Research

Effect of simulated emergency skills training and assessments on the competence and confidence of medical students

I Treadwell, DCur, HED

Skills Centre, Sefako Makgatho Health Sciences University (formerly Medunsa Campus of the University of Limpopo), Pretoria, South Africa

Corresponding author: *I Treadwell (ina.treadwell@gmail.com)*

Background. At Medunsa, Pretoria, South Africa, the training of final-year medical students includes the management of simulations that incorporate, *inter alia*, the following emergency skills: cardiopulmonary resuscitation (CPR), defibrillation, airway suctioning, oropharyngeal airway placement, endotracheal intubation and bag-valve-mask ventilation. Other than CPR, all emergency training of the 2012 student group was by means of apprenticeship in clinical rotations. Therefore, there was no evidence of the students' competence or confidence with regard to their performance of emergency skills.
Objectives. To explore the effect of simulated skills training and assessments on medical students' competence and confidence when using the skills required to manage clinical emergencies.
Method. A one-group pretest post-test quasi-experimental design was used, with a convenience sample (n=82) comprising final-year medical students from 3 of the 6 annual Family Medicine rotations. The participants' competence (knowledge and selected emergency skills as per curriculum) and confidence were assessed before training. The intervention comprised training in relevant theory, demonstrations and supervised hands-on practice. The post-training assessments were a repeat of the pretraining assessments.
Results. The improvement in participants' confidence and competence levels when performing all the emergency skills on completion of the demonstrations and hands-on practice was highly significant ($p \leq 0.001$). Participants were unanimous in their opinion that pre-assessments had enhanced their learning experience.
Conclusions. The strategy of teaching/learning and assessment of emergency skills in simulation was highly effective in enhancing the competence and confidence of medical students when managing a clinical emergency. However, students appeared to be overconfident, which could be ascribed to ignorance, and possibly indicates that feedback during training should be improved.

Afr J Health Professions Educ 2015;7(2):155-157. DOI:10.7196/AJHPE.229

In 2010, a Skills Centre came into operation at the Medunsa campus of the University of Limpopo, which is situated 25 km north-west of Pretoria, South Africa. The medical core curriculum skills list was revised and skills that could be taught in simulated situations were listed for each of the 6 academic years. Since 2011, all 6th-year students have been required to manage 3 simulated clinical emergencies in small groups during the orientation period of the Family Medicine rotation. The skills incorporated in these simulations are cardiopulmonary resuscitation (CPR), airway suctioning, placement of an oropharyngeal airway (OPA), endotracheal intubation, bag-valve-mask (BVM) ventilation and defibrillation.

As the 2012 final-year students had not had exposure to the simulated emergency skills training currently scheduled for 4th-year students, their emergency skills training comprised apprenticeship in real-life clinical situations. Their formal emergency training was limited to CPR in their 4th year and endotracheal intubation and BVM ventilation in their 5th year of study. There was no evidence that these students had had opportunities to practise emergency skills during their practical rotations or of their competence and confidence when performing these skills.

Traditional bedside teaching, based on the apprenticeship model of education, cannot be relied on to provide adequate and comprehensive clinical skills training.[1] The healthcare systems (reduced hospital stay and a rapid advance in diagnosis and treatment technologies) have made this teaching method less effective, resulting in a sharp decline in standards of acquisition of clinical skills among medical students. The drawbacks of an apprenticeship methodology of skills acquisition (where learning is left to chance and is unobserved by teachers) can, however, be overcome by structured and observed training in skills centres.[2]

Growing evidence validating medical simulation as an educational tool has promoted its use beyond the instruction of physicians-in-training,[3] and skills centres have become an established part of training for healthcare professionals. Clinical skills centres provide students with the opportunity to practise clinical techniques on manikins and simulators in a safe environment, without affecting the quality of patient care. This has changed the centuries-old approach to learning medical procedures by first practising on a patient, to one where competency is first demonstrated on a simulator. Simulation training, especially in emergency skills, is designed in such a way that healthcare providers can learn from practising in a situation that they are likely to encounter. It ensures that patients are not put at unnecessary risk by exposure to novice or out-of-practice caregivers,[4] and is also conducive to the conducting of objective assessments.

There is considerable debate on how accurately students assess their own competence. Several studies have shown that medical students' self-perceived competence correlates poorly with objectively assessed competence.[5] Apart from inadequate self-assessment skills, biased self-evaluation in applied settings can also be ascribed to the overconfidence phenomenon. 'We don't know what we know, but we are confident we do … Not only are we wrong, but we are confident that we are right!'[6] A more serious problem that has been identified is that individuals at the lowest levels of mastery lack the metacognitive understanding of what actually constitutes mastery, leading them to greatly overestimate their own skills.[6]

Competence and confidence are terms used for expressing beliefs about one's ability to perform an activity. C*onfidence* refers to self-assurance arising from an appreciation of one's own abilities,[7] while in this study *competence* refers to the ability to perform a clinical skill successfully or efficiently. Competence can, however, be thwarted by a lack of confidence; however, misguided overconfidence in professional capabilities may have serious professional and malpractice consequences.[8] Clinical experience and the level of confidence have no predictive value in performance assessments when using standardised simulated scenarios. As self-confidence is not a reliable indicator of skills competence, it is important to measure both confidence and competence.[9]

Final-year medical students have a sound theoretical knowledge of emergency procedures,[10] but how confident and competent are they in performing these procedures?

