed/files/writing_learning_objectives.pdf).

Continuing Education Credits

One of the two most attractive and compelling reasons for rural EMS units and critical access hospitals to request mobile simulation is the ability of their providers getting continuing education credits (CEUs) at their own sites. CEUs are required for continued certification in the EMS field, nursing, and medicine. Many rural providers can't get away easily or don't have the funding to travel distances to get their continuing education, and therefore will welcome the opportunity to obtain them with your simulation program at their site. This takes considerable preparation on the part of the simulation team, working with the local university or hospital continuing education departments. Plan well ahead as the process is well standardized and has several requirements that must be met.

The *Accreditation Council for Continuing Medical Education* (ACCME) has a good website (http://www.accme.org/) that can guide you for Continuing Medical Education (CME) credits. For Emergency Medical Services, the *National Registry of Emergency Medical Technicians* website (https://www.nremt.org/rwd/public/) provides the necessary starting point. For Nursing credits, go to the *American Nurses Credentialing Center*, a part of the American Nurses Association (https://www.nursingworld.org/ancc/)

Instructor Preparation

While experienced instructors need far less time for preparation than those who are new to simulation (including mobile simulation), there are specific items which must be addressed to provide the best experience for the learners. Chapters 2, 13, and 23 cover the personnel needed, qualifications, training, and experience and will not be reviewed here. This chapter will address the necessary preparation once the instructors and schedules are identified.

The Instructor Portfolio

An instructor portfolio with the supporting documents is a valuable tool for the instructor to have available for preparation for the day of the live simulation event. Having someone in the organization dedicated to preparing the portfolio keeps them consistent and thorough. In fact, as changes are made, this portfolio should be updated and copies or changes sent to all instructors. It provides the best method for instructor preparation and refreshing on the day of the event. The portfolio should include: demographics of the learners, a Scenario Planning Worksheet (SPW), Script, Briefing Document, Debriefing Document, Pre- and Post-tests, and Evidence-Based Literature.

- Demographics

This information is provided with a document such as the *Mobile Simulation Event Planning Worksheet*. One of the first items to ascertain as an instructor is the educational level of the learners (e.g., physician, nurse, EMS services, etc.). When the learner group is represented by a single specialty (e.g., all physicians or all EMS personnel), the instructor has a narrow focus of objectives from which to guide and teach. Multiple learner levels participating in simulation represent the team approach, requiring the instructor to review team objectives rather than individual specialty objectives.

Next, the level of care provided by the institution or service to receive the training affects the instructor preparation. When the learners are from a rural primary care clinic, the objectives will be different than if the learners are from a critical access hospital or a larger center. Since the goal of care varies between the levels of service provided, the instructor must have knowledge of what the learners expect going into the simulation training event.

Finally, knowing whether the learners have ever participated in simulation before assists in the instructor preparation as well. Learners with simulation experience, whether in a simulation center or on a mobile unit, are usually much more familiar with the functionality of the simulator and have a better idea of what to expect. Those who have never participated in a simulation event with human patient simulators may require a more thorough orientation and guidance in the beginning.

- Scenario Planning Worksheet (SPW)

This may have various names in different institutions; this document outlines the simulation event from beginning to end including the case history, simulator settings with changes that occur in the physiology at various stages, and the programming characteristics of that scenario. See Fig. 20.6 for an example. It may outline the educational method (see Chaps. 14 and 21) and the roles of the instructors, facilitators, and support personnel involved. It gives an overview of the case scenario so that the instructor can understand how the scenario is to play out. Laboratory, x-ray, and other data that the learner may request are also included, allowing the instructor to review beforehand.

Objectives are necessary and drive learning (Bloom's Taxonomy, *Other References document, item 1 & 2*) and are included with the scenario planning document. Prior to instructor preparation, the objectives for the simulation learning event must be written. This will be done either by the director at the institution of the learners or the simulation team. Utilizing the objectives, the instructor will gain an understanding of what the learners are to learn and how to measure completion of learning.

- Script

If the simulator will have active dialogue with the learner, the suggested script and guide for the person acting as the voice is included in the script. This provides the instructor with expected responses that the simulated patient will give when the learners inquire about certain topics. It will include information on the simulated patient's chief complaint, history, and responses to certain detailed questions.

- Briefing Document

This document outlines the pre-simulation orientation and introduction that the simulation team will give the learners. It prepares the learners for the event and includes descriptions of the setting, expectations, objectives, and a discussion of suspension of disbelief.

- Debriefing Document

Instruction on the method of debriefing and suggested discussion points. It is important that the instructor read and prepare for the debriefing so that the learning is optimal (see Chap. 16).

Title:

Setting:

Learner:

Personnel needed:

Timing: 15-minute scenario, 10-15-minute rapid debrief, repeat 15-minute scenario, 10-15-minute final debrief.

Overall Goal for Learners:

1.
2.
3.

Objectives:

1.
2.
3.
4.
5.

Patient:

DOB:	**Sex:**	**Weight:**
Age:	**Height:**	**BMI:**

Chief complaint:

HPI:

Review of Systems:

-
-

Past Medical History:

Past Surgical History:

Medications:

Allergies:

Social History:

Family History:

Physical Exam:

- Vital Signs: (See page 4)
- HEENT:
- Respiratory:
- Cardiovascular:
- Abdomen:
- Musculoskeletal:
- Genitourinary:
- Neuro:
- Integument:

Diagnostics Available:

Differential Diagnosis:

-
-
-
-

Assessment:

Plan:

-
-

Fig. 20.6 Scenario planning worksheet

Debrief: PEARLS
(Promoting Excellence And Reflective Learning in Simulation)

Reactions:

- Initial reactions and emotions from the scenario

Description:

- Develop shared understanding of case
  - o Please share a short summary of the case.
  - o What was going on with this patient?
  - o Does everyone agree?
- What are some signs and symptoms of ______?
- What did you find from the physical assessment that led you to your treatment plan?

Analysis:

- Analyze performance
  - o How do you feel you worked as a team?
  - o What did you develop for your differential diagnoses?
  - o What is your treatment plan for this individual?

Application/Summary:

- Identify take-aways: at least 3 things such as:
  - o Signs and symptoms
  - o Treatment plan
  - o Communication

Scenario Planning: Programming and Moulage

	Baseline	5 minutes	8 minutes	12 minutes
Temperature				
Blood Pressure				
Heart Rate				
Rhythm				
Respiratory Rate				
O2 Saturation				
Eyes				
Heart Sounds				
Lung Sounds				
Bowel Sounds				
Pain				

Setup and Preparation

Setting:
Monitor Setup/Parameters:
IV access:
Oxygen:
IV Fluids:
Medications:
Intubation:
Mannequin:

- Male or Female
- Clothing:
- Props:

Special Equipment Needs:
Moulage:

Fig. 20.6 (continued)

References

Change Log			
Date:	**Event:**	**Changes:**	**Completed by:**

Last Used	
Date:	**Learners:**

Fig. 20.6 (continued)

- Pre- and Post-Tests

Utilized to assess what was learned, the instruction, etc., these tests give important data for both the simulation team and the learners. Those with instructor evaluations are important to be reviewed to further learn the expectations of you as an instructor.

- Evidence-Based Literature

We suggest that every scenario should have an evidence-based literature review, with the citations noted in the supporting documents for the instructor to review. This not only provides the instructor with the most up-to-date information on the topic but also allows the instructor to review for areas of special concern that may surface during the preparation or running of the live scenario.

The Dry Run

Best preparation includes the dry run (otherwise known as a dress rehearsal), particularly if the scenario is new. The dry run should include all personnel who will be participating in the live event, including the voices for the simulators and any support personnel. The goal is to identify areas in the running of the scenario that need revising or correcting. The scenario portfolio should be sent to the instructors and any necessary personnel. Once familiar with the scenario, the medical condition portrayed by the scenario and the supporting documents, the instructor is in the best position to identify those areas needing improvement. This is especially true if the instructor is a content expert related to the medical or surgical condition being simulated. We suggest the dry run be done no later than 1 week before the scenario will be run live if possible. At times, there may be many suggested changes after the dry run; this is often not unexpected. New scenarios or those representing diseases and conditions in which the medical literature has reported evidence for new diagnostic or therapeutic modalities are especially open to change. Having the instructor present not only gives another perspective, but allows the content expert to contribute to the dry run and provides the instructor with yet one more option for scenario preparation. Occasionally, there are enough changes that there is a need for a second dry run. If instructors are not able to participate in the dry runs, any changes will need to be made in the portfolio documents and forwarded to them immediately after they are made to allow them to have time for review and further preparation for the live event.

One person should be identified to record the changes and corrections during the dry run and develop an action plan for making and distributing the changes. As noted earlier, it is important to get the new documents to the instructors for their preparation.

The Day of the Event

Having an instructor Portfolio and *Mobile Simulation Event Planning Worksheet* (MSEPW) available, the instructor has all the necessary information to be prepared for the simulation event. Once the simulation team has the vehicle and equipment set up, the instructor should receive a last-minute briefing by the team prior to learners arriving. If needed, the team should orient the instructor to the vehicle and equipment, although ideally this should take place before the day of the event. An efficient and effective method to do this is with a video tour of the vehicle and equipment narrated by a simulation team member which is made available to all instructors. Having reviewed it before the event allows the instructor to be familiar with the setting and lessens the orientation time at the site.

Learner Preparation

To ensure that the learners receive the best training, it is imperative that they are adequately prepared for the simulation event prior to participating in the event. Although there are several ways to accomplish this, the simulation team is best suited to accomplish the learner preparation. This ensures standardization in their preparation and affords the team the luxury of knowing precisely what was offered to the learners.

Schedule

The date, time, and location must be established and communicated to the learners well in advance of the event, allowing them time to adjust their schedules if needed. This is usually done by the institution requesting the training, although it may be a good policy for the simulation team to confirm or send out a save-the-date notice to the learners. This also allows the simulation team to highlight the benefits of mobile medical simulation training.

Pre-course Materials

The information that is sent out to the learners prior to the event must be a decision between the learner's administrators and the simulation team. It is important to realize that not all administrators have the same expectations, and for the experience to be appreciated by them, the simulation team should try to accommodate their requests within reason. Once the simulation team has been to the institution more than once, it is easier to standardize the process if the institution and administration find the simulation team flexible and easy to work with. If new to mobile simulation, the institution receiving the training will often rely on the simulation team's expertise to guide them in the learner preparation. Several items may be included in the pre-course materials; the choice of those materials depends on those factors discussed earlier. There are several methods of providing the pre-course materials to the learners. Some programs have a web link that includes all the materials; learners are instructed to review them online before the simulation event. Other methods include emailing learners with attachments, or simply providing all the information at the site on the day of simulation (the latter being the least desirable method, as it limits learners' time for adequate preparation).

- *Orientation*: If available, a video orientation to the mobile simulation vehicle and equipment can go a long way in allowing the learner to get past the "wow factor" of the technology and uniqueness. Almost universally, the mobile simulation vehicle creates excitement for those who see it for the first time. The highly technical and expensive equipment may capture the learner's attention but make it difficult to focus on the objectives of the simulation. This excitement at the time of the event is often reduced by introducing the learners to the equipment in advance with a video orientation. With appropriate narration, the simulation team can explain the location and function of the equipment and supplies, the necessary housekeeping issues, and what to expect during the simulation, making the learner transition into the environment on the day of the event much smoother. If a video orientation is used prior to the event, it is wise to do a brief review when the learners arrive for the event. The learners can be sent a web link to the video well before the event or it can be used at the time of the event, depending on the time available that day.
- *Logistics*: Start and finish times may need to be emphasized to avoid preventable delays. Often, the amount of time the simulation team has at a remote site is limited. The learner may have a limited time to participate as well if having to step out of a clinical or work setting to engage in the simulation. Therefore, adhering to a tight schedule may be mandatory. In that case, the necessity of promptness must be communicated clearly. Additionally, specifying the location and waiting area, etc. reduces confusion for the new learners.
- *Objectives*: Once the learning objectives are established, they should be relayed to the learners, to allow them to focus on the topics requested. General objectives related to teamwork, communication, situational awareness, clinical reasoning and debriefing should accompany all simulations. Scenario-specific objectives

that relate to certain medical conditions or preselected learning issues may also be included if the learner's director allows them to know the condition before the event.

