The College of Emergency Medicine

ST4 High Fidelity Simulation Course

Pre-course Reading

Contents

1. List of contributors 3

2. Introduction to simulation: aims & objectives 4

3. Adult educational theory applied to simulation 7

4. The simulation room: contents and what happens in it 11

5. The process of debriefing 17

6. What is Crisis Resource Management (CRM) in the Emergency Department? 21

7. Conclusions: application to the work environment - What can be simulated and what is not appropriate to simulate 31

8. Appendix 34

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Chapter 1: Introduction to Simulation

This College of Emergency Medicine (CEM) approved simulation training course will be using High Fidelity Simulators (HFS) in the place of patients to run through clinical scenarios relevant to ST4 trainees.

The HFS is a manikin, driven by computers. It can talk, demonstrate physical signs as per physiological changes, and can respond to interventions and treatments [1]. During the simulated scenarios the manikin should be treated in the same way that you would treat a patient. All questions should be directed at the manikin (the patient) as appropriate, and the members of the team involved in the scenario within the simulation room.

The simulation room will be arranged to reflect a typical area in the Emergency Department (ED), such as the resuscitation room. To maximise your learning experience you are encouraged to immerse yourself as much as possible into this setting being a real area in the ED and a real clinical scenario.

There will be an opportunity to familiarise yourself with the manikin and the room prior to commencement of the scenarios.

During these scenarios, which will cover a variety of clinical topics, candidates will be expected to consider their use of both technical and non-technical skills. Non-technical skills, which include communication, leadership, team

working and planning, will be covered in more depth in the Crisis Resource Management chapter.

The scenarios are intentionally designed to reflect the high-pressure environment in which you work on a daily basis. You will be expected to interact with your patient; team and relatives whilst instigating any management plans in the same way as you would at work [2].

The simulation centre provides facilities for candidates to watch, in real time, all the scenarios in which they are not directly involved. This allows candidates to learn, and reflect on the actions of others during each scenario. The scenario may also be recorded to allow candidates to see elements of their own actions during the debriefing session.

Although many of you may feel ‘camera shy’ the cameras are inconspicuous and we hope you will quickly forget their presence as you become immersed in the scenario. We can reassure you that the recordings will only be used for the course you are attending. Using video clips has been shown not only to stimulate discussion and reflection but also to identify critical clinical and non-clinical cues that may have been initially missed in the scenario [3].

Please remember that the Simulation room is a safe learning environment where mistakes are only learning opportunities. Therefore, have the confidence of your convictions, forget you are being watched, and act as you would if you were at work.

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Chapter 2: Adult educational theory applied to simulation

Introduction

Simulation is a unique learning environment in which candidates can experience the application of interventions in a 'safe' environment. Simulation enables various adult learning theories to be applied to a wide variety of clinical scenarios. It is important to understand how adults learn in order to target simulation to individuals and groups. In this chapter we will discuss the educational theories relevant to the knowledge and assessment in simulation.

Educational theories

When activities are being developed it is important to consider the following points in regards to adult learning:

- Adult learners bring a wide range of experiences, knowledge, self-direction, interests and competencies
- Adults learn better if the goals and objectives are realistic and personal to them
- Adult learners need direct, concrete experiences that can be applied in the 'real' work place
- Adult learners in small-group activities enable application, analysis, synthesis and evaluation as well as providing an environment in which to share, reflect and generalise learning experiences
- Adult learners require feedback on their progress and efforts

- Adult learners need coaching and support to help them transfer learning into daily practice

The commonly used educational theories are ***behaviourism***, ***constructivism*** and ***cognitivism*** [1, 3]. The behaviourism theory assigns teachers in modifying behaviour by creating situations where learning is reinforced by responses exhibited. The constructivism approach emphasises the learner's ability to solve real life problems. The theory of constructivism is that reflecting on one's experience generates own understanding of the world. An example is the Kolb's cycle of experiential learning (Fig. 1)

