Could advanced simulation training make emergency medical staff better skilled healthcare professionals?

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Abstract: (150-200w)
The sentence “practice makes perfect” is mainly used for practical skills acquisition. Ambulance staff training curriculum has always had a strong emphasis on skills development. While using the simplest technology may be used for rehearsing protocols or practising basic skills, newer technologies, such as advanced patient simulators coupled with digital audio and video recording systems may bring fresh opportunities that can help staff develop better team working skills. Such types of higher level skills can only be addressed through highly realistic simulation training, which are safe re-enactments of real life situations that may involve other emergency services. There is now an increasing body of evidence demonstrating that exposing healthcare professionals to simulation training can significantly enhance their level of preparedness to deal with a range of situations and help them develop their clinical skills and knowledge. Ambulance staff still have too few opportunities to take part in highly realistic simulation exercises followed by structured debriefings that enhance reflection. Quality of patient care may be improved by increased investment of ambulance services in this area of continuing professional development for their staff.

Key words:
Simulation training, Teamwork, Patient safety, Human factors, Patient simulators, High-fidelity simulation

Key phrases:

- Simulation is an effective training technique for the acquisition of technical and team working skills.
- Simulation training encourages reflective practice and can help support continuing professional development.
- The adoption of the most appropriate training methods should enhance the quality of patient care.
- Each ambulance service should aim to develop a simulation training programme to enhance the level of preparedness of their staff.

So far, the training of pre-hospital healthcare staff has primarily and successfully made use of basic simulation techniques and tools. In several instances the clinical skills acquired thanks to the use of part-task trainers has shown to be transferable to real life practice. Paramedics training in endotracheal intubation using a systematic mannequin-only teaching programme demonstrated an acceptable success rate in the actual field setting (Stratton *et al.*, 1991). A similar study involving nurses and the insertion of a laryngeal mask airway demonstrated also a positive transfer of skills from mannequin to real patients (Roberts *et al.*, 1997). Another study, which used a more sophisticated mannequin at the time, showed transferability of skills of medical students from mannequin to patient regarding cardiovascular assessment (Woolliscroft et al., 1987). While the vast majority of emergency medical staff have only ever been trained using fairly basic mannequins, a few centres have offered highly realistic (high-fidelity) simulation training to paramedic staff (Gordon et al., 1999) for several decades. Such type of simulation goes well beyond the acquisition of clinical skills, and often makes use of patient simulators such as the Laerdal SimMan™ (Figure 1) or simulated patients, who are trained actors (Collins and Harden, 1998) (Figure 2).

Figure 1: Student paramedic treating a patient (remotely operated patient simulator) during a scenario taking place in a simulated home environment.

Figure 2: Use of a simulated patient to enhance the realism of the scenario during the patient assessment phase.

From part-task-trainers to interactive patient simulators

It is not uncommon that during training, to complement the skills that may have been acquired using passive part-task trainers such as airway management models, junior paramedics are given the opportunity to work in operating departments to perfect their intubation skills on real patients. To that effect it has been reported that trainee paramedics have been involved in simulation training sessions to perform intubations alongside junior anaesthetists in a simulated environment as part of a scenario (Schwid *et al.*, 2002). This allows for interprofessional education and possibly replicates what sometimes occurs in real life. In the scenario described by Schwid et al (2002), the acquisition of intubation skills by the trainee paramedics (or more precisely, not to intubate properly in this case) was not the learning objective in this instance. The aim was to expose the junior anaesthetists to a series of incidents with potentially life threatening consequences for the patient (Oesophageal intubation and anaphylactic reaction) and see how they would assess the situation and manage the patient. The different physiological signs showing that the patient had not been properly intubated and had a reaction to an antibiotic injection could simply be observed by the fact that chest movements were absent and that according to the patient monitor the patient was desaturating and becoming tachycardic. All of this was possible because they were using a computer controlled patient simulator. With an oesophageal intubation, no breathing sound can be heard from the patient simulator's chest. At the onset of the anaphylactic reaction, the patient's tongue can be made to swell, and should the patient be breathing spontaneously, wheezing would be heard. This type of very advanced mannequin can be pre-programmed or controlled by an operator in real time to respond interactively to any the treatment provided and even communicate verbally to the scenario participants when conscious. This is normally achieved by having the operator speaking in a microphone to a speaker inside the patient simulator's head. It is particularly well adapted for the development of realistic and complex or rare clinical scenarios and for uniprofessional or multiprofessional team training.