- *Pre-course Assignment*: The institution or the simulation team may request an assignment be given to the learners prior to attending the simulation event. This may be as specific as a review of literature related to the case, or as general as a review of TeamSTEPPS® or other teamwork or communication method. It allows the learner and instructors to focus on the appropriate issues during the simulation and debriefing.
- *Pre-test*: To meet requirements for education credits, and to evaluate the level of learning, the administration of a pre- and post-test can be beneficial. Your team must make sure that each learner's pre-test is aligned with the post-test to ensure accurate data collection. Sending out the pre-test in advance may save time on the day of the event and possibly provide information of use to the team before meeting the learners, but may complicate pairing the pre- and post-tests. The most effective way to administer them, however, is on the day of the event. It is helpful to advise the learners in advance that the pre- and post-tests will be administered to enhance compliance and be clear about expectations.
- *Briefing*: Setting the stage for the simulation prior to the actual event improves the learners' experience and education. Providing information regarding the setting (clinic, emergency room, ambulance, etc.), the chief complaint and history of present illness helps the learner to focus on the learning objectives.

Suspension of Disbelief

As with any simulation, it is important to prepare the students to suspend their disbelief and help them to cognitively agree that the mobile simulation event is real and they are functioning in an actual clinical encounter (fiction contract) [7]. Addressing this in the briefing, whether in documents sent to them beforehand or on the day of the event helps get them engaged before the event and continue the engagement throughout the simulation and after the event. Since suspension of disbelief can be a difficult concept for many learners to fully understand, it is imperative that the simulation team and instructors be clear about the scenario's relevance to their scope of practice. The learner then can realize that the ultimate goal is learning.

Psychological Safety

Protecting the learner's psychological safety [8] by clearly outlining the formative nature of the simulation and the fact that their performance will not be used as an evaluative method allows them to engage without potential threats to their professional identity. This is accomplished by making sure that the expectations are very clear, helping them establish the fiction contract, taking care of the logistical details, and declaring your commitment to respecting the learners and their safety. If there is a need for the simulation to be used as a summative tool, it is imperative that the learners are made aware of this well before the day of the event with clearly outlined expectations.

The briefing may be accomplished by a document sent to the learner before the event and reviewed on the day of the event. Alternatively, a live briefing just prior to the event may suffice for learners used to simulation education. The bottom line is that the learners need to know their expectations, be made familiar with the logistics, have an orientation to the equipment, and understand their roles and safety.

Summary

Preparing instructors and students for healthcare education utilizing mobile simulation programs requires attention to some unique details. Not only is the classroom different (vehicle housing the simulation training equipment), but the demographics and needs of the learners, the objectives, the logistics of mobile simulation education, and possibly more require adequate instructor and student preparation to provide the best educational experience possible. Having an organized method of preparation from the time of request to the completion of the training facilitates this process. Presented in this chapter are the details of the preparation and an example of a Mobile Simulation Event Planning Worksheet and a Scenario Planning Worksheet which may be used and modified to fit the needs of any program.

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21 Instructor Development/Qualifications

Kim Leighton

Key Points

1. Standards of best practice and guidelines exist to outline expectations of education and training for simulation instructors.
2. Numerous methods exist to facilitate the simulation instructor's attainment of competency.
3. Tools are available to educators that can be used to document performance and path to competency.
4. The remote simulation instructor must be confident, competent, and self-sufficient in the role.

Introduction

The instructor responsible for the development and implementation of simulation-based experiences (SBEs) requires a unique set of qualifications that is different than providing instruction in traditional healthcare learning environments such as a classroom, laboratory, or hospital. While simulation as a learning method is not new, changes in technology have led to the need for a different skill set for healthcare instructors. Forty years ago, students were taught to give injections using oranges. Many still learn using this method. Many were also taught various skills by

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doing them on each other –nasogastric tube insertion and injections of saline, for example. Fortunately, instructors now have new equipment and methods to teach these skills, much to the relief of students everywhere. The increasing capabilities of technology have allowed educators to add complexity to the learning process by focusing on higher order thinking skills (e.g., clinical judgment and critical thinking), communication, and teamwork, all of which are critical to provision of safe patient care [1].

At the same time, learning environments have changed. Online formats have replaced many physical classrooms and science laboratory experiences can be completed online and in virtual reality. The scope of the traditional clinical environment has expanded far beyond the walls of the hospital to include community-based and global learning experiences. Simulation, once tethered (literally) to a space in a school or hospital, can now be used in mobile environments due to advancement of technology. Instructors quickly began to create in situ experiences, simulations that take place in a patient care setting [2]. Traditional disaster drills began to incorporate simulation and instructors came to realize that learning activities could occur wherever the manikin could be supported (electricity). The creation of wireless manikins that can run on battery power allows instructors to travel outside of the typical laboratory space, enhancing the ability to reach learners, rather than requiring learners to come to the lab.

The purpose of this chapter is to outline the requirements and recommendations for achieving the qualifications needed to be a successful simulation instructor in the mobile environment. Standards of best practice, accreditation guidelines, and organizational recommendations related to instructor ability will be presented. Key knowledge, skills, and attitudes (KSAs) needed for success in areas of preparation, prebriefing, facilitation, debriefing, and evaluation will be defined as well as the need for crossover knowledge of the operations role. Opportunities for gaining the key KSAs through instructor development will be outlined, followed by methods used to evaluate competency. Lastly, special considerations for instructor development and qualifications for working in mobile environments will be discussed.

What Is a Simulation Instructor?

Simulation instructors are known by various terms: instructor, teacher, faculty, facilitator, educator, subject matter expert, or simulationist. Oftentimes, the organization or employer determines what the role is called; other times, the person determines what they prefer to be called. Some definitions to consider:

- Instructor: “A person who teaches a subject or skill” [3].
- Faculty: Teachers having academic rank in an educational institution [3].
- Facilitator: “An individual who is involved in the implementation and/or delivery of simulation activities” [2, p. 12].

- Subject Matter Expert (SME): "A person with extensive experience and knowledge in a particular subject area, who acts as a consultant and content expert during development of a course" [4, p. 16]. The SME may, or may not, also be the instructor.
- Simulationist: "An individual who is involved in the design, implementation, and/or delivery of simulation activities" [2, p. 36].

As you can see, some of the terms are synonyms of the others and often used interchangeably in the literature, such as instructor, teacher, and educator. Some have connotations within the hierarchy of higher education that dictate the parameters of the role, while the same term used in a staff development environment means something different. Most commonly in simulation education, the focus is placed on the word facilitator, with an expanded definition: the individual is trained to "provide guidance, support, and structure at some or all stages of simulation-based learning including prebriefing, simulation, and/or debriefing" [5, p. S42]. The facilitator helps the learners to meet the learning objectives without specifically giving them the answer or telling them how to perform. The experiential nature of simulation is designed to allow learners to critically think and reach decisions as to how to approach patient management on their own or in a team.

The variety of terms used to define the instructor need not be confusing and may be defined more specifically by the employer. The instructor is present to ensure that the learning experience is created and implemented in a way that allows learners to care for a simulated patient(s) or situation, use clinical judgment to make care decisions, carry out that care, and evaluate the patient's outcome. One of the hardest things for the instructor to do is to be quiet and not interfere with the learning process. In this chapter, the term instructor and facilitator may be used interchangeably. It should also be noted that depending on job descriptions, a mobile instructor may not have responsibility for all aspects of the SBE. For example, some mobile instructors may implement a SBE but not have been responsible for the creation of the scenario. This comprehensive chapter will cover all aspects that a mobile simulation instructor could be responsible for.

Standards, Accreditation, and Organization Recommendations

Major simulation organizations have issued standards of best practice that define qualifications required of the simulation instructor. You will see that it is no longer sufficient to move an educator from one role into another without the proper training. For example, in nursing education, the early simulation instructors were moved from the skills laboratory. It has become clear over the past decade that the required skill set of those two educators is quite different. The following organizations have issued standards and guidelines to ensure that instructors are prepared for their role in experiential learning.

International Nursing Association for Clinical Simulation and Learning (INACSL)

The International Nursing Association for Clinical Simulation and Learning (INACSL) first released Standards of Best Practice: Simulation[SM] in 2011 [6], with the most current edition released in December 2016 [5]. There are eight standards and an accompanying glossary of terms used in the Standards. The Standards of Best Practice: Simulation include a standard statement, criterion, and descriptions of how to meet the criterion. The standards provide an outline of expectations for the instructor. The Standards and specific criterion related to the development or qualifications of the instructor include the following:

- Facilitation
  - "Effective facilitation requires a facilitator who has specific skills and knowledge in simulation pedagogy" [7, p. S17].
- Debriefing
  - "The debrief is facilitated by a person(s) competent in the process of debriefing" [8, p. S22].
- Professional Integrity
  - "Foster and role model attributes of professional integrity at all times.
  - Follow standards of practice, guidelines, principles, and ethics of one's profession" [9, p. S31].
- Simulation Operations
  - "Provide personnel with appropriate expertise to support and sustain the SBE program" [10, p. 682].

Society for Simulation in Healthcare

The Society for Simulation in Healthcare (SSH) has disseminated standards to be met in order to achieve program accreditation. There are seven Core Standards, one of which addresses development or qualifications of instructors:

- Human Resources
  - "The Simulation Program has a process in place to orient, support, and evaluate Simulation Program staff" [11, p. 4]. This standard addresses role orientation, program changes, ongoing professional development, evaluation, and feedback.

The optional Teaching/Education Standards that address development or qualifications of instructors include the following:

- Educational Activity Design
  - "The Simulation Program has personnel with expertise designing simulation educational activities" [12, p. 3].

- Qualified Educators
  - "The Simulation Program has access to qualified educators.
  - The Simulation Program has a process to assure ongoing development and competence of its simulation educators, at least annually.
  - The Simulation Program has a process to assure orientation and development of those who participate in the delivery of educational activities but are not simulation experts" [12, p. 3–4].

Association for Simulated Practice in Healthcare

The Association for Simulated Practice in Healthcare (ASPiH) has extended standards that include themes related to faculty, technical personnel, activity, and resources. Theme 1: Faculty include the following standards:

- "Faculty engage in continuing professional development with regular evaluation of performance by both learner and fellow faculty.
- Faculty are competent in the process of debriefing" [13]

Association of Standardized Patient Educators

The Association of Standardized Patient Educators (ASPE) created standards specifically for those who include human role players (standardized patients, SP) in their simulation programs. Of the five domains included in these standards, Domain 5: Professional Development relates to development and qualifications of the instructor:

- Principle 1: Career Development
  - "Develop and promote expertise in knowledge, skills, and attitudes related to SP-based simulation.
  - Develop and promote expertise in theories, principles, and processes of educational and assessment relevant to the context of one's practice.
  - Engage in educational opportunities.
  - Seek out opportunities for career mentoring" [14, p. 7].

The National Council of State Boards of Nursing

The National Council of State Boards of Nursing (NCSBN) disseminated a set of guidelines (Alexander et al., 2015) following on the heels of the landmark multisite simulation study that found simulation (under certain conditions) could replace up to 50% of traditional undergraduate nursing education clinical experiences [15]. Guidelines were provided to guide administrators and faculty in creating the necessary administrative support, environment, and faculty preparation required to ensure quality use of simulation as a replacement for traditional clinical experiences. One major guideline was:

- "Lead faculty and sim lab personnel are qualified to conduct simulation
- Faculty are prepared to lead simulations" [16, p. 40].