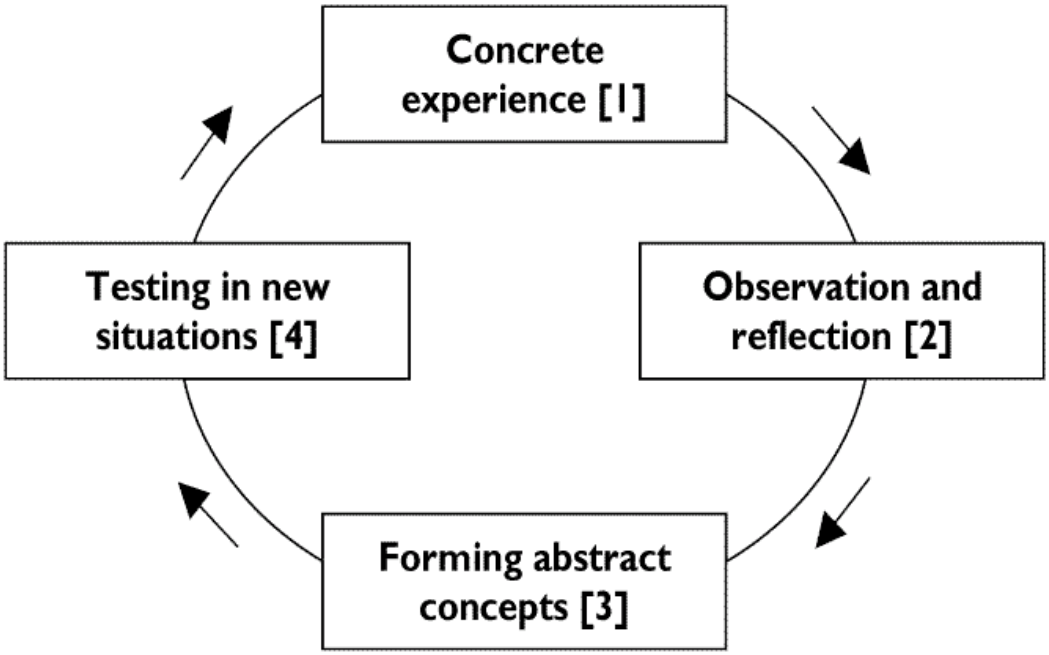

Figure 1: Kolb's cycle of experiential learning

The learning process often begins with a person performing a task and then seeing the effect of the action. The second step involves understanding the effects to enable the learner to anticipate the action that would follow. Third step is understanding the general principles of the action involved. The final step involves implementation of the action.

Kolb's principle is applied in simulation by the introduction of a new skill to the candidates, such as management of the difficult airway. A potentially life threatening condition that may not have been encountered in the clinical environment can be created in a 'safe' environment in simulation for the candidates to experience [4]. This will allow reflection and discussion with a clinical expert on the management of this type of scenario. The learner is able to develop, from a 'safe' environment of simulation, a pathway in this situation and use it to manage such a patient in the clinical environment.

Cognitivism occurs when the learner processes information. According to Jerome Bruner, there are three components to learning a subject [2]. Firstly, acquisition of new information built on something that is already known. Secondly, transformation of information for use in new situations. Finally, evaluation of all aspects of processing of information to ensure it is correct. In simulation, cognitivism is applied to debriefing of scenarios. The debriefer guides the candidates to the next questions and facilitates the journey to learning and reflection. Also, new information is acquired, transformed and evaluated by the candidate through involvement in the scenarios and debriefing process.

Conclusion

Simulation-based training represents an evolution of the apprentice model of teaching (i.e. see one, do one, teach one) in which the needs of adult learners are met more effectively. It has the potential to increase competency as well as improve patient safety. The effectiveness of simulation lies in the application of the educational theory. The most significant learning experiences occur in authentic activity, during immersion in realistic settings via hands-on training. The unique environment in simulation enables the development of knowledge and skills of the clinical environment that mirrors the clinical setting and is better and 'safer than the real thing'.