Being prepared for any situation

Work in the pre-hospital care setting is usually very varied, hence the importance of maintaining an appropriate level of preparedness. This can be to respond to and manage crisis situations potentially involving a very large number of casualties, or smaller scale incidents that are normally unexpected. One of the main advantages of simulation is the opportunity it offers in controlling the learning experience offered to the participants. With a little know-how patient simulators can be setup to reproduce a very wide range of clinical cases, going from a male patient with traumatic wounds to the expectant mother suffering from pre-eclampsia. "Being prepared for any situation" should also include training alongside other emergency services so staff can learn from one another.

One of the recommendations recently made by members of an expert panel from the Society for Academic Emergency Medicine is that "*simulation-based training should prioritize procedures infrequently encountered in clinical practice and commonly performed procedures that possess a potential risk to a patient when performed by the less skilled practitioner" (Wang et al., 2008)*. It is commonly said that "practice makes perfect", however as clearly recognised by Beaubien and Baker (2004) and Salas and Burke (Salas and Burke, 2002), this statement is only true if the learners can benefit from timely expert feedback and guidance, usually immediately after a scenario. This allows the scenario participants to learn from their mistakes as well as develop learning or development plans for themselves. Such approach also encourages reflection and helps scenario participants and others assimilate what they experienced or observed.

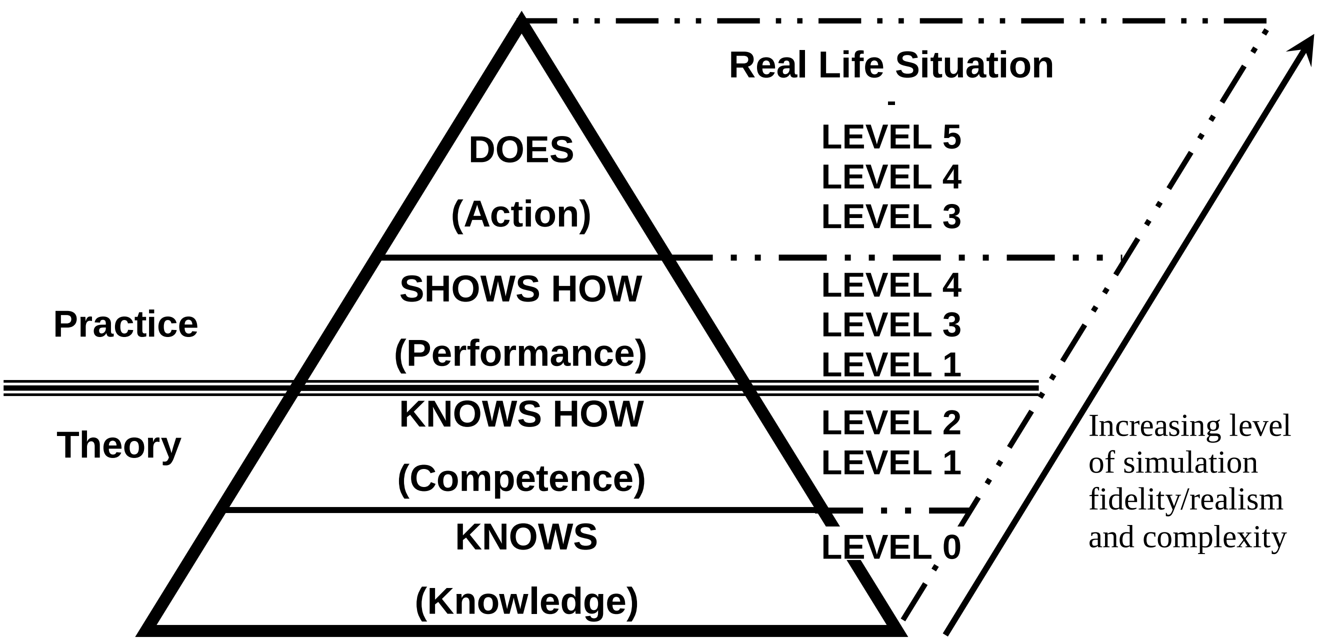

Figure 3: Framework for acquisition of experience and skills through simulation training adapted from the pyramid proposed by Miller (1990) and according to the simulation levels defined by (Alinier 2007). Reproduced with permission from Medical Teacher.

