Simulation in plastic surgery: Features and uses that lead to effective learning

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Background. Increased competition for surgical exposure and practice, smaller teaching platforms and shorter training times have an impact on the quality of training and competence of plastic surgery registrars. Demands for accountability and minimising patient risks are the driving forces for incorporating simulation in healthcare education. We addressed the problem of whether the features and uses of simulation would enhance postgraduate plastic surgery education and training and ensure more effective learning.
Objective. To identify and describe: (*i*) how simulation impacts on student learning; therefore, how the effectiveness of learning may be enhanced in postgraduate and/or plastic surgery education and training; and (*ii*) which features and uses of simulation have the potential to enhance learning in plastic surgery.
Methods. A descriptive design was used for the study. Data were collected by means of semi-structured interviews with 8 national and international role players in simulation.
Results. The results indicated a positive outcome of simulation, as it provides, e.g. a non-threatening environment for learning and improves clinical competency, ensuring an increase in patient safety. The features and uses of simulation render it an excellent method to enhance learning effectiveness at different cognitive levels and to fulfil a specific role in integrated and holistic training, while providing opportunities to practise specific skills. The lack of clinical opportunities can be addressed, and more clinical exposure and practice will result in fewer medical errors.
Conclusion. Simulation-based education in postgraduate plastic surgery education and training proved to be an effective teaching-learning method, which provides solutions to current deficiencies, hindrances and gaps in health professions education. The research question was answered and the use of simulation is recommended to enhance plastic surgery education and training and promote safe patient care.

Evidence of the role of simulation in medical education has emphasised the use of simulation technology over the past number of decades in an effort to increase learner knowledge, to provide students with controlled and safe practice opportunities, and to shape the acquisition of doctors' clinical skills.[1-3] Simulation is becoming an integral part of medical education at all levels,[1-3] as medical education, for various reasons, has fast become subject to radical and innovative changes.

Many major shifts in medical education methods are due to changes in the delivery of healthcare. According to Issenberg *et al.*,[3] in the USA, for example, the pressures of managed care shape the form and frequency of hospitalisation, 'resulting in higher percentages of acutely ill patients and shorter in-patient stays'. Medical students, therefore, have fewer opportunities to assess patients with a wide variety of diseases and physical findings, while reductions in physician remuneration due to shrinking financial resources constrain the educational time that doctors in training receive.[4] Consequently, at all educational levels, doctors find it increasingly difficult to keep abreast of skills and topics they need to practise successfully.[4]

Issenberg *et al.*[3] identify 5 factors that contribute to the increased use of simulations in medical education, i.e. lack of clinical teaching opportunities and therefore less patient material due to changes in healthcare delivery; new technologies for diagnosis and management; assessing professional competence; medical errors, patient safety and team training; and the role of deliberate practice.[4]

Surgical training in the 21st century is characterised by an increasingly objective, standardised approach using equipment, such as simulators, to optimise patient safety, surgical care and hospital resources, and minimise errors.[5] The driving forces behind these factors are developments in medical error statistics, evidence-based medicine and fewer attending hours. Through increased accuracy, simulation can improve results and lower risk and procedure costs because of fewer procedures and less operating room time.[5] Simulation during training allows students ample opportunity to hone their skills and competencies in safe, no-risk circumstances. Insufficient and inefficient clinical teaching has stressed the need for strategies to improve clinical education, including the use of simulation.[5] Simulation-based medical education is an educational method that makes use of simulation to bridge the gap between theory and practice.[6] Regarding medical simulation, the word simulation means 'imitation of the operation of a real-world process or system over time'.[7]

Over the past 30 years, new technologies in medicine have revolutionised patient diagnosis and care. Examples are the development of flexible sigmoidoscopy and bronchoscopy, and minimally invasive surgery, including laparoscopy, and robotics for orthopaedics, urology

and cardiology. The benefits of these innovations include reduced postoperative pain and suffering, shorter hospitalisation and earlier resumption of normal activities, as well as significant cost savings.[8]

