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Investing in sophisticated medical simulation training equipment: Is it really worth it?

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Introduction

The acquisition of important life-saving skills, based on the fundamentals of a range of key physiological, biological, and pharmacological principles is paramount to nursing, medical and paramedical education. Over the years, the advancement of technology has enabled the commercialisation of ever more sophisticated and realistic training tools which can play a very important role in the acquisition of skills. The application of such developments goes back to the studies of cardiopulmonary resuscitation skills using the first Laerdal Resusci-Ann manikins (Lind, 1961) and the development of the early full-scale patient simulators started in the 1960's (Abrahamson & Wallace 1980). Nowadays, for example, the newer training tools allow for educational studies involving sophisticated virtual reality simulators for ureteroscopy training (Jacomides et al 2004). However all this training fanciness comes to a price that is not financially affordable by all training centres and one may wonder if it is really cost effective or even necessary to make such investments for training purposes. Could it simply be a "technico-educational" trend started by fiddly clinical tutors and biomedical engineers or is it really bringing added value to the learning experience of our students and trainees?

The reason behind this article is to elucidate those points from my personal perspective, as a trained engineer/physicist working in a Higher Education Institution, managing the operations of a medical simulation centre (HICESC 2005) and facilitating medical simulation training courses for students from different disciplines, and also a member of the Executive Committee (Secretary) of the Society in Europe for Simulation Applied to Medicine (SESAM).

Background information on the technology available

The range of training tools and teaching methods available to clinical skills centres has greatly improved since the use of oranges to teach cannulation (Bowyer et al 2005). Students can now use sophisticated self-directed learning systems such as the Laerdal Virtual Intra Venous trainer which uses a mixture of screen-based interactive simulator with a haptic device to simulate the insertion of a cannula into a human hand or arm (Bowyer et al 2005). Another increasingly popular way of teaching, and in which I have a particular interest, involves the use of sophisticated and interactive computer controlled patient simulators which allow for contextual inter-professional teamwork training through the exposure to realistic clinical scenarios (Beaubien & Baker 2004). Such full body size mannequins are usually setup in simulated operating theatres if it is for operating team training (Aggarwal et al 2004, Holzman et al 1995), in simulated Intensive Care Units for ICU staff training (Hegarty & Bloch 2002, Alinier et al 2004), or even in immobilised ambulances for emergency medical staff or paramedic training.

Although they appear to have only recently become available on the market such mannequins were first developed in the late 60's with the earliest of its kind, "SimOne", created by a team of engineers and scientists from the University of Southern California, Aerojet General Corporation and the Sierra Engineering Company (Hoffman & Abrahamson 1975). Recently Laerdal®, METI® and Gaumard®, have each commercialised medium range computer-controlled mannequins which are more affordable than the fully interactive patient simulators known as the "high fidelity simulation platforms". These more affordable but still expensive mannequins, are respectively SimMan®, Emergency Care Simulator (ECS®), and Hal®. They are partly interactive and offer an interesting range of training capabilities which suit most healthcare professionals' training needs (Airway features, spontaneous breathing, voice, auscultation sounds, ECG output, palpable pulses, blood pressure, venous system…) (Alinier 2006). They allow for realistic interprofessional training sessions where students can be exposed at will to patients with almost any medical condition for which they will have to care. Trainees can be given full control over the treatment of the patient simulator without prompts from their tutor as a real life is not endangered and it allows them to learn from their mistakes. The technology makes that their actions do not need to be triggered by verbal cues, but instead by them performing a correct patient assessment as they would have to do with real patients (Alinier 2006).

The trainees' opinion

There is no doubt that students enjoy practical activities as it often breaks the monotony of lectures where they are bombarded with theoretical facts that they have to assimilate. Several studies have been conducted to evaluate the benefits of different simulators or part-task trainers in the acquisition of a range of skills by trainees (St Clair et al 1992, Roberts et al 1997, Owen & Plummer 2002). The vast majority of such studies demonstrate the value of such training methods and what students think about it, and it is very often extremely positive, however it has to be recognised that the students' perception is directly influenced by the way the session is conducted and how they have been introduced to the concept of simulation.
The transferability of the skills acquired by candidates to real practice is unfortunately often supported only by anecdotal evidences and might be biased by their enthusiasm and excitement for using modern training technology. People in general are attracted by the latest gadgets or cars for example, and they feel the need to possess and use them, even if the only difference is a number of options that is in fact not extremely useful or even necessary. If or when available, trainees or students are also inclined to express the same view or present the same behaviour with regards to teaching equipment or methodology, and it will certainly also to the people assisting them through the learning process.
However it is fairly well recognised that "practice makes perfect", so there is certainly no harm in exposing students to simulated critical incidents and getting them to respond to them, hence when it happens for real they are normally more prepared and have an idea of what they need to do.

