Simulation-based training in Obstetrics and Gynaecology

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Abstract

Medical simulation incorporates mannequins and/or patient actors to allow training of clinical situations in an environment that causes no risks or discomfort to patients. Several aspects of clinical competence can be targeted in simulation sessions, including knowledge, technical skills, attitudes, communication skills, task distribution, and team support.

Technical advances in the last decades of the XXth century led to a new generation of simulators that opened the door to a new era of medical simulation. Many different types of simulators are currently available for post-graduate training in Obstetrics and Gynaecology, allowing residents to achieve a minimum level of skills around the time that they start managing real patients, and allowing healthcare teams to acquire and maintain competence in the resolution of rare and life-threatening situations.

Simulation-based training programmes require a considerable amount of investment in time and equipment, and it appears important for their sustainability to assure a clear institutional-level support, a strong leadership in course organisation, the availability of simulators that are appropriate to the learning objectives, and a non-threatening learning environment.

Simulation is becoming a growing part of routine post-graduate training and is likely to evolve to form part of assessment, continued professional development, certification and revalidation. With the place and benefits of the methodology becoming increasingly clear, the time has come for national and international institutions to get involved in the establishment of objectives and standards, in order to regulate initiatives in this field and to guarantee a high quality of training.

Key words: **Education, educational technology, in service training, mannequins, patient simulation.**

Introduction

Most obstetricians and gynaecologists in practice today acquired their clinical experience over the course of time at the patient's side, but increasing pressures to avoid unnecessary discomfort to patients, to increase the quality of junior medical care, and to limit clinicians' working hours, have put an additional strain on post-graduate training. The situation is particularly challenging in Obstetrics and Gynecology, due to the usually more delicate nature of clinical examinations.

Simulation-based training in Obstetrics and Gynaecology is not a recent phenomenon. More than 250 years ago, the King of France's midwife, Madame du Coudray, developed a real size mannequin to teach the management of childbirth to doctors and midwives across the country (Gelbart, 1998). It was probably already intuitive at the time that the dynamics of the birthing process are more easily explained using a three-dimensional full-scale model. Similar mannequins were used during the XIX and XX centuries throughout Europe (Figure 1). However, in the last two decades of the XX century, advances in mannequin construction and computer performance allowed the development of a new generation of simulators with greater anatomical accuracy and more realistic physiological responses.

Medical simulation is an educational method that incorporates mannequins of varying anatomical and

Fig. 1. — A birthing simulator used for teaching at the University of Porto during the XIX Century, including a real neonatal skull inside the fetal mannequin (courtesy of Prof. Amélia Ferreira – Museum of the History of Medicine, University of Porto).

physiological fidelity and/or patient actors, to allow individuals and teams to practice clinical situations in an environment that causes no risks or discomfort to patients, and poses less time restrictions and less constrains for the provision of feedback. Several aspects of competence can be targeted in simulation-based sessions, including knowledge, skills, and attitudes; as well as teamwork skills such as communication, task distributions, and team support. Establishing the educational objectives of the simulation session and the target audience that it is aimed at, are crucial aspects of the process, and ones that are profoundly affected by the availability of adequate simulators.

Many different types of simulators are currently available for undergraduate and post-graduate training in Obstetrics and Gynaecology, and they can be divided into four basic categories. *Part-task trainers*, that usually only represent a part of the human body and are developed for practicing a limited number of technical skills (i.e. pelvic models for training gynaecological examination, for perineal repair etc.). *Screen-based simulators* that use computer software to simulate a clinical environment, with or without a medical trainee interface (i.e. virtual reality laparoscopic trainers). *Full-body high-fidelity simulators* that use a real-size mannequin in combination with computer models, to provide more or less realistic responses (i.e. delivery simulators with maternal vital signs, or with fetal heart rate signals). *Hybrid simulators* that combine some or several of the previously mentioned characteristics, or that use them in association with patient actors.

Medical simulation needs to be looked upon as a learning method that can be integrated with other available solutions, rather than as one that is going to substitute them. At the post-graduate level, clinical experience with real patients is always required to achieve real competence, so simulation sessions are especially useful when held around the time that this begins, to improve technical skills and communication, as well as to increase self-confidence. One important exception to this general rule of post-graduate medical simulation are the clinical situations that, because of their rarity, do not allow the acquisition and maintenance of competence in real patients, and so regular simulation-based training is the best available alternative.

Potentialities of simulation-based training

Post-graduate simulation-based training in Obstetrics and Gynaecology is currently used with one of the two previously-stated general objectives in mind.