These newer techniques, however, demand psychomotor and perceptual skills that differ from traditional approaches, and these innovative methods may be associated with a higher complication rate than traditional practices.[9] Haluck *et al*.[10] maintain that these 'newer technologies have created an obstacle to traditional teaching that included hands-on experience. For example, endoscopy requires guiding one's manoeuvres in a three-dimensional environment by watching a two-dimensional screen, requiring the operator to compensate for the loss of binocular depth cue with other depth cues.' One of the corollaries to these new techniques was the introduction of simulation technology in the training and assessment of students. Research indicates that training programme directors emphasised that virtual reality and computer-based simulations have become indispensable technological tools in clinical education.[10]

The Accreditation Council for Graduate Medical Education (ACGME) in the USA, in an endeavour to ensure and improve the quality of graduate clinical medical education and to attain a higher level of effectiveness, listed 6 domains of clinical medical competence.[8] Postgraduate programmes should provide educational experiences, which ensure that graduates demonstrate competence in ACGME project outcomes, i.e. patient care; medical knowledge; practice-based learning and improvement; interpersonal and communication skills; professionalism; and system-based practice.[11] These are the educational experiences that benefit most from simulation in the light of a lack of patients and clinical exposure.

Miller[12] proposed a framework (Miller's pyramid), which argues that a medical learner's clinical skills should be assessed at four levels: (*i*) **knows** (knowledge) – recall of facts, principles and theories; (*ii*) **knows how** (competence) – ability to solve problems and describe procedures; (*iii*) **shows how** (performance) – demonstration of skills in a controlled setting; and (*iv*) **does** (action) – behaviour in real practice.[4] Simulation technology is increasingly being used in each domain of competence to assess the first three of Miller's levels of learning because of its ability to programme and select learning-specific findings, conditions and scenarios to provide standardised experiences to all examinees and to include outcome measures that yield reliable data.[13] The research question was whether the features and uses of simulation would enhance plastic surgery education and training and ensure more effective learning.

Methods

The research included data collected by means of semi-structured interviews and a Delphi process. This article focuses on outcomes of the interviews. An article dealing with the Delphi part of the study has been published in *AJHPE*.[14]

Elements of grounded theory came into play to describe features and uses of simulation, and to relate why simulation lends itself perfectly to be included in educational programmes. Grounded theory (inductive approach) was used to develop recommendations to promote learning in postgraduate plastic surgery education and training, as a grounded theory deals with discovering, developing and verifying by means of systematic data collection and data analysis pertaining to a phenomenon.[15]

The study focused on the opinions and perspectives of medical and healthcare professionals regarding the features and uses of simulation, and whether and how simulation as an education and training

method might influence student learning. The study was aimed at developing recommendations to enhance the effectiveness of learning in postgraduate plastic surgery education and training by employing simulation as one of the methods used.

Semi-structured interviews

Semi-structured individual interviews were used to explore key national and international role players' opinions and perceptions on simulation-based medical education, aimed at investigating and establishing clarification on simulation in postgraduate plastic surgery education and training. The features and uses of simulation that might prove effective in postgraduate plastic surgery were thus determined. The researcher conducted the interviews because he is a skilled interviewer and was familiar with the topic; he knew how to phrase the questions, as he was aware of the frame of reference of the interviewees and the goals of the study. It was also important to concentrate on the responses and monitor the coverage of the topic – which would have been impossible for another interviewer.[16] An interview guide (Table 1), developed by the author on the basis of a literature review, was used. Occasionally,

Table 1. Guide for semi-structured interviews with national and international role players

Question

1. What experience with/exposure to simulation in the field of health education have you had in general? Briefly describe your experience with/exposure to simulation in terms of the type of simulation, your role, duration of involvement.

2. Are you currently involved in simulation and/or postgraduate education and training? In what context are you involved?

3. Does/can simulation influence student learning in postgraduate education and training? In what regard?

4. How can effectiveness of learning be enhanced in postgraduate and/or plastic surgery education and training (in the areas of knowledge, skills, clinical competence, professional conduct)?