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Chapter 3: The simulation room: contents and what happens in it

'An ST4 trainee leads a team of doctors and nurses dealing with a young person in severe septic shock. The team appear to be very busy but the atmosphere is relaxed because there is no fear of causing harm to the patient'. The patient is a fully interactive mannequin!

The new simulation centre at the Sherman Postgraduate centre at Guy's Hospital offers a unique opportunity in gaining experience whilst rehearsing real life scenarios in a controlled environment. The centre is staffed by a small team of simulation and education specialists.

The centre is divided into three main areas:

- Simulation platform (fig. 1)
- Control room
- Observation room – Debriefing area (fig. 2)

The simulation platform is designed to be flexible and could be transformed from a High Dependency Unit (HDU) or resuscitation room to a Ward environment as required by the scenario. There are two trolleys with High Fidelity fully interactive mannequins. A monitor (showing physiological parameters) and a defibrillator on either side of each trolley creates the environment of a cubicle in a resuscitation room.

Airway, including difficult airway, vascular access, central venous pressure (CVP) & arterial line trays with all the necessary equipment to carry out a range of procedures are also available. In addition, there is a fully stocked pharmacy cupboard as in a resuscitation room.

The mannequins are fully interactive, with the ability to demonstrate measurable vital signs, communicate and produce a variety of breathing and heart sounds as in a 'real' patient. The mannequins have reacting pupils, and produce sweat or tears, or even simulate swelling of the tongue. The mannequins can be transformed according to the needs of each scenario such as compound fracture or amputation of a limb, lacerations, and even change of sex (fig 3, 4, 5).

The simulation room has three zoom digital roof cameras that capture the action during the scenario. This can be replayed during the debriefing sessions as necessary to highlight certain points. A technician in the control room modifies, in real time, physiological parameters according to an intervention or treatment, which can be seen on the monitor in the simulation room.

The Observation area has a large screen for projecting the video recording of the scenario. It enables the non-participants of the scenario an unobtrusive observation of what happens on the simulation platform, so that they will be able to contribute to the debriefing session after the scenario. In the Observation area the debriefing and critical analysis session takes place at

the end of each scenario. The debriefing sessions, facilitated by the faculty instructors, are crucial components of the learning experience.

The clinical scenarios will aim to improve patient safety by enhancing professional competence, communication, leadership and team working skills. The scenarios are designed to be as realistic as possible involving professionals from all specialities and grades and their difficulty is adjusted according to the level of the participant's experience. As the scenario unfolds participants have to think on their feet, communicate effectively with each other and the 'patient', and demonstrate leadership and initiative skills for a safe patient journey.

The immediate debrief and playback (frame by frame) of the video recording of the scenario facilitates critical analysis of the performance of the team as a whole or at an individual level. The behaviour of the team and the individual candidate is constructively discussed. Communication breakdown and their consequences are identified. Also, the individual's educational needs can be highlighted by the whole team in a confidential and non-threatening environment.

Fig.1: Simulation platform

Fig.2: Observation/Debrief room

Fig. 3: Creating a compound fracture

Fig. 4: Creating an amputated leg

Fig. 5: Creating a scalp laceration

Chapter 4: The process of debriefing: The Heart and Soul of the Simulation Experience

If you ask many participants what the advantage of human patient simulation (HPS) as an educational tool is over other more traditional forms of teaching, they will often site the following: 'the chance to practice real clinical scenarios'; 'the recreation of the doctor – patient interaction' or 'the opportunity to learn in multidisciplinary groups'. However a systematic review in 2005 by Issenbeg [1] identified feedback (including debriefing) as the most important feature of simulation-based medical education. This indeed will be the major focus of the day on this course.

A far longer period of time is given to 'the debrief' than to the actual scenario. This allows for the entire group to be involved rather than the focus being on just those involved in the scenario. Adult learning occurs best when they are actively engaged in a process, participate, play a role and encounter not only tangible events in a cognitive manner but also transactional events in an emotional fashion. To allow for this, the debriefing process is divided into stages: description, analysis and application. This model [2] 'evolves out of the natural order of human processing: to experience an event, to reflect on it, to discuss it with others, and learn and modify behaviour based on the experience.'