1 – To achieve a minimum level of competence for residents, around the time that they start to manage real patients.

2 – To provide training in management of acute clinical situations that, because of their rarity, make it difficult to guarantee acquisition and maintenance of competence, even by experienced staff. The use of simulation to train the resolution of rare but non-acute situations is less adequate, as there are practical limitations to the duration of simulation sessions.

With the first general objective in mind, simulation is used for the acquisition of competency in technical skills, such as the performance of obstetrical and gynaecological ultrasound, surgical techniques in gynaecology, and basic obstetric manoeuvers. Training can also be programmed to include the development of associated communication skills. The modality is usually very appealing to the younger

generations, who are used to more multi-sensorial and interactive learning experiences, providing greater involvement and enjoyment in learning, but it is obviously dependent on the realism of the simulator. It can be used to correct systematic errors, but also needs to be looked upon as a way to increase confidence and motivation. Some simulators provide objective feedback (such as evaluation of the ergonomics of movement in laparoscopy training), which has the advantage of being seen as an unbiased opinion. The faculty frequently refer that it allows the development of both skills and attitudes, and that it is a way of disseminating a clinical culture.

With the second general objective in mind, simulation-based training can be used to achieve and maintain competence in the resolution of obstetrical emergencies and acute surgical complications. Many such situations require rapid intervention by a multiprofessional team (obstetricians, anaesthetists, midwives, nurses), where not only technical skills, but also task distribution, communication, anticipation and planning, and response to stress are key factors. Therefore, the focus is not only on performance of technical skills (application of forceps to the aftercoming head, internal manoeuvers for resolution of shoulder dystocia, etc.) but also on teamwork. These sessions provide a unique opportunity for individuals to undergo self-evaluation and to perfect some of their technical and teamwork skills. It is usually perceived as an intense but positive learning experience, as long as a constructive atmosphere and a non-threatening environment are maintained. The training faculty usually see it is as an opportunity to identify and correct common errors and to disseminate a clinical culture.

While training of healthcare professionals is the most obvious purpose of medical simulation, it can also be used for assessment, certification and revalidation, in all the educational areas that were previously described.

Current use in Obstetrics

Several simulators on the market allow the training of basic obstetrical skills, usually transmitted at the undergraduate level, such as Leopold manoeuvers, evaluation of fundal height, and fetal auscultation. Others can be used for practicing vaginal examination during pregnancy and labour, and for assisting a normal delivery. More complex obstetrical skills such as external cephalic version, instrumental vaginal delivery, and perineal repair can also be practiced in currently existing simulators. More recently, basic aspects of first-trimester ultrasound scanning can be taught using virtual reality simulators or "phantoms", which are plastic mannequins that simulate obstetrical images when scanned using real ultrasound machines. Further advances in the field of virtual reality are expected in the near future, leading to simulators that can be used for training obstetrical ultrasound in all trimesters of pregnancy.

Training of experienced teams requires a much higher level of anatomical and physiological fidelity from mannequins to achieve a "suspense of disbelief". Currently available simulators allow the creation of scenarios to practice the resolution of several obstetrical emergencies such as cord prolapse, breech delivery with retention of the aftercoming head, shoulder dystocia, major post-partum haemorrhage, maternal cardiorespiratory arrest, and eclampsia (Figure 2). Both full-body simulators and hybrid solutions incorporating a patient actor may be used for this purpose, achieving varying degrees of realism for training technical skills and patient communication. Incorporation of mathematical models of human physiology into these simulators allows the generation of automatic and life-like responses, thus reducing the need for instructor input and increasing physiological fidelity.

Current use in Gynaecology

Several part-task trainers are available in the market for training gynaecological and breast examinations, for the introduction of intrauterine devices and for the placement of subcutaneous contraceptive implants. Similarly to first-trimester obstetrical ultrasound, the basic principles of gynaecological ultrasound can be practiced using virtual-reality simulators or "phantoms".

Training of hysteroscopy and laparoscopy techniques can be accomplished using box-trainers with real medical instruments, or using virtual-reality screen-based simulators, or with a more recent form of hybrid simulation, computer-enhanced video box trainers (Burden et al., 2011). All these options can help beginners achieve a minimum level of competence, but the realism provided by virtual reality simulators and computer-enhanced video box trainers may be sufficient to attract experienced clinicians to use them as a form of maintaining their surgical skills, practicing more challenging operations, or managing acute surgical complications.