Key offerings of modern simulation technology

Technological developments have had an impact on previously accepted educational models such as Miller's pyramid for the assessment of clinical skills, competence and performance (Miller, 1990). It was then argued that the highest level of assessment could only take place when observing real practice. More recent adaptations of Miller's pyramid argue that some types of simulation modalities, that is the appropriate use of the simulation technology and the implementation of the appropriate educational strategy, can be used to assess or observe simulation participants "doing" as if they were dealing with a real incident (Alinier, 2007) (Figure 3). This is only achievable if three key components have been carefully considered and addressed to help participants suspend disbelief. The identified components include the environment, the equipment, and the psychological status of the participants, or more precisely if they perceive the simulation experience to be believable (Beaubien and Baker, 2004) (Figure 4). Much of this is dependant on how well the participants have been prepared for the experience, if they have been appropriately encouraged to "Play the game" in considering the patient simulator as a real patient, and if their trust has been gained by the facilitators. There lies a very important factor for the success of a simulation session. Simulation can be a powerful training tool or methodology in many ways depending on how it is facilitated. It can help to build someone's experience as it can make someone feel very incompetent. For the same participant's performance tackling a scenario, whether it was good or poor, the debriefing can make the participant feel very demotivated or inspired to learn more. The main factor is how the session is being facilitated and how feedback is given. When used for training purposes, the facilitators (not in a "trainer" role) should remember that it is a learning experience for the participants, not an assessment. It should be an environment where participants should not fear to make a mistake n front of their peers and be humiliated. The debriefing should be conducted in a non-judgemental way to allow all participants to learn from the mistakes made, leaving the session with a positive attitude rather than hate for future occurrences of this type of activity.

Figure 4: Patient simulator setup inside an ambulance for a high level of environment fidelity with operator sitting in the cabin.

Although derived in the context of surgical training, four key advantages of simulation identified by Kneebone (Kneebone, 2003) are:

• The training agenda can be determined by the needs of the learner, not the patient. Learners can focus on whole procedures or specific components, practising these as often as necessary.

• Because the environment is safe, learners have “permission to fail” and to learn from such failure in a way that would be unthinkable in a clinical setting. This gives the opportunity to explore the limits of each technique (and individual) rather than having to remain within the zone of clinical safety.

• Simulators can provide objective evidence of performance, using their inbuilt tracking functions to map a learner’s trajectory in detail. An increasing range of metrics is being developed and validated, offering potential for formative and summative assessment.

• The capacity of simulators to provide immediate feedback in digital form offers potential for collaborative as well as individual learning.

Supplementation of patient simulators with video cameras

Until recently, for full-scale patient simulation (Alinier, 2007), the feedback provided by patient simulators consisted of a timed log of changes in the physiological parameters and events noted by the patient simulator operator relating to the treatment provided by the scenario participant. Any other audio/video recording facility had to be installed at extra cost by another specialist company (Alinier, 2008, Seropian, 2003). An increasingly common feature of patient simulators is that their software interface now offers the capability to video record what happens during a scenario alongside the physiological data using a webcam or more sophisticated camera systems. The two added advantages of videoing scenarios are that:

- It allows others to remotely observe the scenario while it is occurring (Figures 5 a and b).
- The recording can be played back to the scenario participants and help support the debriefing.

When not involved in a scenario, the feedback generally received suggests that students benefit greatly from being able to remotely observe their peers. They can analyse, take notes, and discuss as a group what happens in the scenario without distracting the scenario participants (Alinier, 2007). Although it is reported that students prefer being hands-on during a simulation session rather than passive, the results of a study demonstrated that, in the short term, students learn as much by watching a facilitated scenario than by being involved in one (Morgan et al., 2002). The idea of allowing others to watch their peers take part in a scenario is to encourage them to reflect about what is happening from a care provider and patient point of view, to think if they would do things differently, and to allow them to learn from others’ mistakes. Figure 5 b shows how much observers can become engaged with what may occur during a scenario depending on their peers' actions or by witnessing the condition of the patient degrading.

Figures 5 a and b: Groups of students in an observation room watching a live scenario taking place in an A&E setting (a) or ITU setting (b).