Checklists were created for Program Preparation and for Faculty Preparation; items related to instructor development and qualifications include the following:

- Program Preparation
  - "The simulation program has an adequate number of dedicated trained simulation faculty members to support the learners in simulation-based experiences.
  - The program has a plan for orienting simulation faculty members to their roles" [16, p. 42].
- Faculty Preparation
  - "Faculty members are prepared by following the INACSL Standards of Best Practice: Simulation.
  - The faculty members are prepared to create a learning environment that encourages active learning, repetitive practice, and reflection and to provide appropriate support throughout each activity.
  - The program provides a means for faculty members to participate in simulation-related professional development" [16, p. 41].

Contributions of SSH, ASPiH, and ASPE are from organizations that are multidisciplinary. The NCSBN represents nursing education and practice. While INACSL was formed by nursing, the membership is multidisciplinary. The recommendations from all of these organizations should be considered, regardless of the profession that is disseminating them as they all are focused on ensuring that the simulation instructor is educated for their role(s).

It is clear from these standards and guidelines that simulation instructors are expected to be trained to competency for specific knowledge, skills, and attitudes (KSA), while maintaining professional integrity and ethical behavior, all within the context of their own profession's guidelines. The instructor should receive regular feedback and evaluation on their KSAs and opportunities for professional development on at least an annual basis.

Key Knowledge, Skills, and Attitudes Leading to Success

There are key components of the SBE that all simulation instructors should have competency in creating or performing. The amount of involvement in each of these components will vary based on the job description and expectations of the instructor's manager or organizational leadership. While some of these are outlined in other chapters of this book, these components bear mentioning in this chapter as well.

1. Preparation for SBE involves several steps, including confirming that the SBE has been scheduled, creating or understanding the defined learning objectives, planning the activity, ensuring that fidelity is adequate, identifying/gathering supplies

and equipment, developing or disseminating preparation requirements, and choosing or understanding the planned evaluation method [17]. Refer to Chaps. 4, 17, 18, and 22 to learn more about preparation and pre-work for the SBE.

2. Prebriefing is designed to ensure that learners understand the expectations of learning in the simulation environment and includes creating an environment that supports the learners' opportunities for success. This includes orienting learners to the environment and equipment, as well as assuring confidentiality. Reviewing learning objectives or assignment of roles may be the instructor's responsibility, but this often depends on the level of the learner and the objectives of the SBE [17, 18].
3. Facilitation must be done by a trained person who is able to manage the SBE at the appropriate level of the learner's understanding and experience. The facilitator (instructor) must be able to maintain full focus on the SBE, provide guidance in the form of cues, ensure learner engagement, and observe performance to guide debriefing and evaluation processes, all while monitoring the length of the scenario and managing time [17]. Guidance in the form of cues may not be included in all scenarios, as this is typically based on the level of the learner and assessment method. This is common in formative assessment, while absent in summative assessment. Refer to Chaps. 14 and 15 for instructional methods of designing and implementing mobile SBE.
4. Debriefing should always be done by the facilitator who observed the learners during the scenario. The instructor is expected to use a theoretical model or plan for debriefing, ensure reflection and engagement, and provide feedback on the learner's performance. This is done in a confidential, respectful manner with the goal of helping learners meet the learning objectives, understand their actions, and define how the simulation learning transfers to the care of human patients [17, 19]. Refer to Chaps. 9 and 16 for further discussion of debriefing.
5. Evaluation methods should be determined prior to the start of the SBE and include evaluation of the learning outcomes [17, 20], the learning environment, the facilitator/instructor/staff, and the experience. Valid and reliable tools should be used for all evaluation; however, they are required for high-stakes testing in which the outcome will impact the learner's livelihood (e.g., licensure, job) [17]. Refer to Chaps. 5, 6, and 20 for further discussion of assessment and evaluation.
6. Operations personnel are technologically savvy persons who support SBE in a multitude of ways, including management of audiovisual, information technology, manikin operation and/or programming, setup/breakdown of simulation, moulage, etc. The role often includes educational and administrative responsibilities [10, 21]. Refer to Chaps. 2, 7, 9, and 13 for additional information about this role.

Theoretical Foundations for Simulation Instructors

Understanding experiential learning is vital to achieving competency in facilitating active learning in the simulation environment. There are a multitude of theories that support this methodology and the instructor should have a working knowledge of them. Theories provide the foundation for development of a SBE. For example,

Table 21.1 Theoretical foundations for SBE and instructor development

Theory	Theorist	Description
Novice to expert	Benner [22]	Five stages of skill acquisition: novice, advanced beginner, competent, proficient, expert
Experiential learning theory	Kolb [25]	Cycle of concrete experience, reflective observation, abstract conceptualization, active experimentation
Sociocultural theory	Vygotsky [23], Wood & Middleton [26]	Zone of proximal development is difference between what learner can do and cannot do; educator's role is to provide experiences that advance development, through scaffolding
Cognitive load theory	Sweller [27]	Brain can only process so much at any given time; chunk information to allow movement from short-term memory to long-term
Social learning theory	Bandura [28]	Learn by doing or through the experience of others
Situated cognition	Dewey [29]	Each learner has a unique experience, even within a group SBE
Mastery learning	Ericsson & Pool [30]	Deliberate practice outside the comfort zone, with performance feedback leading to modification of efforts; goal to reach target performance
Reflection	Schön [31]	Reflection in-action, on-action, after-action

Benner's Novice-to-Expert theory [22] supports different facilitation methods based on the level of the learner. This theory also informs the planning of instructor development opportunities to support instructors who are at different points on the learning curve. Scaffolding of learning concepts, supported by Vygotsky's work [23] combines with Benner as educational plans for both learners and instructors are developed to build off of previous knowledge.

While this chapter is not intended to teach how to create instructor development programs, it may be a role of some instructors to participate in train-the-trainer sessions or to provide mentorship to less experienced instructors. Theoretical frameworks should guide decisions about instructor development and how best to tailor to the needs of each individual as they move from beginner to competent to proficient. An excellent resource for understanding theoretical principles of effective simulation is provided by Clapper [24]. Some common theories used to develop SBEs as well as instructor education are outlined in Table 21.1. These are only a sample, and not intended to be inclusive. The description includes a key feature or two and the reader is encouraged to learn more from further investigation of the resources.

Instructor Development Opportunities

Although the use of simulation in healthcare education has expanded exponentially in the past several years, it is still highly likely that persons hired into a simulation-related position will not have the full skill set or level of competency that is desired [32]. The simulation community is less than 15 years removed from trial-and-error learning of roles and responsibilities. As the perception of simulation's value has increased, so has the need to adhere to guidelines and standards of best practice to achieve high learning outcomes. This requires ongoing instructor development through formal and informal means.

The need to be independent in the role is critical for the simulation instructor working in the mobile environment. A variety of methods exist to help the instructor gain the KSAs needed for the role, including books/manuscripts, workshops, formal courses, certificate programs, academic degree programs, and mentoring. These range in length from 1 day to a year or longer. There are advantages and disadvantages to each option, which should be carefully weighed when deciding which methods to choose. It is likely that a combination of methods will be needed to create a well-rounded instructor. The various attributes related to the types of instructor development are outlined in Table 21.2.

Table 21.2 Considerations for type of instructor development

Attributes	Considerations
Length of education	Range from 1 day to several years.
	Consider cost of education, including travel.
	How soon does the instructor need to reach competency?
	What depth and breadth of knowledge is required for the instructor's role or position?
	New instructors may require more time to learn, process information, and practice new skills.
	Experienced instructors may need a shorter concentrated event to enhance KSAs.
Interaction: Face-to-face, online, or blended learning	What are the qualifications of the teacher or presenter?
	What role does the teacher or presenter have?
	Is the learning event self-directed by the learner or facilitated by the teacher?
	How is engagement in the material accomplished?
	Is there an opportunity for learners to engage and learn from each other?
	Is interaction and engagement in the course monitored or evaluated?
Content	What topics are included in the education event?
	How do the included topics align with the needs of the simulation instructor?
	What is the depth and breadth of the content?
	Does the content reflect evidence-based practice?
	Are references from peer-reviewed sources and less than 5 years old (except for seminal works)?
Practice/repetition of new skills	What opportunities exist to practice new KSAs?
	How is repetition of skills managed?
	Who evaluates progress in meeting the objectives of the educational program?
	How is feedback provided to the simulation instructor?
Achievement of competency	How is mastery of learning accomplished?
	How is (are) feedback and/or debriefing conducted?
	How often is feedback given to the learner?
	Is there tangible evidence of accomplishment, such as a certificate or academic credit?
	Is tangible evidence of accomplishment important to the simulation instructor's organizational leadership?

It is important to develop a plan that will lead to increased competency of the simulation instructor, whether they are at the novice level or more advanced level. The rapid rate at which understanding of simulation as a pedagogy occurs necessitates that all instructors participate in ongoing professional learning. A formal simulation instructor course can be developed internally by the organization if there is a critical mass of current instructors who have expertise in all areas of simulation facilitation. When internal training is available, the training should be held in the mobile environment to ensure that instructors are oriented to the environment they will work in and observed navigating challenges that arise in that environment [33]. Novice instructors will benefit from longer educational opportunities that are engaging, cover a variety of topics and ideas, but that provide extensive opportunities to practice what is being learned while receiving feedback on performance. A more advanced instructor may identify that they lack understanding of the intricacies of debriefing, even though they have been conducting debriefings for many years. This instructor may benefit from education that is focused on just this particular concept. Reading manuscripts or books, attending conference workshops, or a debriefing course may provide increased understanding on the topic. A well-developed educational plan for each simulation instructor will demonstrate that achievement of competency is valued, expected, and supported by the organization's leadership.

Evaluating Instructor Competency

Attending educational events does not equate to achieving competency. Coming home from a conference where new information was heard does not translate to the ability to actually implement the new knowledge. This is why having a well-rounded education plan that incorporates practice, repetition, and feedback is so important. There are several ways to demonstrate competency and achievement. Certification through an organization, such as the SSH, shows that a simulation instructor has knowledge required as an instructor or simulation operations specialist. An advanced certification is available, using a portfolio to demonstrate advanced competency. In addition, there are evaluation tools that can be used to determine level of competency as an instructor.

Certification

- Certified Healthcare Simulation Educator (CHSE)
  - "Formal professional recognition of specialized knowledge, skills, abilities and accomplishments in simulation education" [34].
  - Requirements to take the certification exam include the following:
    - "Participate in healthcare simulation in an educational role;
    - Focused simulation expertise on learners in undergraduate, graduate, allied health or healthcare practitioners;
    - Bachelor's degree or equivalent experience;
    - Two-year continued use of simulation in healthcare education, research, or administration" [34].

- Certified Healthcare Simulation Educator-Advanced (CHSE-A).
  - "Distinguishes those who have proven themselves to be advanced in their practice in healthcare simulation and serve as mentors and examples to others in the field" [34].
  - Eligibility requirements for submission of portfolio include the following:
    - "Currently certified CHSE;
    - Participate in healthcare simulation in an educational role;
    - Focused simulation expertise on learners in undergraduate, graduate, allied health or healthcare practitioners;
    - Master's degree or equivalent experience;
    - Five years of continued use of simulation in healthcare education, research, or administration" [34].
- Certified Healthcare Simulation Operations Specialist (CHSOS).
  - "Formal professional recognition of specialized knowledge, skills, abilities and accomplishments in simulation operations" [34].
  - Eligibility requirements for the exam include the following:
    - Participation in healthcare simulation in an operations role;
    - Focused simulation expertise on learners in undergraduate, graduate, allied health or healthcare practitioners;
    - Bachelor's degree or equivalent experience;
    - Two-years of experience in a healthcare simulation operations role" [34].