The **descriptive phase** encourages the whole group to describe as objectively as possible what has taken place during the scenario and to avoid interpretation and analysis. The aim is to draw out events that may not have

been noticed at the time and to draw attention to unacknowledged interpretations and speculations. It allows the participants to check out the objectivity of their perceptions with their peers, especially with those who were in the scenario with them.

The second, **analysis phase,** allows time for a deeper exploration of some of the emotions that were drawn out during the scenario. As some feelings can be a barrier to learning they need to be worked with to understand their significance and find ways to change, discharge or celebrate them [3]. The analysis phase also allows for a deeper investigation into specific topics, which may be clinical, but more often, centre on a crisis resource management theme or multidisciplinary training. Despite there being learning objectives for each scenario, the participants guide this stage by discussing what is important to them or that which they are unsure of.

Video playback is often combined with the analysis phase, which in some studies, has been shown to improve sustained behavioural changes [4] and not necessarily so in others. [5, 6] It is agreed that the video payback is useful for adding perspective to a debrief since it allows the participants to see how they performed rather than how they thought they had performed. These can sometimes be quite different things and hence helps reduce hindsight bias.

Finally, there is the **application phase**. This is where all the ideas discussed in the analysis phase are brought together. It enables reflection on how the

concepts examined correlate with the picture as a whole and how they may be applied to daily practice.

Support and encouragement is given throughout by the facilitator to promote participation by all those involved. The facilitator's job is to move discussion away from the personalised account of what the participant thought occurred to the more global perspective, away from the individual to the group and without leaving anyone out or alienating them.

This is a chance to finally sit around a table and discuss events immediately after they have occurred, with those who were involved or aware of what went on. This is something that does not happen often enough in the clinical environment but can provide an unrivalled learning experience and a chance for real, open, and honest reflective practice. Enjoy the day!

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Chapter 5: What is Crisis Resource Management (CRM) in the Emergency Department?

Where did CRM come from?

Crew resource management was developed by the aviation industry in the late 1970's by aviation psychologists after an analysis of airplane crashes showed that human error was involved in 85% of events. It emphasised the role of human factors in high stake environments and taught crews to use all available resources to achieve safe flight operations. A decade later, an American anaesthetist called David Gabba was training as a Pilot when he recognised some of the similarities between the two environments of the operating theatre and the cockpit. From there, anaesthetic crisis resource management was born and the full body immersive medical simulation we know today began its development. Since then many specialities including our own have adapted the CRM points to develop their own version.

The publication of 'To Err is Human: Building a Safer Healthcare System' in 1999 by the Institute of Medicine in the US brought CRM into focus as the healthcare community began to realise the extent of medical error. This publication as well as documenting the extent of the problem, challenged the existing view that errors resulted from individual recklessness. Instead they suggested it was faulty systems, processes and conditions that led people to make mistakes or fail to prevent them. CRM forms an essential part of avoiding error and improving patient safety.

What does CRM involve?

Anaesthetic CRM lists the management behaviours below:

1. Anticipation/planning
2. Communication
3. Leadership/assertiveness
4. Awareness and utilization of all available resources
5. Distribution of workload and mobilization of help
6. Routine re-evaluation of situation
7. Awareness and utilization of all available information

These have been further adapted by our American colleagues with a further three additional behaviors.

Key crisis management behaviours added for Emergency Medicine (EM) CRM:

8. Triage/prioritization
9. Efficient management of multiple patients
10. Effective coping with disruptions/distractions

'Calling for help early' has been recognised as a factor in such a large number of incidents that it is often listed separately as individual management behaviour. CRM is also known as human factors or non-technical skills. These non-technical skills have traditionally not been taught in undergraduate

or postgraduate medicine. It is useful to divide these behaviours into Interpersonal or social skills and cognitive skills.