5. Can simulation be used to enhance student learning at different cognitive levels? (Will the student only use simulation to remember knowledge/or understand/or apply/or analyse/or evaluate/or create new concepts and ideas?)

6. Which types of simulation or simulation modalities might lead to effective learning?

7. Which features and applications of simulation in postgraduate or plastic surgery education and training will lead to more effective learning?

8. Does simulation have: (*i*) a contribution to make to postgraduate education; (*ii*) a role to play in postgraduate education; or (*iii*) a specific value to add to postgraduate education?

9. What would your main consideration be if you decided to include simulation in your teaching and training programme?

10. If you have to guide a team of experts tasked to develop a curriculum with simulation as one of the training/learning methods, which important guidelines would you put forward?

11. Do you wish to make any recommendations that may be used in compiling guidelines on simulation for postgraduate plastic surgery?

12. Are there any recommendation(s) you would like to make when considering including simulation in specialist training?

13. Will you please share: (*i*) some of the lessons learnt regarding the implementation of simulation in a curriculum; and (*ii*) the biggest challenge in implementing simulation in training?

additional questions arose during the semi-structured interviews; the data thus collected were included in the research. Data on questions 3, 4 and 7 of the interview guide are reported in this article.

Unit of analysis

National and international role players in simulation and postgraduate education were requested to participate in the semi-structured interviews. Eight participants were invited to participate, all of whom accepted the invitation. Four interviewees were from the USA, Canada and the UK and 4 from South Africa (SA). They were directors of simulation units, clinical heads of clinical medical departments, programme directors of medical and nursing programmes, and education management specialists, researchers and representatives from the simulation industry. Written consent was obtained from all participants.

Data collection and analysis

The author conducted individual interviews with 8 participants, based on an interview guide. The interviews were audio-recorded, transcribed and checked by an independent person who was not part of the study. Field notes taken during the interviews contributed to the data. The data were analysed using the grounded theory approach, which requires continuous comparison of data, following the data analysis steps of coding, categorisation and theory generation.[17] Theory building occurred by finding patterns in the data, which continued until saturation of data was reached.[18] As more data were collected and re-reviewed, codes were grouped into concepts, and then into categories. These categories formed the basis for new theory, and were compared with data collected during the literature study. Data saturation was reached when no more ideas came to the fore.

Reliability and trustworthiness

Reliability was ensured by making use of an explorative study (with 2 individuals who were involved, had a sound knowledge of simulation and complied with the selection criteria), determining strict criteria for sampling, using the carefully constructed interview guide, as well as an interview process that was audio-taped and carefully described.[19] Trustworthiness of the interviewing process was ensured by involving voluntary interviewees with a clear understanding of what the interviewer expected from them, and using open-ended questions, as well as the transcription and verification of data. Scientific record keeping ensured dependability.[19]

Ethical approval

Ethical approval to conduct the research was obtained from the Ethics Committee of the Faculty of Health Sciences, University of the Free State, Bloemfontein, SA (ref. no. ECUFS 122/2015).

Results

Data collected by means of questions 3, 4 and 7 of the semi-structured interviews are reported in this article. Data were analysed, findings were summarised and qualitative perspectives are shared on the *influence of simulation on student learning* (Table 2) and how the *effectiveness of learning can be enhanced* (Table 3). The features and uses of simulation that may enhance learning in postgraduate education and training served as basis for a number of *recommendations to enhance the effectiveness of learning* in postgraduate plastic surgery education and training (Table 4). Quotes from

Table 2. Influence of simulation on student learning in postgraduate education and training

1. Simulation as a learning strategy

Simulation influences student learning in different ways:
- Simulation is a very specific learning and education strategy that can be described as a holistic process that ensures meaningful learning
  - 'To be effective it needs to be an important component in the curriculum.' (S1)
  - 'Effectiveness can only be enhanced if there is proper integration.' (S1)
- Simulation is based on an adult learning strategy, as it is built on adult learning principles that can be combined in different ways
  - 'Different people learn in different ways.' (C3)
- Simulation can replace other educational strategies, e.g. theoretical lectures, by bringing simulated case engagement into the normal learning strategy
  - 'Simulation will trigger more excitement.' (D1)
  - 'Students will be more focused and remember more.' (D1)
  - 'It gives students the opportunity to learn hands-on.' (C1)