The benefits of certification, as per the SSH [34] include "formal recognition, confirmation of commitment to professional development and lifelong learning, international recognition of accomplishments, and demonstration of skills and professional knowledge to employers…" Some employers require CHSE certification of simulation instructor applicants, while others require this achievement within a specified time frame after hire.

Evaluation Tools

Several evaluation tools exist to help determine competency in the various KSAs required of a simulation instructor. It is important to use only valid and reliable tools, especially since demonstration of competency may be associated with performance reviews, hiring decisions, or termination of employment. Valid and reliable tools for evaluation of the simulation instructor include the following:

- Facilitator/Instructor – these tools specifically evaluate skills that should be demonstrated by the simulation instructor:
  - Debriefing Assessment for Simulation in Healthcare© (DASH) examines debriefing strategies and techniques [35].
  - Feedback Assessment for Clinical Education© (FACE) assesses development of reflective feedback skills and their use by clinical instructors [36].

  - Facilitator Competency Rubric (FCR) outlines required instructor/facilitator skills in the areas of preparation, prebrief, facilitation, debrief, and evaluation. Uses a novice-to-expert framework [37].
- Experience – these tools evaluate the SBE, which is created or implemented by the instructor. Inferences can be made from the results of these tools about the KSAs of the instructor:
  - Simulation Effectiveness Tool – Modified (SET-M) considers students' perceptions of how well learning needs were met in prebriefing, during the scenario, and in debriefing. Subscales are confidence, learning, prebriefing, and debriefing [38].
  - Clinical Learning Environment Comparison Survey (CLECS) evaluates how well students believe their learning needs were met in the traditional clinical environment and simulated clinical environment [39].
  - Simulation Learning Effectiveness Inventory considers students' perceptions of course arrangement, equipment resource, debriefing, clinical ability, problem-solving, confidence, and collaboration [40].

The tools identified for evaluation of the instructor can also be used as a method of self-evaluation and identify learning needs of the instructor. The results can help to create the ongoing education plan. For example, after reviewing the FCR, the instructor notes that they do not manage the debriefing session in a manner that approaches the competent-level criteria. The SET-M data shows that learners do not score the debriefing section highly, and the FACES ratings indicate that performance gaps are not identified and explored. These findings should lead to a concerted effort to increase the instructor's KSAs through targeted educational opportunities.

Considerations for Instructor Development and Qualifications in the Mobile Environment

In the mobile environment, assistance and backup may not be readily available. While phone calls, Skype, and FaceTime all bring people in contact with each other, the mobile instructor must be self-sufficient, competent, and cross-trained to other roles.

The mobile simulation instructor requires confidence that they can conduct SBE competently on their own. While support is available via phone or two-way interactive video (e.g., FaceTime), the instructor needs to be able to independently manage the prebriefing, facilitate the scenario, and conduct the debriefing as the onsite instructor. There have been efforts documented since 2001 related to facilitating SBE from a distance [41–44]. While technically feasible, there is variability in learner ratings of the experience, and the question remains as to whether competency and knowledge are impacted differently.

The mobile simulation instructor needs to constantly survey the environment of the SBE to determine overall effectiveness of the learning opportunity in real time. Adjustments may need to be made on the spot, while still maintaining adherence to standards of best practice and guidelines. The instructor should also evaluate the use of resources during the SBE [45]. For example, the instructor needs to be able to adjust the predetermined plan if learners arrive unprepared because they did not complete the required pre-learning activities. Are supplies adequate to meet the learning needs? What happens if a piece of equipment is broken – can the SBE continue? It is the instructor's responsibility that the learning objectives are met, and flexibility and ingenuity are often key to the SBE's success.

All of the components of successful SBE are interlinked and dependent upon each other [46]. While the mobile simulation program may not require that the instructor know the entire role of the operator or vice versa, it is important to have crossover [33]. Consider a mobile simulation laboratory that is 125 miles from the home base when the simulation operator becomes ill. If that person is the only one who knows how to run the simulator's computer software or how to manage audiovisual equipment, then the session will need to be canceled. Another option is that via FaceTime, a qualified simulation operator can "walk through" how to manage the equipment with the simulation instructor. While not ideal, it can salvage a session, but cross-training may be a better long-term solution. Last minute cancellation of the learning opportunity may impact customer or stakeholder relationships. A backup plan is critical for success.

Conclusions and Recommendations

It is clear that simulation instructors have a key role in the success of simulation-based education and that ongoing professional development is vital to their success in this role. The cost of instructor training is significant, and the time required to develop competent instructors can be extensive [1] due to rapidly changing simulation pedagogy and the need for repetitious practice. While remote simulation instructors do have access to assistance via audiovisual technology, they must be confident, independent, and competent in their skills. The simulation instructor should have demonstrated competency in preparing for the simulation, conducting prebriefing, facilitating the scenario, debriefing, and evaluating the environment and the learning outcomes, depending on their role description. Cross-training to the role of the simulation operations specialist will help to ensure that remote learning sessions occur even when one person is unable to continue. A variety of methods exist to provide education, training, and professional development opportunities to the remote simulation instructor that will allow guidelines and standards of best practice to be met and exceeded in this environment.

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Pre/Post Session Measurement

22

Travis Spier

> **Key Points**
> 1. The design of pre/post session evaluations should be deliberate and consider multiple factors.
> 2. Analysis of pre/post session evaluation data can guide future simulation activities.
> 3. Subsequent simulation activities should be built on experiences and learning from previous simulation activities.

Performance feedback and evaluative processes are essential tools to determine the success and benefit of a simulation activity. Determining the impact and influence of an educational experience within simulation warrants a systematic approach to harvest results from the investment and encounter. It is widely accepted within the healthcare community that an evidence-based approach guides clinical initiatives as healthcare clinicians seek to improve the delivery of care through performance improvement and reduction of errors in the care provided. Integrating medical simulation into clinical environments provides institutions and participants an opportunity to experience the reality of the unknown. The reality of performance gaps that exist in clinical environments highlights educational opportunities that mobile simulation can address and potentially influence. The occurence of low-frequency–high-risk events along with the consequences of clinical decisions made outside the realm of comfort,

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confidence, competence, and capability can be replicated and delievered through simulation scenarios. Designing a plan to evaluate session and learner performance can guide the educator and simulation specialist toward designing immersive encounters that complement the needs of the patient, facility, learner, and industry.

The uniqueness, benefit, and vulnerability of conducting simulation encounters outside the walls of a brick-and-mortar simulation center provide inherent benefits beyond the simulation scenario itself. Learners have the ability to experience a simulated clinical situation based on a world and clinical environment with which they are familiar. Additionally, the immersive experience permits, yet highlights performance gaps that are based on reality not fiction. Being able to address these gaps in an educational environment reduces inherent risk to patients by allowing clinicians to encounter scenario-based cases that permit mistakes and promote performance growth. Desperate experiential opportunities are safely encountered under a simulation platform verse a real-life emergency that unfolds with gaps in clinical knowledge and performance.

Mobile simulation encounters take place in a variety of settings. In situ encounters provide the clinician with simulated cases in a native environment that they work in and are most familiar with. These in situ encounters have a rich opportunity to evaluate performance gaps based on environment, resources, readiness, and workflow processes. Participants consider the in situ environment as a neutral and familiar ground to partake in medical simulation while fostering knowledge acquisition within the immersive experience. Mobile simulation environments are designed to resemble a generalized clinical encounter with the aesthetic perceptions that replicates a specific clinical space. Creative yet adaptive planning can create a variety of environments that complement the learner's immersive needs. The mobility of simulation lies within the operational capabilities of a program. A wide variety of mobile platforms exist with a vast array of infrastructure and technology designed into each example. Operational budgets and scope tend to be an influencing factor when considering a mobile sim platform.

The innovative ideas proposed for in situ environments lies within the availability of resources and hands of the designing team and simulation specialists. Wide varieties of low-cost solutions are possible for mobile simulation planners. Additionally, the use of actual clinical space where learners work is an optimal environment to utilize. The use of dedicated and non-dedicated transport vehicles that move equipment to an in situ learning space tends to be a common practice and sim resource when mobile platforms are considered. Secondly, retrofitted vehicles from a prior unaffiliated purpose tend to be a familiar platform for developing a financially restricted program. Lastly, the funding allocation and design of a frame up build have the benefit of meeting specific programmatic needs, inclusion of technology aids, and design of dedicated simulated encounters. Implementing an evaluative tool that is useful within the constructs of the environment along with the realm of the learner's performance is essential. The environment of simulation should not negatively influence the experience or performance of the learners. The environment of simulation scenarios should complement the immersion and success achieved by participants.

Development and design of a pre/post measurement tool is vital in determining the return on investment in addition to the success of a simulation initiative. The evaluative tool is frequently based on the unique needs and capabilities of learners. Due to the adept nature and offerings within mobile simulation, a wide variety of participants can migrate through a mobile environment seeking immersive scenarios. The mobile simulation team should be prepared for a variety of participants based on their programmatic scope. These encounters include, but are not limited to, lay-public personnel, high school students, under graduate and post graduate students, first responders, law enforcement, fire and EMS providers, Armed Forces, inpatient care providers, clinic staff, dental clinics, long-term care providers, along with a variety of allied health and other specialty care clinicians. The uniqueness of objectives and measurement parameters can complement a single profession or cover a vast array of participants.

Planning scenarios should account for the evaluative parameters set forth in the objectives and desired outcomes of the simulation encounter. Determining the scope and focus of the evaluative tool should be considerate of individual, professional, location/environment, and organizational aptitudes. The outcomes identified in pre/post data can inform facilitators of the capabilities and gaps evident in individual and team performance. Descriptive criteria should collectively review pre and post scenario capabilities of individual participants and teams. Collectively, data collection from a site can reflect institutional or agency aptitudes and offer potential recommendations for performance improvement or change.

Continued and regular connectivity continues to build upon existing simulation encounters and revitalizes prior experiences from simulation scenarios. Evaluative timelines should be set as a mechanism to connect with learners to determine retained, implemented, utilized, and disparate knowledge and skills gained from a simulation encounter. The disparity between low-volume and high-volume real-life clinical encounters may demonstrate variable outcomes within the evaluative tool. For example, participants in a rural healthcare setting may have fewer real-life clinical encounters on a specific case to leverage implementation strategies for gained knowledge and skills compared to their counterparts practicing in a tertiary or urban location. The learners in a rural low-volume setting may need continued and remedial simulation encounters on a specific low-volume clinical case to maintain or sustain knowledge gained from a specific simulation scenario.

When considering the design of an evaluative tool used within a mobile environment, the simulation educator can reference a variety of existing validated resources. In many cases, these resources are highly regarded within simulation, vetted by technical evidence, and utilized throughout a vast array of educational environments impacted by simulation. Many of the tools evaluate a specific population of learners or skill set of participants. Some of the existing tools focus heavily on undergraduate and postgraduate student performance. Research will depict minimal historic literature or evidence focused on the evaluative process specifically planned for a mobile environment or an in situ environment of existing and practicing clinicians. This evaluative gap includes a lack of literature and research on clinicians in rural areas of America and healthcare providers such as EMS personnel working outside the walls of a hospital. These understudied areas all benefit from the scope and capability of mobile simulation. Identifying an applicable system and tool to evaluate the specific population of learners mentioned is the intended purpose of this chapter. Evaluative processes within pre/post performance measurement should identify measurable parameters that are educationally applicable and clinically appropriate for the learners. As mentioned previously, the data collection on performance may be reflective of individuals, team, and organizational performance. The benefit of evaluating interdisciplinary or interprofessional team when applicable can also provide a holistic overview of capabilities and services at a site.