Non-technical skills

Interpersonal skills

- Communication
- Team working
- Leadership

Cognitive skills

- Situational awareness
- Planning
- Decision making
- Task management

But haven't we all got great communication, team working and leadership skills?

Admittedly it is rare to find a clinician who doesn't list communication, team working and occasionally leadership as one of their strengths. Yet analysis of medical behaviour patterns does not support this view and indeed most clinicians would not recognise their working environment to be filled with colleagues who all do this well.

So what do they mean, or more importantly, how do I get better at them?

In simulation training each training episode is debriefed by a facilitator who will explore various examples of CRM and defines practical measures, which individuals can employ to improve.

It is clear no one factor sits in isolation from each other but rather they are all interrelated. So good team working must involve excellent communication skills, task management and planning and leadership. Likewise, good situational awareness relies on communication, team working and decision making.

Although CRM lists some very simple points on its own knowing the components of the list does not improve practice. Each point needs to be broken down so that individuals have some practical ideas of how to improve.

Some techniques to improve your CRM

Interpersonal skills

Communication

- Sharing the mental model
- Remember: Things said are not things heard and things heard are not things understood

- Use checks to ensure understanding – ask them to repeat command to check understanding and acknowledge whether this is correct
- 'Actively' listen

Team working

- 'A cooperative effort by members of a team to achieve a common goal'

- A good team player does not rely on excellent leadership. They will assist in the management of a patient and overcome weaknesses in leadership to ensure the patient has the best possible care.

Leadership

- Influences and directs the performance of team members by using all available resources towards the achievement of a defined goal.
- 'Like' all your team members
- Construct an environment where all team layers feel able to share their views
- Offer and request information
- It is 'What is right' not 'who is right'
- Do not stick with one leadership style

Cognitive skills

Situational awareness

- The ability to perceive and assess a situation and anticipate future developments
- Background control is a technique to avoid the fixation error inherent in concentration.
- Ensure you remember to scan your environment frequently to pick up change.
- Encourage all team members to take on this role.

Planning

- Planning is a mental process requiring effort – ensure this is your only task
- Always consider the worst case scenario
- Always plan with alternatives and factor in a sufficient buffer of time, resources and staff.
- Consider long-term consequences – as emergency physicians we are particularly poor at this.

Decision making

- Use Decision models such as DECIDE or FOR-DEC

  Detect – something has changed

  Estimate – does this change have any significance?

  Choose – choose a safe action

Identify – what options do I have?

Do – Act

Evaluate – what effect did action have?

- Correct mistakes immediately
- Call for help early
- Encourage feedback
- 'wipe the slate clean' stop your thought process being clouded by medico-legal concerns or social implications
- Critically evaluate your first hypothesis
- Generate alternatives – avoid fixation error by listing differential diagnosis or alternative actions

Calling for help early

- Use a structured format.
- Define what you want as the outcome prior to the call and stick to it.
- Share the mental model
- Gather the appropriate information prior to the call

Emergency Medicine Crisis Resource Principles

Behavioural Principle	**Example of good practice**	**Example of poor practice**
Anticipation/planning	Familiarises self with resuscitation area and equipment before clinical encounter	Superficial evaluation Minimises reported problems
Communication	Clear, direct instructions to an individual by name Invites discussion from all team members	Instructions thrown out into the air Does not identify self to team Does not identify team members
Leadership/assertiveness	Takes control, accepts discussion Controls dissent	Allows antagonism to develop Blames individuals for failings
Awareness and utilization of all available resources	Calls for appropriate help	Overestimates own ability to cope under pressure and manage a clinical scenario
Routine re-evaluation of situation	Reassesses condition after an intervention	Institutes an intervention and then leaves

Awareness and utilization of all available information	Reads hospital and paramedic notes	Jumps to a course of action on incomplete information
Distribution of workload and mobilization of help	Delegates tasks to people able to cope with the task	Does not recognise when an individual is overloaded with tasks
Triage/prioritization	Defers less vital interventions	Focuses exclusively on one patient to the detriment of others
Efficient management of multiple patients	Directs attention to the sickest patient, maintains awareness of whole department	Focuses on a single patient with a more interesting condition
Effective coping with disruptions/distractions	Controls information flow	Ignores requests for help

So why do we need them?