There is always a degree of anxiety when participants realise that they are going to be observed by their peers, but during their first scenario they soon totally forget about the cameras. The quantitative feedback collected after each of our sessions shows that participants report that neither the presence of the cameras, or their peers or tutors who observe remotely, affects their performance. Such results however must strongly correlate with the way the session is being conducted to make the participants feel at ease, but this would need to be confirmed by carrying out a proper research study involving facilitators who have very different communication styles. Although it is not always necessary for scenario participants to watch themselves, video recordings of scenarios are regularly used to support debriefings of complex scenarios and investigate team dynamics (Murray and Foster, 2000, Wallin et al., 2007, Ostergaard et al., 2004). In a bid to improve patient safety a similar approach has also been adopted to analyse real life paediatric and orthopaedic operations (Catchpole *et al.*, 2007). The analysis of simulated or real cases allows for the identification of potential problems, which can be deficiencies in a system or related to human factors such as communication or teamwork issues. Such problems can be detrimental to patients and need to be addressed by further training or procedural changes.

The use of high-fidelity simulation to improve patient safety

As highlighted by Good (Good, 2003), patient simulators have a unique role to play in helping students, postgraduates and practising clinicians learn to recognise and treat infrequently occurring and often highly complex clinical problems, but also to practise and develop team working skills. It is widely recognised that many patient deaths or near misses are due to human errors, and very often communication failures within healthcare teams (Kohn et al., 1999, Leonard et al., 2004). Those errors are preventable, and a reported lack of training in the domain of communication and interpersonal skills within healthcare teams have encouraged modern curricula to address these topics (Hundert et al., 1996) (Figure 6). Effective and regular training in teamwork and communication has the potential to substantially decrease the rate of medical errors and deaths due to preventable adverse events. Teaching and assessing communication and interpersonal competence is common in other high-risk industries such as aviation, nuclear energy, and offshore installations (Helmreich et al., 1999, Department of Health, 2006, Leonard et al., 2004, Donaldson, 2009) but is not yet compulsory in medicine or healthcare in general (Department of Health, 2006). Simulation is a common element of Crisis Resource Management (CRM) courses (Murray and Foster, 2000, Gaba et al., 2001).

The key principles of CRM (Rall and Gaba, 2005) are:

- Knowing the environment
- Anticipating and planning
- Using all available resources
- Preventing or managing fixation errors
- Using cognitive aids
- Exercising leadership and followership
- Using all available information
- Communicate effectively
- Cross-checks
- Assertiveness
- Calling for help early
- Distributing the workload
- Re-evaluating repeatedly
- Using good teamwork
- Setting priorities dynamically

Conscious implementation in clinical practice of the above principles can only enhance patient safety. Simulation can play an important role in identifying current teamwork issues or staff clinical practice deficiencies, but also in providing a medium through which one can learn how to implement the above principles.

Figure 6: Addressing communication issues between healthcare disciplines: Paramedic students taking part in a multiprofessional simulation session as part of a project funded by the Higher Education Academy - Health Sciences and Practice Subject centre.

Running large-scale emergency response exercises (Jenvald and Morin, 2004) on a regular basis would be too costly for emergency services, however an ongoing smaller scale simulation training programme run by a small team of trained and dedicated facilitators could prove very effective at maintaining staff skills and level of preparedness for rarely occurring situations. Such initiative is currently being put in place by the South East Coast Ambulance Service NHS Trust where static and mobile simulation will be introduced to ensure staff are clinically up-to-date and trained in human factors (Mitchell et al., 2007). Their plan is to expose clinical staff on a yearly basis through a formative simulation training programme covering human factors in a training centre and in addition to run ad-hoc simulation training with a mobile unit equipped with video recording equipment while staff are on duty with their vehicle and equipment. The programme would ensure that each frontline staff would benefits from a minimum of two simulation training experiences per year.

Conclusions

Even the combination of the most advanced patient simulators is still a fair way from being perfect duplications of real patients and meeting all the possible educational needs of healthcare professionals (Alinier et al., 2006). Despite a few limitations in the health care setting where the focus is often on the patient, high-fidelity simulation is widely recognised as the way forward to address patient safety issues. Despite the cost of the technology, the main barrier to the implementation of a simulation training programme is often the cost of employing the staff who will make it a success. The facilitation of high-fidelity simulation sessions is very different from traditional teaching and requires particular skills which often call upon the expertise from several people. Some of the key attributes required are: good communication and debriefing skills, clinical and technical knowledge, and expertise in the principles of crisis resource management and effective team working. Higher expectations from the general public and probable future government initiatives may force more investment in the provision of patient safety focused Continuing Professional Development for ambulance services frontline staff.

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