Major challenges to implementation

Because of its very practical nature, simulation-based training requires a considerable amount of instructor time and feedback, as well as a limited number of participants per session. It can therefore be perceived as a more expensive learning method,

Fig. 2. — The maternal cardiorespiratory arrest scenario at the Obstetric Emergencies Course of the Biomedical Simulation Centre, Medical School – University of Porto, where multiprofessional teams practice the management of six rare and life-threatening situations (acute fetal hypoxia, shoulder dystocia, eclampsia, maternal cardiorespiratory arrest, retention of the aftercoming head, and major postpartum haemorrhage).

when compared to the classical postgraduate alternatives of clinical meetings, courses, and supervised practice. Specific investments are also required to buy the equipment and to maintain it operational, as well as to have appropriate facilities to organise simulation sessions. Some of the benefits of medical simulation appear to be almost intuitive, but to provide unequivocal evidence of them is a difficult task, as study design is hampered by several practical difficulties, including the obligation to provide equal opportunities in training, the large number of confounding factors that affect the learning process, and the scarcity of objective and meaningful outcomes.

Simulation-based programmes that have achieved some degree of sustainability report that it is essential to assure a clear institutional-level commitment to implement and maintain the courses (Ayres-de-Campos et al., 2011). In some cases, there are financial incentives for these programmes, as lower malpractice insurance premiums are offered to clinicians and to units that perform regular training. In countries where this is not available, the wish to promote an in-house "safety culture", with the potential to reduce litigation and adverse outcomes, may constitute the main motive for support, and funding for this can sometimes be found in local, regional or governmental healthcare sources. Institutions that have a major focus on training of junior staff may want to promote these courses to provide a more structured experience at the early stages of professional development.

Setting up postgraduate simulation-based training courses requires familiarity with the principles of adult learning, a good understanding of clinical practice, careful planning of course contents and support information, knowledge of simulators that are relevant to the learning objectives, and an ability to recruit good trainers (Ayres-de-Campos et al., 2011). Regular running of these courses requires a capacity to make adequate scheduling options, to prepare scenarios carefully, to avoid potential conflicts during the course, and to keep staff and participants motivated throughout the sessions. Strong leadership for both the strategic vision and everyday operational matters is an important characteristic of successful training programmes.

Some healthcare professionals dislike the personal exposure that simulation creates, considering it to be both threatening and stressful (Ayres-de-Campos et al., 2011). This may include junior trainees who have difficulties in certain clinical skills, or senior healthcare professionals who are worried about exposing some of their weaknesses. Some participants report the sensation of feeling under evaluation and/or of leaving the course with a reduced self-esteem. Removing the authority gradients within the course, providing non-directive debriefing with an emphasis on what was done well, and promoting self-evaluation rather than external assessment usually reduces many of these discomforts. Care must be taken to maintain a constructive attitude towards the learning process and to focus on letting participants arrive at their own conclusions rather than being told what to do. Attention to these issues is essential to assure increased satisfaction with the learning experience (Ayres-de-Campos et al., 2011).

A vision for the future

The medical simulation industry has been expanding over the last decade and will probably continue to produce increasingly realistic and educationally useful mannequins. On the other hand, it is unlikely that the purposes of avoiding unnecessary discomfort to patients and increasing the quality of care at all levels of training will diminish. Simulation-based training is therefore likely to become a growing part of routine post-graduate training, as a method to help

junior staff achieve a minimum level of competence, and for healthcare teams to practice the management of rare and life-threatening situations. As is the case in other areas of Medicine, such as Anaesthesiology, simulation is also likely to evolve to form part of assessment, both in the selection of candidates for the speciality and in the evaluation of their progress throughout residency. Simulation-based stations have become part of objective structured clinical examinations (OSCE) integrated in the assessment of candidates for the primary fellowship of the Royal College of Anaesthetists examination (http://www.rcoa.ac.uk/index.asp?PageID=1148). The unique potential of simulation to provide an insight into candidates' capacity to execute technical skills, to communicate with patients, and to interact with other healthcare professionals put it into a class of its own in the assessment process. In time, it may evolve to become part of continued professional development, certification and revalidation.

With the place and benefits of simulation-based training in Obstetrics and Gynaecology becoming increasingly clear, the time has come for the involvement of national and international institutions in the establishment of objectives and standards, and in the regulation of available programmes. The universities have a major role to play in the dissemination of the method, because of the financial and organisational advantages of academic simulation centres, where mannequins and facilities can be shared with undergraduate training, and where experienced teaching staff is easier to find. However, national and international institutions in the area of Obstetrics and Gynaecology also need to be involved, in order to guarantee a high quality of training at the postgraduate level.

Disclosure of interests

DAdC is a consultant for CAE Healthcare (Sarasota, Florida, USA).

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