2. Motivation to make a difference

Simulation of rare clinical cases or life-threatening, important scenarios is motivational:
- '… students can be motivated to make a difference in a patient's life.' (C1)

3. Importance of preparation

Theoretical grounding and preparation will influence student learning:
- 'Students may attend a lecture, e-learning programme, read articles, do a self-test before visiting the simulation lab, which ensures that learning is more meaningful, and promotes deep learning and commitment.' (D1)

Identify own shortcomings, evaluate own level of competence against own tempo:
- 'Students must be prepared when they come to the simulation lab.' (D2)

4. Learn by repetition

Practising non-technical and technical skills will influence student learning:
- 'Giving students the opportunity to practise in the simulation lab so that they are more competent when performing certain procedures on a patient.' (C1, D1)

5. Group simulations

Simulation scenarios that include different health professionals will foster and enhance learning:
- 'Debriefing provides students the opportunity not only to identify their own shortcomings, but also those of the individual group members and of the group as a whole.' (C1)

Learn to work in groups and that communication among them is of great importance:
- 'You have to have small-group engagement.' (S1)

6. Level of competence

The aim of simulation is to attain and sustain a certain level of competence or expertise:
- Ensure that the health professional/student maintains the same level of competence after the initial mastering of the procedure
  - 'Attaining some sort of competence level quicker before going to the patient.' (C2)
  - 'Competent = bare minimum (knows/knows how).' (C2)
  - 'Proficient = level of skill above minimum (shows/does).' (C2)
  - 'As you practise a skill more, you become proficient = on your way to mastering.' (C2)

Table 3. Enhancing the effectiveness of learning in postgraduate and/or plastic surgery education and training by introducing simulation

1. Non-threatening environment

A non-threatening environment enhances the effectiveness of learning:

- Enhancement of learning
  - 'Students can practise with less stress.' (D1, D2)
  - 'You learn in an environment where you are allowed to make mistakes.' (D1)
  - 'To get learners to think about their actions, to analyse, taking ownership of own learning, reflective learning.' (D2)
  - 'They learn in a completely safe, non-threatening environment.' (D2)
- Patient safety
  - 'First learn through simulation, then on real patient.' (D1)
  - 'Steep learning curve before practising on real patient.' (D1)
  - 'Give them a plan according to which they can work when in a real situation.' (D2)
  - 'It allows them to practise more on the simulator – so there are fewer medical errors when working with real patients.' (D2)

Advantage of using simulation in training:

- 'Operation time less; complications fewer; costs lower – big advantage to train postgraduate students/registrars.' (D1)

2. Soft medical skills

Training of soft skills through simulation enhances the effectiveness of learning:

- Interpersonal communication, interprofessional communication, patient communication, health communication etc. to be included in simulation training
  - 'Some people may think these are not technical skills (as in AFRIMED/CANMED) so these are not assessed.' (D1)
  - 'Colleges to include soft skills in evaluation.' (D1)
  - 'Powerful tool to develop clinical reasoning.' (S1)
  - 'Clinical reasoning will happen in a complex space.' (S1)
  - 'Different reasoning in rural situations.' (S1)

3. Deliberate practice

Deliberate practice enhances the effectiveness of learning:

- Bench models may be used to practise psychomotor skills by repetition or deliberate practice of specific procedures until students feel safe
  - 'To make deliberate practice more successful, students may use a tick-sheet to test themselves.' (C2)
  - 'To make deliberate practice more successful, the student must be accompanied by consultant/educator.' (D1)
  - 'Student must know what he/she is doing correctly.' (D1)
  - 'There must be scheduled times for practice, as well as for feedback.' (D1)
  - 'Registrars are adult learners and identify skills that need more practice.' (D1)