Objective

The objective of this study was to explore the effect of simulated skills training and assessments on final-year medical students' competence and confidence in performing skills required to manage clinical emergencies.

Method

The study was conducted at the Skills Centre at Medunsa. The population of MB ChB VI students (*N*=176) was divided into 6 groups that rotated, as per curriculum, through 6 blocks of various disciplines during the year. A convenience sample (*n*=82) was used, comprising all the consenting students from 3 of these groups during their Family Medicine rotation. Ethical clearance was granted by the Medunsa Research and Ethics Committee and informed consent was obtained from participants.

A one-group pretest post-test quasi-experimental design was used to determine the effect of skills training and assessment on students' competence and confidence in performing emergency procedures. *Pretraining* assessments of participants' competence (knowledge and selected emergency skills as per curriculum) and confidence were administered. The *intervention* comprised 3 training and practice sessions of 30 minutes each: (*i*) adult CPR and defibrillation; (*ii*) adult endotracheal intubation; and (*iii*) resuscitation of a paediatric patient (CPR, airway suctioning, placement of an OPA, and BVM ventilation). Three groups, each comprising 9 - 10 students, rotated through the 3 stations, each manned by 2 lecturers who supervised the students and, by implication, provided them with feedback.

The *post-training* assessments were a repeat of the pretraining assessments. Pre- and post-training assessments were conducted on the same day to minimise the threat of maturation and history. To prevent social desirability bias the questionnaires were administered by the researcher, and responses to questionnaires were not accessible to the lecturers.

The pre- and post-training questionnaires comprised a 4-point Likert scale for self-report of confidence levels in performing 6 skills: CPR, clearing the airway by suctioning, placement of an OPA, endotracheal intubation, BVM ventilation and defibrillation. A statement on the effect of skills assessment prior to the teaching session was added to the post-training questionnaire.

The multiple-choice questions (MCQ) test, used before and after the training, comprised questions relevant to the range of skills. The test was compiled and verified by 4 lecturers involved in emergency care training. The Objective Structured Clinical Examination (OSCE) assessment tools were compiled and tested to assess objectively the skills performed at each of the 3 OSCE stations. A pilot study with 43 students in the first Family Medicine rotation of 2012 was conducted to determine the viability of the instruments and timing of the activities. These results were not included in the study.

Results

The results of the MCQ test, questionnaires and OSCE were captured on an Excel spreadsheet. The test and OSCE results before and after the teaching sessions were compared using Fisher's exact test. All statistical tests were two-sided and *p*-values ≤0.01 were considered significant.

The mean scores of the pre- and post-training tests and OSCE assessments, the differences (improvement) and significance thereof are shown in Table 1.

The responses to the 4 categories of the Likert scale were summarised by frequency counts and percentages. The pre- and post-training percentages of 'competent' outcomes (a combination of responses in category 1 (very confident) and category 2 (confident)) were compared using Fisher's exact test. The mean scores of the pre- and post-training confidence

Table 1. Differences in the mean scores of pre- and post-training assessments (*n*=82)

Assessments	Training	Mean score pretraining, %	Mean score post-training, %	Difference, %	Significance, *p*-value
MCQ test		42	64	21	0.0001
OSCE station 1	Paediatric resuscitation	23	74	51	0.0001
OSCE station 2	CPR and defibrillation	19	81	62	0.0001
OSCE station 3	Endotracheal intubation	16	52	37	0.0001

Table 2. Differences in pre- and post-training confidence levels in performing emergency skills (*n*=82)

Skill	Confidence pretraining, %	Confidence post-training, %	Difference, %	Significance, *p*-value
Airway suctioning	66	100	34	<0.001
Placement of OPA	33	99	66	<0.001
BVM ventilation	81	100	19	<0.001
Endotracheal intubation	30	94	64	<0.001
CPR	87	100	13	<0.001
Defibrillation	33	96	64	<0.001

Table 3. Value of pretraining assessment (*n*=82)

Value of OSCE	Strongly disagree, %	Disagree, %	Agree, %	Strongly agree, %
Created awareness	0	0	9	91
Enhanced learning	0	0	12	88

levels, the differences (improvement) and significance thereof are given in Table 2.

Participants were unanimous (combination of category 1 (strongly agree) and category 2 (agree)) in their opinion that the pretraining OSCE had made them aware of their learning needs and the OSCE experience had enhanced their learning during the teaching session (Table 3).