Developing an evaluative process in mobile simulation is based upon the deliberate and open relationship between the simulation event planner and the requesting agency/facility. Spending time developing an evaluative plan will guide the collaborative team in the type of scenarios selected and the performance expectations desired within each case. Discussion about optimal scenario selection should address agency/facility clinical opportunities along with identified learner gaps. The anticipated gaps can be identified through a pre-event questionnaire exploring the skill and performance opportunities onsite based on specific or broad clinical cases. The scenario development should complement the learning needs of individuals and an agency/facility. Scenario design can guide the performance and clinical expectations built within the simulated case. Each simulated case allows for specified learning and action criteria depicted for learners and teams to achieve within the immersive scenario.

Designing an evaluative process through pre and post assessment requires a thoughtful planning and design process. Event planners should identify various aspects about the mobile simulation event. The list below highlights considerations placed into the design of scenarios with pre/post assessment criteria in mind. These considerations will feed into the design and development of a pre and post assessment document.

Learners Participating – Nursing, EMS, Physician, Advanced Practice Providers, etc.

Facility/Agency Scope and Capability – rural/urban, BLS/ALS, Critical Access/Tertiary

Clinical Experience – low−/high-volume facility/agency, new graduate/seasoned clinician

Clinician Scope – level and scope of care provided along with capabilities of the participants

Prior Encounters with Simulation – prior experience using simulation, feedback on the prior encounters, virgin encounter with simulation (technology shock)

Scenario Requests – medical/trauma, adult/pediatric/infant/OB, basic/complex, commonality of exposure

Learner/Site Expectations – what are the participants and site expecting from the event

Environmental Considerations – how the environment and ascetics influence the immersion when participating in a mobile, in situ, or non-clinical space

Outcomes – what desirable outcomes are expected from the event

Learning Objectives – what objectives are driving the scenario and outcome criteria

Assessment Criteria – clinical performance criteria/expectations built within the scenario, that is, achieved, partially achieved, not achieved

Gap Assessment – educational plan to address knowledge and performance gaps identified within the scenario

Risk Mitigation – risk considerations for patients, participants, agency/facility, and staff

Post Interventions Implementation – how and when will simulation be reintroduced to the facility/agency again, will participants have an opportunity to apply the knowledge and skills gained from the event into clinical practice

Deliberate consideration should be given to evaluative questions placed on the pre/post assessment. The selection of these questions should highlight a measurable outcome from the mobile simulation event. Utilizing questions that inquire about pre and post event confidence, performance and knowledge allows planners the opportunity to compare and contrast the impact of a specific scenario or event. Question selection can highlight learner confidence in a specific skill or existence of applicable knowledge while caring for a patient with a defined clinical condition. Evaluating individual and team performance criteria demonstrated in part of a specific scenario should coincide with evidence-based standards and institutional practices. Ideally, the evaluative document should invite individual feedback from participants around their perceived strengths and weaknesses while caring for a simulated patient. Design of questions should be centered on scenarios that have measureable criteria for applicable and anticipated clinical criteria. The highlighted performance criteria possess an ability to connect educational and performance objectives defined in the planning documents of a scenario.

Taking advantage of inviting questions that reveal individual perceptions affords the planning team an ability to consider changes in performance and knowledge after a mobile sim event. Learners have the opportunity to highlight their perceived gaps during a pre-assessment evaluation and specifically describe defined areas of performance discomfort and lack of clinical confidence. At the conclusion of an event, learners can elicit the knowledge and skills gained from participating in the mobile simulation event. Designing questions that touch on these potential, perceived and known gaps allows simulation planners an opportunity to determine the impact of the encounter and immersive experience. Learners have the opportunity to encounter the same questions in the post event evaluation that calculates the impact of the scenario on their skills and knowledge for a specific clinical condition.

In an effort to optimize learning, it is beneficial for continued exposure to scenarios that build upon previously acquired skill, knowledge, and performance expectations. It allows participants the ability to refine their approach in caring for specific conditions. Utilizing a post event questionnaire within defined timelines allows planners an opportunity to determine the retention of skills and knowledge gained from the mobile simulation event. The questionnaire also provides an opportunity to inquire about the applications of skills and knowledge gained from the simulation event into real-life clinical encounters. The timing for these questionnaires is determinate of logistical and operational considerations in the evaluation of the data recovered. Sending the participant a post event questionnaire at a one-month, six-month, and nine-month window affords planners the ability to identify the impact that simulation had on the learners and determine the application and retention of information covered during the event.

Mobile simulation has the ability to focus on exposing a mass of learners to immersive encounter depicted in low-frequency–high-risk event. Notably, mobile simulation has been optimized as an immersive educational tool in rural healthcare facilities and within the rural EMS community. Over the past 10 years, mobile simulation has proven to be an economical solution for sites and facilities to expose their staff to defined clinical cases and educational opportunities. These opportunities allow for controlled, immersive educational encounters focused on improving the system and delivery of care. The pre/post evaluative tool can guide planners, administrators, and educators in addressing educational needs their staff and site have in various clinical situations.

Evaluating the impact and influence mobile simulation has on patient outcomes has been difficult since it is not solely at a defined site or inclusive of an isolated group of learners. Mobile simulation can be easily implemented within a larger scope of learners, at remote sites that cover a wide geographical footprint. The variability of participants, frequency of classes, and the variety of locations inhibit a gathering of the same group of learners repetitively to truly assess a side-by-side comparison in performance objectives collected between one event and another. As such, it is also difficult to truly study the impact of individual performance on patient care since a concentration of mobile simulation is focused on benefiting a broad spectrum of learners at a remote site. This programmatic dedication intends to optimize immersive simulation encounters in an effort to unite and unify systems and delivery of care. However, it is noted that the use of a pre/post evaluative tool has the ability to assess individual perceptions toward pre/post event performance defined by generalized capabilities, efficiencies, or opportunities at a specific site or location. The inconsistency of participants, variables in clinical experience, differences in skill and scope will influence the overall event scores. This data variability does elicit the vulnerability of care delivery realistically seen at sites within the day-to-day staffing constructs at sites.

One of the notable benefits of utilizing in situ mobile simulation is that the training can occur at the site or facility and within a defined clinical environment. Optimally, learners can experience the mobile simulation event within their home or native space. This grants the host site the ability to apply familiar, actual site capabilities and resources to the scenario and immersive experience. The feedback secured from the pre/post evaluations may have an influential impact on the workflow process encountered in their native clinical environment. Feedback in this case may highlight specific opportunities for environmental improvements or changes in organizational processes. In contrast, utilizing a truly mobile simulation environment affords the host location the ability to preserve their clinical environments for real patients when presented with high census or limited resources. Participant feedback in this truly mobile environment is potentially less about the native encounter and more about the clinical experience with a specific scenario in mind. Since the native environment and resources are not readily available in a truly mobile environment, verbalizations of these specific actions or resources will need to occur. Pre/post evaluative feedback in this case is potentially centered around the experience or care within a specific scenario and potentially less about the immersion into a live native clinical environment.

Optimally, no matter where the simulation encounter occurs, the impact of repeated encounters and exposure to continued simulated cases affords the learners an opportunity to grow their clinical experience and knowledge through routine immersive practice. Practically, simulation encounters have the ability to build upon repeated experiences; therefore, reviewing historical pre/post event data allows for determining changes in perceived comfort, confidence, skill, and knowledge at a site or facility.

As mentioned earlier, the design of pre/post event questions is a collective effort gained from educational objectives and implemented clinical scenario. Performance criteria measurement within the scenarios can be designed utilizing various rubrics depicting clinical efficiencies. Ideally, scenario design highlights functional tasks and accomplishments intended within the case. The objectives can be centered on a variety of individual or team performance criteria such as completing a clinical assessment, successfully interpreting the clinical assessment and findings, implementing critical thinking and clinical reasoning to determine differential diagnosis, initiating clinical treatment for a defined condition, successfully identifying role clarification within a team event, or establishing effective communication channels as a team. Scenario design should define the tasks expected within the case that learners are being evaluated against. Many standardized clinical education courses offer a regimented systematic checklist that highlights performance expectation. The checklist depicts if the participant completed specific performance and action criteria applicable to the scenarios progression and expected management. Logical scoring of the participant or team within a given scenario may be determined on what tasks or actions are or are not completed and the time frame that the specified tasks are completed in. From the actions of the individual or team, a description of the performance can be obtained. In many cases, terminology describing the overall performance can be applied to the scores such as entry level, novice, average, above average, or expert level actions. Descriptively, planners will need to identify the criteria expected within each level of clinical identification. The definition for each level of performance can be specific to the scenario or broad. It is possible that planners could broadly describe an employment classification based on clinical experience or be finite toward achieving defined objectives. Within the scenario, there may be specific action items that are deemed as essential in determining the level of achievement that an individual or team is performing at. These action items may highlight the inclusion or exclusion of specific tasks, care, or decisions made during the scenario.

Based on the design of the form, both quantitative and qualitative practices can be applied. Evaluating individual and team performance scores can be secured from the pre/post evaluative document as an individual event or from a series of events. When a mobile sim program facilitates routine visits to a site or facility, historic data can be collected on the progression of individual and team performance. The information has the opportunity to demonstrate the changes that occur with self-reported comfort and confidence scores on specific tasks. There are potential variables that can influence the reported confidence/comfort scores of questions listed in the pre/post assessment. Scenarios can be written with descriptive variability, yet include specific tasks that are being evaluated on the pre/post evaluative form. For example, if the pre/post form is inquiring about participant confidence/comfort level in initiating an IV line in a pediatric patient, the four scenarios assigned to an event will likely all have different story lines but all be inclusive of initiating an IV on a pediatric patient. This repeated opportunity within the various scenarios is intended to increase exposure to a specific skill with an intent to improve confidence/comfort in completing the task.

To formulate a reference of a pre/post evaluative tool, an example mobile simulation event is included below.

Fictional Case Example

The following information was documented following a phone call with a critical access facility and simulation event planner on an upcoming mobile simulation request (see Fig. 22.1). The facility point-of-contact highlighted outcomes that they would like to achieve from the in situ simulation event within their obstetrical unit. The request will occur approximately 6 months after the last obstetrical simulation event at the facility. The prior simulation event provided an introduction into the use of the manikin, task-based education on post-partum hemorrhage (PPH) skills, institutional policy on managing a PPH case, and a simulated PPH scenario. The debriefing that occurred with the prior sim event highlighted a variety of process gaps that exist and a process improvement project was implemented by the facility after completing the simulation scenario.

As demonstrated in the aforementioned example (Fig. 22.1), the pre/post evaluative form was able to depict improvements in staff comfort and confidence surrounding a post-partum hemorrhage scenario. The progressive improvements are beneficial for the mobile simulation program depicting an educational impact on the efforts and activities surrounding the clinical case. For the healthcare facility, they have addressed an educational and performance gap identified during a real-life clinical event that occurred prior to the incorporation of mobile simulation. The commitment toward staff education and development has improved how staff respond to an emergent event involving PPH. The improved clinical performance potentially decreases the risk encountered by the patient by preparing staff to respond the obstetrical emergency. Group performance was evaluated during the scenario utilizing a clinical judgment/performance rubric depicting three levels of performance criteria. The three performance areas were identified as Developing, Accomplished, and Exemplary. The performance rubric follows a theory authored by Lasater in 2007 [1].