4. Feedback

Feedback enhances the effectiveness of learning:

- Constructive feedback
  - 'Can be according to a debriefing manner: first focus on the positive, then focus on things which he/she should do in another way without negative critique.' (D1)
  - 'Give feedback directly after simulation/time slot; in writing or on video.' (D1)
  - 'Feedback to be planned, structured according to a template or may be more personal.' (D1)
  - 'For non-technical skills use the debriefing method – look at what was good; discuss what can be different.' (D1)
  - 'For technical skills – use a tick-sheet; it will allow for more constructive feedback and certain skills can be revisited.' (D1)
  - 'Give feedback to students so that they can correct themselves.'
- Feedback and assessment with a view to enhancing the effectiveness of learning
  - 'Formative feedback will help students to prepare for assessment and examination; then they will have time to correct their mistakes.' (D1)
  - 'Timely feedback before assessment can help the student to lower stress levels.' (D1)
  - 'Feedback on quality of operations can offer opinion where the registrar is safe; by using easy scenarios evaluate whether the registrar executes the technique in a good/proper way and/or quick enough – this is a good learning opportunity.' (C1)
  - 'Students to be observed on a continuing basis.' (C2)
  - 'Student can be observed during a skill performance.' (C2)

5. Debriefing

Debriefing enhances the effectiveness of learning:

- The process of debriefing gives more insight
  - 'Debriefing is another way to learn.' (C1)
  - 'It is the debriefing aspect that affects learning.' (D2)
  - 'Do not use debriefing as a teaching opportunity, let learners think how they can improve.' (D2)
  - 'Observation of skills, then debriefing after that, improves practical skills.' (C2)

Table 3. (continued) Enhancing the effectiveness of learning in postgraduate and/or plastic surgery education and training by introducing simulation
6. Realism or fidelity
Realism of fidelity enhances the effectiveness of learning:
• The degree of realism of a scenario or patient influences the effectiveness of learning: 'In the beginning, students do not believe in the simulation scenario; later you can observe the "overcoming of disbelief" – the suspension of disbelief – they think it is a real patient: that leads to more effective learning than using a paper case.' (D2)
7. Repetitive practice
Repetitive practice enhances the effectiveness of learning:
• For learning to take place, a medical or practical situation is necessary
• 'You have to practise on a continuous basis – do it repeatedly over the time span of a month or year.' (C1, D1)
• 'It must become a natural action – you learn by repeating – repeat soon after the first practice; 1 week; after weeks; months.' (C1)
8. Training platform
The training platform enhances the effectiveness of learning:
• As training platforms may become smaller in certain disciplines, simulation offers opportunities for learning
• 'Platform varies from rural situation to complex.' (S1)
9. Assessment
Assessment enhances the effectiveness of learning:
• Evaluation of clinical skills in summative assessment of registrars plays a role in effective learning
• 'In the field of specialists, assessment should include well-defined objectives and competencies.' (C2)
• 'Assess levels for competence.' (C2)
• 'Assessment to be reliable and statistically sound; use tick-sheet.' (C2)
• 'Use simulated patients for clinical examinations.' (S2)

interviewees' responses are indicated in inverted commas, followed by a code number assigned to each of the participants.

Simulation influences student learning (Table 2), as it substitutes other learning strategies; it supports adult learning principles, as it requires students to prepare, placing a responsibility on them as adult learners; it provides self-confidence and skills, motivating students to confront life-threating situations, making a difference to a patient's life; it provides the opportunity to learn by repetition, to work individually or in groups; it fosters communication; and it ensures that the student attains and sustains a specific level of competency.