The practice of the richest countries

The acquisition of expensive training models makes that it is often not affordable by less fortunate countries. Such countries are sometimes left with only one option, that is to carry on using their traditional teaching and learning methods to help their students acquiring the skills they need. It often excludes the use of any sophisticated training models and calls upon the use of patients volunteering or being used without consent in teaching hospitals (Coldicott et al 2003). For ethical reasons such approach has now been banned in a number countries, but is still practised in the majority of places around the globe. In an attempt to increase patient safety and comply with ethical issues significant investment has been made by the health education sector. The investment has often allowed to provide better training facilities and teaching tools. There are, for example, currently over 1500 adult and paediatric patient simulators spread over approximately 40 countries across the world (BMSC 2005). Of these, the majority are in the

United States and approximately 240 are based in the United Kingdom alone. Such models are very expensive and often require specialist skills to be operated and maintained, yet their number has grown at an unprecedented rate over the last 5 years. This shows that it must be recognised as being something to have for a reason or another.
The use of simulation in medical training is becoming well developed and this can be observed through the large number of simulation centres that now exist around the world, however realistic simulation technology is still only sparsely used some disciplines such as in nursing education. Research funded by the British Heart Foundation (Edcomm/Oct98/9d) at the University of Hertfordshire has shown that the use of scenario-based simulation experience is indeed beneficial in improving undergraduate nursing students' skills (Alinier et al 2006).

What makes it a successful training method?

The way simulation training tools are used is more important than the tool itself. To provide a beneficial learning experience to students, the patient simulator needs to be used appropriately, that is accordingly to the level of experience of the trainees and with adequate briefing.

The use of simulation in medical training is becoming well developed and this can be observed through the large number of simulation centres that now exist around the world, and through the development of national and international societies and associations and their meetings dedicated to simulation learning such as "SESAM" (Society in Europe for Simulation Applied to Medicine), "SMS" (Society for Medical Simulation), "UK NAMS" (UK National Association for Medical Simulation) to only site a few (websites in the list of references). However realistic simulation technology is still only sparsely used in some disciplines where it could be particularly relevant such as in nursing. Research funded by the British Heart Foundation (Edcomm/Oct98/9d) at the University of Hertfordshire has shown that the use of scenario-based simulation experience is indeed beneficial in improving undergraduate nursing students' skills (Alinier et al 2006).

Organising access to a large cohort of students or reorganising their timetable to incorporate scenario-based simulation training can present difficulties. A method adopted by some centres is to adopt a more flexible approach to allow students to book time to familiarise themselves with the equipment and patient simulator under supervision as they would do in a clinical skills centre (Bradley & Postlethwaite 2003, Du Boulay & Medway 1999).

The way forward

As pointed out earlier in this paper, there is now growing evidence that highly sophisticated models and training devices are beneficial to the acquisition of skills required by healthcare trainees, but also to the maintenance of some less commonly used skills by qualified and practicing healthcare professionals. Collaboration of a group of institutions or centres can be particularly interesting in terms of costs sharing, especially in the initial stages of development and acquisition of expertise in simulation-based education. Centres which cannot afford the purchase of a patient simulator could collaborate toward a common initiative in order to share the financial burden. An option adopted and still used by a number of companies or institutions is to rent out the facilities from centres that possess the equipment required. This can present a number of advantages for both parties especially if it is not used on a permanent basis.

As highlighted in the proceedings of a recent conference held in Sibiu, Romania: "*The major problems that have to be faced regarding the adoption of such technology are the financial commitments incurred by the equipment itself and its adequate use by lecturers or trainers. Teaching using realistic simulation requires a different approach to traditional clinical skills teaching for example. The use of advanced mannequins may also require computing skills not available within the team of lecturers wanting to make use of the technology and therefore require additional technical support and training (Bradley & Postlethwaite 2003). If time is not a*

significant factor in the implementation of simulation training, minimal institutional support and appropriate training of staff can progressively enable the development and efficient use of such technology in a nursing curriculum. The environment in which the patient simulator is setup, along with the medical equipment surrounding it, is also a key element in the delivery of realistic simulation training sessions, and can incur major additional costs. However we believe that even with a limited budget it is possible to create and acquire the resources needed to expose nursing students in an effective way to simulation training. Working towards the development of a sophisticated and specialised training laboratory at low cost requires the use and development of in-house resources in all possible aspects." (Alinier et al 2004, p161). Key to the success of an effective and sustainable implementation of simulation training is a mix of skills and attributes which include dedication, enthusiasm, collaboration, and networking (Alinier et al 2004).

Conclusion

Our experience of developing a university-based simulation facility has been lengthy, as it has been conceived on a limited budget as we were not sure how it would be perceived and if it would be successful or not. Our centre, HICESC, is now well established and used very regularly by medical, nursing and paramedic trainees. The most important to take away is that investing in expensive training tools such as computer controlled patient simulators is very valuable as long as it is appropriately and intensively used. It enables the exposure of trainees from different disciplines to specific patient cases in controlled and safe environment where we can assess their knowledge and their teamwork and communication abilities. It requires the adoption of a different teaching approach from basic clinical skills or Advanced Life Support training to obtain the best results. This means that tutors need to be trained accordingly and interact with the wider simulation community to benefit from the experience of others. Similarly, trainees need to be briefed in order to understand how those new training tools operate and how they are meant to learn and benefit from such exposure. With time and dedication, all institutions should be able to derive plans that should allow them to effectively expose their students to simulation practice. It is through the training of a dedicated team of teaching staff and their accumulated experience of conducting simulation sessions that their expertise will increase to the benefit of the students.