Simulation Request:	Hospital In-situ Simulation – Critical Access Facility The facility conducts an average of 32 deliveries per year The facility encountered a complex PPH case one year prior and have made institutional improvements since the event. The facility committed to staff development and education surrounding the topic following a post event debriefing with staff.
Topic Requested:	Post-Partum Hemorrhage (PPH) – ongoing staff development opportunity
Facilities Objectives:	Staff involvement with designated roles during a PPH case Recognition of blood loss quantities during a PPH Implementing effective fundal massage Incorporating the use of PPH medications during PPH Utilizing a PPH balloon during a PPH case Implementing emergent blood transfusion Incorporating the use of an operative team for the PPH case Implementing a policy based phased response to PPH
Participants:	Nursing staff (10 Registered Nurses) with various levels of OB experience, Physician #1 (10 years of OB), Physician #2 (1y of OB)
Sessions:	Session #1 9am-1030am,Session #2 12n-130p
Scenario:	32 year old female, G3P2, 39/2, prenatal care, two prior vaginal deliveries, GB negative, no known complications, membranes ruptured 30 minutes prior, clear amniotic fluid, contractions every 90 seconds lasting 30 seconds, progressive and imminent delivery within 3 minutes of starting the scenario, multiple clots following the delivery with 500cc of frank red blood, placenta pending, boggy uterus, incremental amounts of increasing blood loss with each minute of time, blood loss of 3000cc within eight minutes of the delivery, the physician arrives at the bedside five minutes after the delivery, The placenta delivers seven minutes after the delivery, placental detachment with retained piece is noted on exam.
Scenario Timeline:	Anticipated duration of the scenario – 15 minutes Anticipated duration of the debriefing – 45 minutes Educational skill remediation – 30 minutes
Pre/Post Assessment:	Blinded – participants, Summative Data – institutional Session Data - combined
Pre/Post Questions:	Please describe your comfort level in caring for a patient with post-partum hemorrhage. Uncomfortable 1 2 3 4 5 Comfortable Please describe your comfort level in using a PPH Balloon. Uncomfortable 1 2 3 4 5 Comfortable

Fig. 22.1 Fictional case example

	Please describe your comfort level in utilizing medications used during a post-partum hemorrhage. Uncomfortable 1 2 3 4 5 Comfortable
	Please describe your comfort level in caring for a hemorrhaging mother requiring an emergent blood transfusion. Uncomfortable 1 2 3 4 5 Comfortable
	Please describe two clinical situations that make you uncomfortable while caring for post-partum hemorrhage patient.
Debriefing Inquires:	Describe the assessment criteria for calculating blood loss during a delivery
	Describe the location and technique for performing a fundal massage on a boggy uterus
	Describe the decision criteria for progressive treatment in managing a PPH case
	Describe the criteria and delays associated with notifying an on call off site operative team for a PPH case
Results from Pre Assessment:	Please describe your comfort level in caring for a patient with post-partum hemorrhage. Uncomfortable 1 2 3 4 5 Comfortable

1	pre -three	25%
2	pre -five	42%
3	pre -three	25%
4	pre -one	8%
5	pre -zero	0%

Average pre comfort/confidence score: 2.16

Please describe your comfort level in using a PPH Balloon.
Uncomfortable 1 2 3 4 5 Comfortable

1	pre –seven	58%
2	pre –three	25%
3	pre –one	8%
4	pre –one	8%
5	pre –zero	0%

Average pre comfort/confidence score: 1.66

Please describe your comfort level in utilizing medications used during a post-partum hemorrhage.
Uncomfortable 1 2 3 4 5 Comfortable

Fig. 22.1 (continued)

1	pre -one	1%
2	pre -three	25%
3	pre -four	33%
4	pre -four	33%
5	pre -zero	0%

Average pre comfort confidence score: 2.92

Please describe your comfort level in caring for a hemorrhaging mother requiring an emergent blood transfusion.

Uncomfortable 1 2 3 4 5 Comfortable

1	pre -two	17%
2	pre –five	42%
3	pre –four	33%
4	pre –one	8%
5	pre –zero	0%

Average pre comfort/confidence score: 2.33

Please describe two clinical situations that make you uncomfortable while caring for post-partum hemorrhage patient.

4) not having enough help during a PPH case
(2) not having the provider present for the delivery
(5) using the PPH balloon
(1) timing between the medications ordered
(2) not getting the bleeding stopped

Results from Post Assessment: Please describe your comfort level in caring for a patient with post-partum hemorrhage.

Uncomfortable 1 2 3 4 5 Comfortable

1	pre –three	25%	post –one	8%
2	pre –five	42%	post –three	25%
3	pre -three	25%	post –six	50%
4	pre -one	8%	post –two	17%
5	pre -zero	0%	post –zero	0%

Average pre comfort/confidence score: 2.16
Average post comfort/confidence score: 2.75
Percent change from pre to post simulation: 27%

Please describe your comfort level in using a PPH Balloon.

Uncomfortable 1 2 3 4 5 Comfortable

1	pre –seven	58%	post –two	17%
2	pre –three	25%	post –seven	58%
3	pre –one	8%	post –two	17%
4	pre –one	8%	post –one	8%
5	pre –zero	0%	post –zero	0%

Average pre comfort/confidence score: 1.66
Average post comfort/confidence score: 2.16
Percent change from pre to post simulation: 30%

Fig. 22.1 (continued)

1	pre -one	1%	post –zero	0%
2	pre -three	25%	post –zero	0%
3	pre -four	33%	post –six	50%
4	pre -four	33%	post –five	42%
5	pre -zero	0%	post –one	8%

Average pre comfort/confidence score: 2.92

Average post comfort/confidence score: 3.31

Percent change from pre to post simulation: 13%

Please describe your comfort level in caring for a hemorrhaging mother requiring an emergent blood transfusion.

Uncomfortable 1 2 3 4 5 Comfortable

1	pre –two	17%	post -one	8%
2	pre –five	42%	post –six	50%
3	pre –four	33%	post –four	33%
4	pre –one	8%	post –one	8%
5	pre –zero	0%	post –zero	0%

Average pre comfort/confidence score: 2.33

Average post comfort/confidence score: 2.42

Percent change from pre to post simulation: 4%

Please list two educational accomplishments that you achieved in today's simulation training event.

(6) use of the PPH balloon
(4) starting a second line with blood tubing
(2) use of the PPH cart and supplies
(3) bleeding potential of PPH
(1) how to do a fundal massage
(3) estimating blood loss during PPH

Summary: Improvements in comfort/confidence were accomplished under the listed criteria on the pre/post evaluation form. Statistical improvements in comfort/confidence were demonstrated throughout the listed questions and participant rankings. Post assessment qualitative feedback interpretively met two of the pre assessment weakness statements. Three unidentified accomplishments were noted on post assessment evaluation.
Institutional policies were referenced within the scenario and discussed during the debriefing sessions.
Organizational process improvements were identified regarding the contents of the PPH cart and implementation of an emergent blood transfusion protocol for PPH patients.
Remedial skills opportunities were offered on the use of the PPH balloon, medication selection, location and usage along with fundal massage location and technique, In-depth discussion occurred during the debriefings focused on institutional response to a PPH and the staffing variables and remedies based on the time of the day. Comparative results of the data reflect continued staff comfort and confidents in the listed questions from the initial sim session six months earlier.

Fig. 22.1 (continued)

Mobile simulation is an emerging environment and platform that educators can leverage when conducting simulation encounters. Though the intended audience may vary from site to site, the flexibility of an immersive platform merits consideration due to the benefits seen with existing successful mobile simulation programs. Implementing and utilizing an effective pre/post evaluative tool can assist facilities, sites, and planners in demonstrating the impact of an immersive encounter. A well-planned tool can assist program, facility, and site administrators in highlighting the impact of simulation in a mobile environment. Effective data collection has the ability to depict results that demonstrate benefits and staff-reported outcomes of a mobile program. Conducting simulation with a mobile platform allows underserved clinical areas the opportunity to experience simulation outside of the traditional fixated brick-and-mortar facility and within their own native clinical environment. Deliberate planning should go into the design of the pre/post assessment tool to demonstrate the impact of simulation. Designing questions that leverage the immersive experience collectively with clinical and educational objectives has the potential to showcase the return on investment in mobile simulation encounters across various clinical professions.

Reference

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In Situ Simulation

23

Jason Langenfeld

Key Points

1. There are unique advantages and challenges to performing simulation in situ.
2. In situ simulation can be utilized to evaluate medical skill or knowledge as well as team dynamics, systems, and processes.
3. Consideration of resources, space, and administrative support is imperative when initiating an in situ simulation program.

Introduction

The benefits and opportunities present in simulation have been well established and discussed to this point [1]. What is less clear is the translation of skills or knowledge to the patient care environment [2]. In this chapter, we will specifically explore simulation in situ. In situ simulation refers to any activity that occurs at the point of care or in the active clinical environment. It challenges the participants to operate and train in the same location, and presumably in the same manner, that they perform patient care. This may be in the field, in a clinic, or in hospital. It may also be in public areas or event spaces. Any place where care for a patient occurs is a potential setting for in situ medical simulation, such as outpatient medical or dental clinics, hospital-based units, emergency departments, operating rooms, and ICU settings.

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Just as the setting of the simulation activity may vary from traditional simulation lab-based activity or even mobile lab activity, in situ simulation may have differing goals based on objectives and desired outcomes. We will examine the similarities and differences between in situ medical simulation and more traditional simulation activities. This will include advantages, opportunities, and challenges to this style of simulation.

Effective training is imperative for effective performance. There are many ways to teach and train in medicine. This may include classroom instruction, demonstration, procedure labs, simulation in training centers or in the field. Taking the training to the environment in which the trainees operate or will be expected to perform helps to add realism and clarify application of the training [3]. It may also allow for identification of errors or inefficiencies in a system before they cause breakdown in real-world performance or compromise safety of the patients or caregivers [4]. Identification and mitigation of those issues can work to enhance teamwork, improve performance, and ultimately lead to better patient care and increased patient safety [5].

In situ simulation can used for specific end-goals, following needs analysis [6]. It may focus on limited goal-specific training or utilized as part of a larger education system or activity [7]. In situ simulation may also be effective for unit-based settings to evaluate a system or prepare for an event or opening, such as a new EMS service, a new inpatient pediatric unit, clinic, or redesigned emergency department [8–10]. It may be used to increase familiarity and improve function of established or newly formed teams, such as an ICU or trauma service, or intermittent teams, such as in-hospital rapid response or code teams [11–13]. As with more traditional simulation activities, there is frequently a focus on high-risk, low-occurrence, topics. However, simulation activities in the clinical setting may provide increased or improved opportunities to practice and evaluate teamwork, leadership, and behavioral factors.

While medical simulation training often takes place by occupation or role, in situ simulation is well suited for multidisciplinary team or unit training. When utilizing simulation centers, or off-site simulation, training is often attached to a course or curriculum. It is not uncommon for nursing students to concentrate on assessments or procedures. Students or medical residents may come as part of an educational program to practice resuscitation, objective structured clinical examination (OSCE), or medical or surgical techniques. Respiratory therapists may come to learn how to manage ventilators or bedside patient care. More experienced professionals may utilize simulation for a refresher course or to participate in required assessments. Each profession may utilize simulation differently to meet the needs identified for their education and training.

However, in medicine, rarely does anyone practice in a vacuum. Medical teams come in all shapes and sizes. They may vary in composition and consist of different individuals at different times. Teams will look different in community health centers, dental clinics, operating rooms, dermatology offices, or emergency departments. Just as there are countless settings and teams, with each one looking different, each member of those teams may have different roles and tasks. In that regard, each may have different training needs. Consideration of those needs will help to develop effective simulation training [14]. As with any training, the needs of the trainees and training goals of trainers will function to form the structure of specific simulation training.

In Situ Simulation vs. Off-Site Simulation

When considering in situ simulation, it is important to make note of the differences that exist in comparison to a more traditional simulation center or lab setting. Those differences can present both unique challenges as well as opportunities. Differences in facilities, location, equipment, personnel, and cost are all very real. There may also be differences in objectives for training in different environments or teams [15]. In situ simulation can provide more realistic training opportunities, more accurately reflecting the learners' clinical practice, and may prove more effective than other simulation modalities [16].

Resources

The resources and time required for in situ simulation can vary dramatically from off-site simulation in more traditional simulation centers [2, 15]. Some of those differences exist in use of time, equipment, and space. Those considerations must be taken into account while planning for in situ simulation activities.

Equipment

Decisions must be made in the development of in situ simulation on whether the simulation training will utilize the equipment present in the clinical setting, transport simulation equipment and supplies to the site, or a mix of both. For instance, the use of real-world cardiac monitors versus those set up for training will require different preparation in advance. The use of real-world disposable medical items will require inventory control and affect the cost, as opposed to using simulation-specific materials that occasionally may be reused or repurposed.