Interviewees' opinions on how simulation can enhance the effectiveness of learning are indicated in Table 3 and emphasise the role of simulation as a non-threatening learning method that enhances the effectiveness of learning. Students can practise with less stress in a completely safe environment before working with real patients; this highlights the advantages of training using simulation. Simulation also enhances the effectiveness of learning by fostering interpersonal, interprofessional patient communication, communication regarding health and reasoning skills. Through deliberate, as well as repetitive practice, learning is enhanced (Table 3). The debriefing aspect offers another way of learning and allows students to decide on self-improvement. Authentic scenarios help students to learn more effectively than when using paper cases. The assessment opportunities of simulation improve student learning.

Recommendations to enhance the effectiveness of learning in postgraduate plastic surgery education and training are offered in Table 4. To apply the unique features and uses of simulation in a correct manner influences the effectiveness of learning in a positive way.

Discussion
The third and fourth semi-structured interview questions addressed the effect of simulation on student learning and how learning may be enhanced by simulation as a learning method in postgraduate and/or plastic surgery education and training. The opinion was that simulation does enhance the effectiveness of learning as far as the mastery of knowledge, skills, clinical competence and professional conduct is concerned.

The findings of data gathered during the semi-structured interviews were compared with perspectives gained from the literature review. Key outcomes of this research were the identification of the features and uses of simulation, and how simulation might be applied to enhance the effectiveness of learning in plastic surgery. As specific features and uses of simulation influence learning positively, these should be maximised in plastic surgery education. The results of the study provided ample evidence that simulation improves teaching and learning in medical (surgical) postgraduate education, as is evident from the following research.

According to Issenberg et al.,[4] 'traditional medical training has focused on individual learning to care for individual patients. Medical education has neglected the importance of teamwork and the need to develop safe systems. The knowledge, skills and attitudes needed for safe practice are not normally acquired, nor are they required, as part of medical education.' Simulation is an appropriate method for team training – a prerequisite for interprofessional healthcare required of modern medical education.

Simulation offers the possibility of a cyclic learning dimension structure, i.e. a safe, purposefully planned learning environment, including variations of learning strategies/methods and the opportunity to select material offering different applicable learning opportunities, and ensuring a unique learning experience where the learning can be evaluated by the registrar or feedback/debriefing can be done by a consultant to achieve competence, or to re-plan and/or deliberately practise specific, identified learning units.

Deliberate practice, not just time and experience in clinical settings, is key to the development of medical clinical competence.[4] Deliberate practice involves '(a) repetitive performance of intended cognitive and psychomotor skills in a focused domain, coupled with (b) rigorous skills assessment that provides learners with (c) specific, informative feedback,

Table 4. Recommendations to enhance the effectiveness of learning in postgraduate plastic surgery education and training by applying the unique features and uses of simulation
Environment
The provision of a controlled non-threatening environment to registrars will unlock the opportunity to learn more effectively:
• Simulation has the ability to create a safe environment, enabling registrars to detect problems and patient care errors in a non-threatening way of learning, fostering reasoning skills and thought processes; learning takes place where it is acceptable to make mistakes and causes less stress
• The simulation environment is open to accommodate a process that can change from a uni- to a multipurpose process where learning can be based on a single objective or on multiple objectives; learning could span different cognitive levels and include variations from superficial to deep learning
• A simulation scenario may be changed or adapted to a more complex scenario, where learning could take place at a entirely different level of competence and applicability
Curriculum
The integration of simulation in the curriculum of a postgraduate plastic surgery training programme will offer registrars the opportunity to learn more effectively:
• Simulation should be integrated in the curriculum and training schedule and be directed by guidelines for teaching through simulation; the role of simulation should be clearly stated in curriculum documents and how it will form part of the registrars' performance management
• Teaching and learning strategies should be aligned with educational goals and learning outcomes and should be adaptable to the learning situation
• Simulation offers the opportunity for large-group training by developing scenarios for multiprofessional teams, where individual and group learning can take place with an opportunity for debriefing and constructive feedback; individualised learning according to the registrars' learning needs set to specific standards should be offered
Clinical teaching and learning
Simulation should offer registrars opportunities for clinical learning to be more effective:
• Registrars' engagement in deliberate practice should take place according to set learning outcomes based on real clinical problems in simulated settings; the realism of clinical problems and the hands-on experience should help them to master clinical outcomes and to transfer knowledge, skills and competencies to real clinical settings
• Learning outcomes will enhance the effectiveness of learning and processes must be in place to ensure they are met
• Smaller learning units can give registrars the opportunity to master learning outcomes at their own pace, ensuring intrinsic motivation and fostering deep learning
• Effective learning is enhanced when registrars practise clinical skills across a wide range of difficulty levels; scenarios set on different levels of difficulty ensure that learning takes place at different cognitive levels
• By offering registrars the opportunity to engage in repetitive practice in a safe environment will give them the challenge to correct and hone their clinical skills and competencies
Feedback
Registrars should approach simulation opportunities in a different way when accompanied by consultants, who give feedback; they will experience scenarios as a direct learning opportunity; problems can be corrected immediately – they should see it as teaching them purposefully and deliberately:
• Feedback should be planned, formally scheduled and be an integral part of the training programme
• Feedback should be built into simulations, or presented at scheduled times, on video or electronic media
• Registrars should use the opportunity of feedback to correct themselves by taking notice of feedback on accuracy and timing
• Constructive feedback should drive decisions as far as preparation for final assessment
Technology
Technology should be seen as offering endless possibilities to enhance learning for registrars:
• Technical skills, non-technical skills and the softer skills can be explored for learning at different levels by adding or changing scenarios
• Sharing facilities between institutions will be beneficial, as registrars can see or use a whole spectrum of simulations; standardisation of outcomes is possible, as well as opportunities for quality learning and learning of new skills