References

- Abrahamson S, Wallace P. 1980. Using computer-controlled interactive manikins in medical education. Medical Teacher 2 (1), 25-31
- Aggarwal R, Undre S, Moorthy K, Vincent C, Darzi A. 2004. The simulated operating theatre: comprehensive training for surgical teams. Quality and Safety in Health Care 13 (Suppl 1):i27-i32
- Alinier G. 2006. A Typology of Educationally Focused Medical Simulation Tools. Medical Education (under review)
- Alinier G, Hunt B, Gordon R, Harwood C. 2006. Effectiveness of intermediate-fidelity simulation training technology in undergraduate nursing education. Journal of Advanced Nursing (in press)
- Alinier G, Hunt WB, Gordon R, Harwood C. 2004. Enabling students to practise nursing skills using simulation technology: Could your institution do it? Paper presented orally at the 5th European Federation of Nurse Educators (FINE) Conference, Sibiu, Romania, 14-15 October 2004 and published in Beldean L, Zeitler U, Rogozea L. 2005. Nursing Today. Alma Mater, Sibiu, RO. pp161-164. ISBN973-632-224-6
- Beaubien JM, Baker DP. 2004. The use of simulation for training teamwork skills in health care: how long can you go? Quality and Safety in Health Care 13 (Suppl 1):i51-i56
- Bowyer MW, Pimentel EA, Fellows JB, Scofield RL, Ackerman VL, Horne PE, Liu AV, Schwartz GR, Scerbo MW. 2005. Teaching intravenous cannulation to medical students: comparative analysis of two simulators and two traditional educational approaches. Studies in Health Technology and Informatics.111:57-63

- Bradley P, Postlethwaite K. 2003. Setting up a clinical skills learning facility. Medical Education 37 (Suppl. 1), 6-13
- BMSC (Bristol Medical Simulation Centre) website. http://www.bris.ac.uk/Depts/BMSC/linkseurope.htm visited on 28/10/05
- Coldicott Y, Pope C, Roberts C. 2003. The ethics of intimate examinations – teaching tomorrow's doctors. British Medical Journal 326:97-101
- Gaumard Scientific Company, Inc. URL: http://www.gaumard.com Last accessed on 14/11/2005
- Hegarty MK, Bloch MB. 2002. The use of simulators in intensive care training. Current Anaesthesia & Critical Care 13, 194-200
- HICESC (Hertforshire Intensive Care & Emergency Simulation Centre), University of Hertfordshire. URL: http://www.health.herts.ac.uk/hicesc Last accessed on 16/12/05
- Hoffman KI, Abrahamson S. 1975. The “cost-effectiveness” of Sim One. Journal of Medical Education 50, 1127-1128
- Holzman RS, Cooper JB, Gaba DM, Philip JM, Small SD, Feinstein D. 1995. Anesthesia Crisis Resource Management: Real-Life Simulation Training in Operating Room Crises. Journal of Clinical Anesthesia 7:675-687
- Jacomides L, Ogan K, Cadeddu JA, Pearle M. 2004. Use of a Virtual Reality Simulator for Ureteroscopy Training. Journal of Urology. 171(1):320-323
- Laerdal Medical. URL: http://www.laerdal.com Last accessed on 14/11/2005
- Lind B. 1961. Teaching mouth-to-mouth resuscitation in primary schools. Acta Anaesthesiol Scandinavica. 9 Suppl: 63–69
- Medical Education Technologies, Inc. (METI). URL: http://www.meti.com Last accessed on 14/11/2005
- NAMS UK (National Association of Medical Simulators). URL: http://www.namsuk.co.uk Last accessed on 28/11/2005
- Owen H, Plummer JL. 2002. Improving learning of a clinical skill: the first year’s experience of teaching endotracheal intubation in a clinical simulation facility. Medical Education 36: 635-642
- Roberts I, Allsop P, Dickinson M, Curry P, Eastwick-Field P, Eyre G. 1997. Airway management training using the laryngeal mask airway: a comparison of two different training programmes. Resuscitation 33: 211-214
- SESAM (Society in Europe for Simulation Applied to Medicine). URL: http://www.sesam.ws Last accessed on 28/11/2005
- SMS (Society for Medical Simulation). URL: http://www.socmedsim.org Last accessed on 8/11/2005
- St Clair EW, Oddone EZ, Waugh RA, Corey GR, Feussner JR. 1992. Assessing Housestaff Diagnostic Skills Using a Cardiology Patient Simulator. Annals of Internal Medicine 117: 751-756