It is important to consider realism in the selection of equipment as well. One of the benefits of in situ simulation is the ability to create a scenario that mirrors the learners' clinical practice. So, the more that it can occur in real clinical areas with real equipment will assist in that realism. If the equipment from the clinical area is to be utilized, care must be taken to maintain immediate function for patient care. Any adjunct equipment must function in concert with the existing resources [17]. Medical supplies and disposables, such as gauze, IV, tubing, and the like can be used from floor stock, but care must be taken to accurately inventory and replace used items expeditiously.

The use of in situ simulation in various clinical settings can present a challenge with different equipment in each area. Coordination with each clinical location is required to determine needs and assist in equipment management. Availability to use equipment present in the clinical area can be limited by local regulations, budgetary constraints, and availability. In that case, efforts should be made to match the clinical equipment as much as possible. If a separate airway or resuscitation cart is to be used, it should match the cart used in the clinical setting as closely as possible. This is true for other equipment, such as monitors and pumps. It is sometimes possible to obtain decommissioned or used equipment from medical facilities or other sources to utilize for simulation, which may be of assistance.

Simulation can sometimes be an exercise in accommodation and ingenuity. There is often a need to mix modalities and make do with what is available. While use of high-fidelity mannequin simulators is common, it is by no means required. Use of lower fidelity models, standardized patients, or a mix of modalities may be just as effective [18]. Any equipment or supplies brought into the clinical area for simulation should be clearly labeled as simulation equipment and not for clinical use. This may include expired medications or supplies, stimuli, or decommissioned equipment. Appropriate labeling will help in the setup and breakdown of the training scenario and ensure real-world patient safety.

The mobility associated with in situ simulation allows utilization of equipment in multiple settings. As opposed to different training groups or units coming to the simulation lab to train, the simulation training comes to them. This allows for flexibility not always available in a brick-and-mortar simulation center. The same equipment and resources can be utilized for different clinical settings or scenarios. Equipment chosen for in situ simulation exercises must be able to be transported to and from different clinical settings.

Space

While utilization of simulation equipment and medical supplies differs from a simulation center, so too does the utilization of space. As opposed to operating in a predefined space such as a simulation lab, in situ simulation does not require or allow for a separate dedicated space. Some resources can then be preserved. There is likely less need to expend time and resources creating a realistic environment when you are utilizing the actual clinical environment in which trainees practice. Overall space requirements are often significantly decreased as well, requiring only space for staging and storage. As mentioned before, this can present advantages, but may also create challenges [15]. It does require utilization of space, often clinical, that is already in existence. However, it is important to note that use of clinical space is subject to the needs of real-world patient care, which can affect availability at any time. Unlike a simulation center or dedicated lab, it is often difficult to protect the time and space required for in situ simulation.

While in situ simulation does not require independent dedicated space, it also does not provide such space. Identification of space and time required for in situ simulation is an important first step. Simulation exercises will affect the length of time that a given space may be unavailable for its intended clinical use. The space chosen should be closest to real-world clinical environment while striving for least impact on continuing patient care. Consideration and preference must be given to direct patient care, with every attempt being made to have the least impact on the care of patients in real time. There needs to be consideration not only of the training time, but also of the setup, debriefing, and breakdown time required. Any area used for training will be unavailable for clinical use until the completion or interruption of training. This can be done with minimal impact on clinical processes, but occupation of clinical space needs to be discussed and cleared with all interested parties prior to performing simulation or training activities [19].

There are also matters of storage and transport that need to be accounted for when planning simulation scenarios. While there may be opportunities for local storage, many clinical settings are already limited on space. When planning training activities, there needs to be a plan for transportation of simulation equipment to and from the in situ position. This may be easy if there is a storage closet down the hall, but more difficult for utilization in remote clinical settings or in settings not collocated with existing simulation equipment or program. If not associated with larger simulation center, the need for permanent on-site storage should be considered when establishing an in situ simulation program.

Personnel

In situ simulation differs from off-site simulation in the use of human resources, as well. Personnel considerations are important both for trainees and for simulation staff. In addition to the scheduled length of training, timing and planning may be less reliable and consistent than off-site training, and will likely require longer blocking of time.

Training personnel will notice a significant difference between in situ and laboratory simulation. Not only must equipment be portable, so must be the personnel. Often, those facilitating the training and operating the simulators need to be present at the clinical site. This may involve removing them from daily activities at their normal location or job. They must also learn to be flexible with setup and take down. Additionally, there is a need to conduct training at different times of day, to capture trainees on different shifts and schedules. This may require trainers and facilitators to be available at hours which they do not normally work.

In regard to trainees, it must be determined how the training teams will be selected. In off-site simulation, trainees are often scheduled at a predetermined time outside of normal duty hours. In situ simulation is most often performed using personnel who are on duty at the regular place of work. This occurs during the course of the normal workday, and in addition to the clinical workload. Those personnel, then, may have other obligations at the time of the training. This does require commitment and support from the supervisors and leaders of that unit to facilitate successful training. It also requires flexibility both from the trainers and from trainees at making the scenarios work. This may require more intensive utilization of simulation personnel to ensure timely setup and execution of this area. It may also require that unit representatives, not acting in their normal capacity, be available to assist and facilitate. It may also require that those individuals assume clinical responsibility for the duration of the simulation training [20].

Time

As previously noted, the time required for in situ simulation must be considered in the planning of such exercises. This includes time required for the facilitators and trainers as well as the trainees. Occupation and utilization of clinical space and personnel is a necessary sacrifice of in situ simulation. Flexibility is also a requirement for success. Limitations will vary based on location, but there will be a portion of exercises that must be rescheduled or delayed due to clinical workload. While frustrating, it is an accepted risk in performing in situ simulation. Patterson et al. noted a 10–15% cancellation rate due to volume or acuity, [2] though that number may fluctuate significantly based on location and other factors.

In order to be effective, in situ simulation must be performed with enough repetition to gain capture of the clinical workforce as well as frequent enough to maintain retention of learning or skills [12]. While there is interruption of clinical work, in situ simulation may decrease required attendance and training outside of normal work hours for many trainees. This can reduce burden and cost to the system in the long run [20]. As in situ simulation often occurs in high acuity and highly occupied locations, maintaining time limitations may help to limit adverse impact on clinical responsibilities. Ultimately, there will be times when there may be no other reasonable option than to cancel or postpone a training session. That risk is inherent for in situ simulation and must be considered when planning, to include options for rescheduling to gain capture of those learners.

Objectives

Clearly, the location and resources required for in situ simulation are different from those of brick-and-mortar simulation centers. However, it is often overlooked that the objectives of in situ simulation may also differ significantly. While there are many approaches to training and evaluation with simulation, the setting of the simulation may have different advantages depending on details and function [21]. In situ simulation can be utilized to evaluate systems or team-based functions rather than objective evaluation of individual performance or competency, which may be more often performed in a controlled simulation environment.

Evaluation of team dynamics can arguably be best done in the setting in which that team normally operates. For this reason, in situ simulation may have advantages over a simulation center or other off-site simulation. Additionally, since in situ simulation often utilizes personnel on duty for the training, those individuals get to train with the same team that they are working with on a day-to-day basis. Evaluation of multidisciplinary teams can help to identify barriers to success and breakdown in communication. There are multiple constructs available for team evaluation, but the overall goal is to improve team function with clear communication and ultimately improve patient safety and outcomes [22]. Occasionally, the simulation exercises can be integrated with other training initiatives or programs. Klipfel et al. describe unit-based training with in situ simulation utilizing the TeamSTEPPS patient safety model to help enforce skills and allow teams to practice with tools provided [23].

In situ simulation is also well suited for evaluation of systems and processes. This may include current systems or testing prior to the implementation of new units or systems [24]. A very important benefit of in situ simulation is the ability to identify latent hazards. Operation in the actual clinical setting in which a team practices can identify deficiencies in new or well-established systems. This can help to evaluate team dynamics, systems issues, environmental risks, or process problems [25]. In this setting, it is imperative that there be a commitment from the institution to address any issues identified. Otherwise, this may lead to perpetuation of risk to patient and system.

Cost

One potential difference between a simulation center and in situ simulation is cost. In situ simulation may potentially provide cost savings, given the decreased need for physical space and the ability to re-purposed equipment to different clinical settings. While in situ simulation is useful for medical training, it may not completely satisfy an institution's needs for simulation training in the long run. However, it is often an opportunity for institutions that may not be able to afford to provide full-time simulation staff or facilities to initiate a simulation program. In this way, it may be used independently, or as a pilot program amenable to future expansion [26]. In that case, resources and equipment will require an upfront investment, and will occupy a large portion of overall cost initially. That being said, in situ simulation can be scalable and expandable. The resources required to initiate effective training can be far less than establishing an off-site simulation center [27].

In situ simulation may also be used as an adjunct to existing simulation programs. Operating in the clinical space may help alleviate congestion with scheduling in simulation centers, allowing for increased utilization and value for overall cost. If utilizing existing equipment and personnel, the fiscal impact of operating medical simulation in situ may be much lower [28]. In determining the fiscal impact of an in situ simulation program, once again, the training needs must be considered first.

Perception/Realism

Finally, in situ simulation may increase the sense of realism in simulation training. Realism is a constant challenge in medical simulation. Simulation training asks the trainees to suspend disbelief and "play it like it's real." As in situ simulation occurs in the same space is clinical performance, it far better reflects the setting in which the trainees practice. Additionally, in situ simulation can integrate with real-time workflow inpatient care to increase overall realism. This may include continuing other patient care responsibilities during the simulation, utilizing realistic notifications, such as phone or radio use, or working with existing radiology or EMR systems. Simulation in the clinical arena provides opportunity to evaluate trainees in a more natural setting and may reinforce skills or behaviors addressed in previous simulation or other training.

In developing in situ training, it is important to avoid some short cuts occasionally utilized in medical simulation [17]. It is not uncommon to utilize role switching or time compression in simulation. Occasionally, trainees are asked to step outside of their role and playing the role of another participant. For instance, a physician playing the role of the nurse or vice versa. It is important to try to minimize this type of crossing lines. Lab and imaging may be made available in unrealistic time periods to help move the case forward. Minimizing those foils will help to maximize the value of in situ simulation. Matching practice in actual clinical roles and in as close to real-time as possible will more accurately reveal latent errors in systems or practice, and help identify additional training needs.

Challenges to In Situ Simulation

We have discussed some of the unique characteristics of in situ simulation. It is important to consider the barriers and challenges present in the utilization of in situ simulation as well. While there are notable advantages to simulation in situ, they will also be disadvantages.

The most notable barrier in situ simulation is disruption of patient care. Because the spaces used for in situ simulation are, by nature, used for active patient care, restriction of the spaces will also restrict the resources available for that patient care. This can create delays and complications of care. It may also create perception of delay with any patients or families present at the time of the training. This perception must be mitigated by unit personnel or training staff. It is important to educate not only trainees, but also those occupying the same space, such as bystanders, patients, and personnel not immediately involved in the training. Of paramount importance is ensuring that any simulation or training activity does not adversely affect the care of real-time patients.

Personnel

Personnel can also present a challenge for in situ simulation. The utilization of personnel performing the regular duties may increase your ability to get them to the training, though those real-time activities may also disrupt or interfere with your training session. Oftentimes, individuals have specific educational time or protected time. This can determine whether they may be available for on- or off-shift training.