that results in increasingly (d) better skills performance in a controlled setting'.[4] Simulation is the ideal way to ensure deliberate practice, regardless of whether patient material is available or not. Research emphasises the importance of repetition for clinical skills acquisition and maintenance,[20] and research evidence clearly shows that high-fidelity medical simulations facilitate learning.[4]

Simulation-based education allows students to practise and acquire patient care skills in a controlled and safe learning environment. Feedback to students, the opportunity for deliberate and repetitive practice, multiple learning strategies, individualised learning within a controlled environment, and the opportunity for hands-on experience foster students' self-confidence and play a cardinal role in mastering educational outcomes.[8]

To revolutionise medical education, an increased efficiency of education by standardising the curriculum, an individualisation of education and a shift from time-based training to competency-based training are essential.[21] Residents (registrars/specialists in training) may receive little guidance in terms of the knowledge, competencies, skills and attitudes that they are expected to acquire during residency. Surgical training in the 21st century is characterised by an increasingly objective, standardised approach using equipment such as simulators to optimise patient safety, surgical care and hospital resources, and to minimise errors.[5] The driving forces behind this are developments in medical error statistics, evidence-based medicine and fewer attending hours. Through increased accuracy, simulation can improve results and also lower risk and procedure cost because of fewer procedures and less operating room time.[5]

Simulation can play an important role in postgraduate education; however, it cannot totally substitute education involving real patients in genuine settings.

Conclusion

From the findings of this research, it is clear that simulation can be introduced as a teaching method and a learning opportunity for residents to improve plastic surgery education and training. To ensure success, however, clear recommendations on how simulation can enhance effective learning, and a description of the role and value of simulation based on scientific research, should be available. This requires the development of guidelines for teaching through simulation as part of training programmes for evidence-based plastic surgery education/practice.

Research is required to enhance the role of simulation in plastic surgery training,[22,23] and this study made a contribution in that regard by identifying why and how simulation can improve the effectiveness of postgraduate and/or plastic surgery teaching and learning. 'Simulation has the potential to play an integral role in developing better and safer health care services for patients worldwide, avoiding risk and providing real-life opportunity for students to hone their skills.'[22,23] The features and uses of simulation discussed here will contribute to and lay the foundation for more effective learning in plastic surgery education and training in the future. The novel contribution made by this study entails the compilation of the advantages simulation holds for medical education, with special reference to postgraduate plastic surgery education, and the detail in which this teaching-learning method is expounded.

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