We work in an extremely error prone environment due to the complexity of our working environment, not only due to its characteristics but also due to the demands imposed on us as problem solvers.

Problem solving in the complex environments is exacerbated by:

- Uncertainty
- Lack of transparency
- Singularity of the situation
- Information overload or lack of information
- Time pressure
- Risk
- Plurality of goals
- Presence of many players

It is worth remembering that complexity is a subjective characteristic i.e. 'a mental construction' which depends on the experience of the individual of a situation or of task demands. While you may not experience the situation as complex your colleague may.

Conclusion

Although simulation training has made the training of CRM its remit it should not be the only place to experience and practise these ideas. For them to become effective in a crisis situation they need to be practised on a daily basis. Try one or two of them in your daily practice.

Chapter 6: Conclusions: application to the work environment, what can be simulated and what is not appropriate to simulate

By now you will have an appreciation for the unique content of this ST4 Emergency Medicine Simulation Course. However, this course is not designed to enhance your core medical knowledge. It will also provide little development in your psychomotor skills e.g. placing a chest drain. But what it will provide is experience in developing your Crisis Resource Management (CRM) and decision making techniques that are every bit as crucial for good outcomes.

Therefore, you may ask, is any of this relevant to EM? It is arguably more so than any other specialty. The ED's unique operating characteristics provide a natural laboratory for the study of error [1]. The multiple, complex functions of an ED combine with overcrowding, high decision density and excessive cognitive load. Add to the mix the views, opinions and skills of various other external specialties and you have the ideal environment for adverse outcomes to occur [2]. This is the case whether you work in a busy urban environment or a rural setting.

So, is this relevant to you as the EM trainee? As a higher trainee you are regarded as a ***Senior Clinical Decision Maker*** [3]. This means that at times you will be the lead clinician for a particular case, responsible for making

urgent decisions that have significant implications for the outcome of the patient.

Firstly, this may involve a rare clinical condition which you have only read about, and requiring you to use unfamiliar tests and treatments. The simulation environment on the course is ideal to expose yourself to these types of difficult cases.

Secondly, senior clinical decision making may require dealing with treatment complications and team conflict. Here, the more inexperienced staff will look to you for leadership in moments of crisis. Picture yourself in the resuscitation bay with the hypotensive septic patient and two in-patient teams in open disagreement. Or a FY2 doctor who has accidentally rendered a patient apnoeic with midazolam. It is these types of scenarios where you will call on CRM principles such as leadership and communication to rescue the situation[4].

Can the elements of CRM taught on the course translate to other facets of the ED outside of a resus scenario? Yes they can.

You will have worked a night shift where Majors area is completely full with a 3 hour wait, 2 sick patients in the resuscitation room and staff shortages. How do you deal with this? Many key CRM points are just as relevant to this sort of departmental problems too.

There are, however, many elements of EM training that are not appropriate for the high fidelity simulation setting. Detailed history taking and proper physical examination techniques are not skills to be refined in the setting of a high fidelity manikin. Although technology can help (e.g. video teaching) it is no substitute for either actual, or actor – simulated patients.

As mentioned earlier, procedural skill development is not relevant to the high fidelity SimMan manikin – other simulation equipment, and other courses are more suitable for these.

The only final thing to say is…….enjoy the course!

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Appendix: Glossary of terms

Abbreviation	**Definition**
CEM	College of Emergency Medicine
CRM	Crisis Resource Management
CVP	Central Venous Pressure
ED	Emergency Department
EM	Emergency Medicine
HDU	High Dependency Unit
HFS	High Fidelity Simulation
HPS	Human Patient Simulation