As mentioned before, capture of those learners is dependent upon their workflow and availability based on real-world patient care. There is time required for simulation, and that time must be taken from the learners' daily duties. Appropriate timing can also be difficult to ascertain. There is often a need to perform simulation training off-hours, and to avoid peak hours of use. Additionally, as certain clinical settings operate 24 hours a day, there may be the need to perform repeat training at multiple times a day to increased capture of trainees. In addition to the learners, simulation team or trainers also have an increased labor requirement associated with in situ simulation. Where a brick-and-mortar simulation center can be set up ahead of time and often be run by one well-trained operator, facilitation of in situ simulation will require significantly increased resource in preparation and at the time of training.

Data Collection and Recording

Simulation exercises in situ may present specific challenges to research and data collection. Data collection can be tricky for in situ simulation. Secure capture and storage of simulation training in situ can be more difficult than in other simulation settings. Simulation centers often utilize video recording or other recording technologies to help assess and debrief learners. However, those systems are not often present in clinical settings. It should be determined prior to training whether any recording of the events will take place. Given the presence of patients, families and bystanders, additional care must be given to ensure their privacy. This can limit the capture of simulation proceedings. While there are multiple recording systems available, personal cameras or cell phones can also be used, with care taken to avoid any private health information or real patient recording. Portable recording may also require additional personnel to operate them, and a systematic approach to storage of material.

Evaluations and surveys are often used before, during, and after a simulation activity. Structured debriefing is arguably as important as the training setup. All of these may be limited in in situ simulation. Patient privacy must be respected, and video recording is often difficult or unavailable in a real clinical setting [2]. Due to compressed and variable time available, assessments can be harder to capture. Preparation in advance and providing materials in a user-friendly manner may assist in that capture.

Legal and Privacy

There are multiple considerations regarding medico-legal risks of in situ simulation. Because of the public forum in which the training occurs, there are concerns that any errors will be not only witnessed but also made public or amplified. Patterson et al. provide insights into the research and medico-legal considerations of in situ simulation [2]. There are questions that need to be addressed prior to implementation of in situ simulation. Will the simulation and training be used for or involve research? Will it be voluntary or mandatory? Does the training fall under an institutional quality assurance or quality improvement policy? Will there be video capture of the training and debrief? There is no one answer or correct answers. However, the answers to these questions may affect the protected nature of any information from training and should be addressed in the development of any program.

Cultural Resistance

Cultural obstacles exist in any simulation curriculum. However, they are especially notable for in situ simulation. Oftentimes, in situ simulation does not allow the learner early preparation or specific times for training. This may lead to increased performance anxiety or fear of failure. The performance in the clinical setting may also increase that fear of failure and anxiety, as it is not recognized often in a protected space, such as a training center. As it occurs in a more public setting, while scenario or training session is going on, it may be witnessed by other workers in the area as well as patients and families. The perception of failure in front of those workers or patients can lead to increased resistance. As mentioned before, it is imperative to manage expectations of both learners as well as others in the setting of the time of the training.

Leadership support and buy-in are imperative to any training program, but especially important when enacting a program that occurs in the clinical space. While leaders may be familiar with simulation and enthusiastic about its uses, commitment and interest is not always equal among learners. To ensure appropriate management of perceptions and fears, there needs to support on multiple levels. Buy-in not only among the learners but also among supervisors and administrators is essential to the success of any given program [29]. Engaging leadership from the hospital, departmental, and service line areas is imperative. Given that in situ simulation lends itself while to team training, leadership for physicians, nurses, technicians, and ancillary staff will need to be involved. Top-down support and demonstration are necessary, especially in utilizing a clinical setting. While there is no clear best practice to manage these issues, development of a management plan prior to institution of any in situ simulation program is a must.

Getting Started

There are multiple applications to simulation and specifically to in situ simulation in medical education. In situ simulation is specifically well suited for evaluation of systems and teams. After evaluating the needs of the trainees, focus can be placed on areas where providers are somewhat less comfortable, such as reinforcement of low-frequency/high-risk medical conditions or scenarios. In situ simulation can be used in conjunction with established programs or trainings [23]. There may also be a role for in situ simulation in establishment of new units or processes. This may include rapid response teams, trauma response, and new inpatient units.

In situ simulation can be used in conjunction with established or existing simulation education. Alternatively, in situ simulation may be deployed in areas with decreased resources. This includes austere environments or specialized situations such as military response or training [30]. It may allow early adoption of simulation to gain exposure for clinical personnel and help identify additional training needs prior to or in conjunction with development of a brick-and-mortar simulation center.

There are multiple resources available that discuss initiation or establishment of in situ simulation programs [17, 31]. Determination of training needs should supersede technical or logistical planning, and must be considered first. That starts with the target audience, which will shape learning objectives and desired outcomes. Once the team and objectives are established, the training location and required resources can be assessed [6]. With goals and resources in mind, simulation scenarios can then be constructed to enforce learning objectives or evaluations. That will include critical actions, learning points, and structured pre-brief and debrief plans.

In addition to teams and objectives, a resource management must be considered. What equipment is necessary and how it should be utilized should be determined when planning any events. Training goals and objectives will help determine what resources you need, both equipment and personnel. Some locations may have access to necessary equipment. Others may require acquisition of that equipment, or transport from another location. In situ simulation can take many shapes and sizes, and will differ based on needs and availability. While outside the purview of this discussion, effective learning can be accomplished with actors, standardized patients, volunteers, low-facility, or high-fidelity equipment. It is the planning, to include learning objectives, critical actions, structured assessments, and debrief, that makes for a constructive educational experience.

Establishing Teams

Multidisciplinary teams exist within all areas of medicine. As such, training together can help identify strengths and weaknesses of that team. This is often easier to accomplish with simulation in situ, as the training occurs at the site of clinical care. When done in the process of regular workflow, it encourages capture of all members of the working team. Boet et al. discuss development of professional team training in simulation [14]. Each team member has different areas of expertise and levels of training, and that should be reflected in any training scenarios. Simulation may be used to evaluate teams as well as identify areas for additional focus. While in some settings, teams are stable, and leadership is constant, there is evidence that teams in medical emergencies are not stable, and roles are constantly changing [32]. In order to account for fluctuations in team structure and variation, as well as to ensure a reasonable level of participation, in situ simulation training needs to be conducted on a frequent and recurring basis. Additionally, interdisciplinary team training is best when compulsory to prevent avoidance or disproportionate participation among the clinical teams.

Safety

Just as real-world medical care must take priority over simulation training, safety of the patients and staff must also be paramount. This goes back to determining a use plan for equipment and separation of equipment and supplies. Unique pitfalls do exist when operating in the clinical arena. For instance, when performing simulation exercises, real medications are often not utilized. They may be substituted with expired medications or inert substances. Occasionally, this can include things like tap water or artificial coloring. These "medications" must be appropriately labeled and clearly marked for simulation use. Administration of the wrong substance or medication to a real-world patient may lead to significant harm and must be avoided at all costs. Similarly, equipment used in simulation is oftentimes modified for the needs of the training or may be otherwise not approved or not working for clinical use. Occasionally, this is to accommodate the needs of other simulators who use simulation equipment. Additionally, nonfunctioning or obsolete equipment is often re-purposed for simulation or training. The time to recognize nonfunctional equipment is not during emergent or urgent care of real-world patients. So, as labeling is imperative, so too is inventory and assurance that all simulation materials and equipment are removed from the scene prior to resuming patient care in that area. As discussed previously, if using materials or equipment normally used in clinical care, the clinical area needs to be brought to its fully stocked and complete state prior to resumption of patient care. This may include restocking supplies. This also includes ensuring that any equipment or facilities used are appropriately cleaned and reset in a manner consistent with department or unit policies.

Pre-Brief and Debrief

Much discussion has been given to the need for effective debriefing in simulation exercises. However, the importance of pre-briefing in preparation can sometimes be overlooked. When planning in situ simulation scenarios and exercises, care must be taken to clearly establish rules of engagement. This becomes particularly important to consider when utilizing simulation in a clinical care area. Pre-briefing can help establish rules of engagement as well as expectation for the training exercise. Additionally, it can increase awareness of the learners as well as those in the patient care environment and increase overall transparency. This includes explaining the situation to nonparticipating staff as well as bystanders such as patients and families present. Signs or posters can be used to clearly delineate the area being utilized for simulation. This can help to separate interactions and ensure separation of equipment and medications or materials used.

Clear instructions should be given both at the beginning as well as the end of the simulation exercise in regard to utilization of equipment and materials. If the material use plan calls for maintaining separation of materials and equipment for simulation and clinical care, that should be explained to all participants. Clear labeling should be ensured on all that needs to be removed from the area. Participants should be aware and make sure to clear their pockets both before and after the simulation to ensure that no medication or equipment leaves the simulation area and maybe inadvertently used later for patient care or vice versa.

While effective facilitation and debriefing are imperative in any simulation training, they are of critical importance in utilizing in situ simulation. The use of the clinical setting makes debriefing, by requirement, brief and focused. Finding appropriate time and space for debrief of the training scenario can be challenging in the clinical setting. There is often not a dedicated space for such activity, and privacy must be considered as well. While debrief can be accomplished at the bedside, it is often best done outside the view and earshot of other patients and families. This is especially true when discussing opportunities for learning or shortcomings. Clinical duties may also limit the time available for debrief for the learners in in situ simulation.

The facilitator of the session must be adept at observing and evaluating for the training objectives, to include critical actions, communications, and participant interactions. As mentioned previously, the ability to record interactions is often limited by the setting. Similarly, the ability to evaluate or play back any recorded material in real-time is also limited. Such material may be maintained for later review, but immediate debrief must be pointed and concise [2].

Creating specific structure and time limits to evaluation and debrief may assist with effective scheduling, practice, and acceptance by trainees and unit leadership. That requires appropriate preparation and training by facilitators to ensure success. Preparation includes standardizing evaluation and debrief structures, as well as being mindful of the need for discussion and interaction. Opportunities for extended feedback sessions at a later time as well as the ability for both the trainees and facilitators to provide comments for later review may help mitigate the time constraints in the active clinical setting [17]. Those feedback structures will help keep to the schedule as well as minimize delay in real-world patient care secondary to in situ simulation training.

Conclusion

In situ simulation presents unique opportunities and challenges in medical training. Integrating simulation training into the clinical care environment can provide additional realism and help to evaluate applications to clinical practice. It can be used to improve safety and reliability, especially in high-stress and high-risk clinical environments, and provides opportunities for interdisciplinary team-based training at the point of care. In this way, in situ simulation can be used to augment other simulation programs or present a reasonable alternative for those without significant existing simulation resources.

Application of simulation in situ can be particularly useful to assist in multidisciplinary team training and to evaluate team dynamics, specifically in the clinical arena in which they practice. Utilizing real-world clinical settings can help to identify latent threats, system issues, and process improvement opportunities [33]. This can apply to well-established units or newly formed clinical environments and teams [34]. There are other unique applications well suited for in situ simulation. This includes focus on high-risk, high-stress events [28, 35] or skill development in specialized practices. Training can be targeted at acute interventions for patient safety, or at maintaining and retaining important skills [36]. This may be part of a longitudinal training program, or designed to provide just in time training at the point of care [37]. In situ simulation has been used to help medical providers understand the microsystems present in their work environment to augment their clinical and technical skills [38]. This not only improves patient safety, but trainees may also gain a better understanding of the experiences of their patients [39].

Consideration of resources, personnel, cost, space, and administrative support is imperative when developing an in situ simulation program. A focus on realism must be maintained to capitalize on the advantages of simulation in clinical practice settings. The closer that a simulation scenario replicates actual patient care in the clinical area, the more it will accurately reflect team function and clinical practice.

While there are definitely roles for brick-and-mortar simulation centers, in situ simulation may function to augment those programs, and provide unique advantages in effective training of medical personnel. Just as there are specific opportunities for in situ simulation, distinct challenges exist which much be considered in the development of any program. An understanding of the benefits and barriers that exist will help create successful implementation strategies for in situ simulation. Addressing cultural and logistical challenges, as well as a clear understanding of the goals, objectives, and target audience will help ensure successful implementation of in situ simulation.

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