Discussion

The lowest mean OSCE score was for endotracheal intubation (16% pretraining and 52% post-training). The medical students seem to find this emergency skill the most problematic. The literature shows that medical graduates feel inadequately prepared for performing an endotracheal intubation and it is recommended that more emphasis be placed on training medical students in this skill.[11]

The improvement of participants' competence in performing emergency skills in the post-training OSCE was highly significant ($p<0.001$). This improvement corresponds to the findings in a study on residents' improved competence in critical resuscitation procedures following an intensive simulation-based training programme.[12]

The literature reports low confidence levels and poor self-assessment of proficiency with regard to procedural skills among medical students entering clinical rotations. Their confidence improved significantly after a course in procedural skills.[13] Our results likewise indicate a highly significant increase in confidence levels when performing each of the skills.

Students reported that the pretraining assessment (OSCE) improved their learning. This was similar to a report indicating that students who were evaluated prior to their training performed better in the post-training evaluation than a control group who had not been evaluated before training.[14]

A limitation of this study was that, although the students seemed alarmingly overconfident, the data were unsuitable to statistically determine the correlation between competence (scores in percentages) and confidence (4 categories). An additional limitation was that individual feedback, as implied during supervised hands-on sessions, was not monitored. The absence of a correlation between confidence and grades could be the result of a lack of appropriate and clear feedback.[4] Students' inflation of their abilities might be caused by ignorance rather than arrogance;[15] such exaggerated judgements might be the result of an absence of feedback or failure to incorporate feedback into self-perception.[5] Students tended to overestimate their own abilities. High-quality feedback[15] could act as an antidote to such inaccurate self-assessment.

Conclusion

The strategy of teaching/learning and assessment of emergency skills in simulation proved highly effective in enhancing the competence and confidence of medical students in their management of a simulated clinical emergency. The improvement of students' performance and confidence levels on completion of demonstrations and hands-on practice was highly significant ($p<0.001$).

The students appeared to be overconfident before engaging in this teaching/learning strategy. Their confidence levels escalated significantly on completion of the simulation, but were unfounded when compared with the proficiency scores. This confirms a finding previously reported in the literature that self-confidence is not a reliable indicator of skills competence.[10]

Recommendations

As students' confidence levels were higher than their actual competency levels in the performance of emergency skills, it is recommended that training in the latter be expanded to include high-quality individual feedback. The effect of such individual feedback and its role in enhancing self-perception should be further researched.

Acknowledgements. I would like to acknowledge the help and contributions of staff from the Skills Centre (H Havenga, M Theron, Y Uys, B Randa, K Kgasi, T Zana and T van Dyk), the Department of Family Medicine (Drs K Hlabyago, H Mabuza, S Nyalunga, C Barua, I Govender and J Ndimande) and the students who participated in this study.

References

1. Remmen R, Derese A, Scherpbier A, et al. Can medical schools rely on clerkships to train students in basic clinical skills? Med Educ 1999;33(8):600-605. [http://dx.doi.org/10.1046/j.1365-2923.1999.00467.x]
2. Ahmed AM. Role of clinical skills centres in maintaining and promoting clinical teaching. Sudan J Public Health 2008;3(2):97.
3. Meguerdichian DA, Heiner JD, Younggren BN. Emergency medicine simulation: A resident's perspective. Ann Emerg Med 2012;60(1):121. [http://dx.doi.org/10.1016/j.annemergmed.2011.08.011]
4. Brookes L. Developing simulation training for medical emergencies. Medscape interview, Paul Preston. http://www.medscape.com/index/list_6121_1 (accessed 15 November 2012).
5. Lai NM, Teng CL. Self-perceived competence correlates poorly with objectively measured competence in evidence based medicine among medical students. BMC Med Educ 2011;11(1):25. [http://dx.doi.org/10.1186/1472-6920-11-25]
6. Heath L, DeHoek A, Locatelli SH. Indirect measures in evaluation: On not knowing what we don't know. Practical Assessment, Research and Evaluation 2012;17(6). http://pareonline.net/pdf/v17n6.pdf (accessed 15 November 2012).
7. Oxford dictionaries. http://oxforddictionaries.com/definition/english/confidence (accessed 20 March 2013).
8. Elzubeir MA, Rizk DEE. Assessing confidence and competence of senior medical students in an obstetrics and gynaecology clerkship using an OSCE. Educ Health 2001;14(3):373-382.
9. Hansen M, Oosthuizen G, Windsor J, et al. Enhancement of medical interns' levels of clinical skills competence and self-confidence levels via video iPods: Pilot randomized controlled trial. J Med Internet Res 2011;13(1):e29. [http://dx.doi.org/10.2196/jmir.1596]
10. Remes V, Sinisaari I, Harjula A, Helenius I. Emergency procedure skills of graduating medical doctors. Med Teach 2003;25(2):149-154. [http://dx.doi.org/10.1080/0142159031000925535]
11. Ochsmann EB, Zier U, Drexler H, Schmid K. Well prepared for work? Junior doctors' self-assessment after medical education. BMC Med Educ 2011;24(11):99. [http://dx.doi.org/10.1186/1472-6920-11-99]
12. Langhan TS, Rigby IJ, Walker IW, Howes D, Donnon T, Lord JA. Simulation-based training in critical resuscitation procedures improves residents' competence. CJEM 2009;11(6):535-539.
13. Stewart RA, Hauge LS, Stewart RD, Rosen RL, Charnot-Katsikas A, Prinz RA. A CRASH course in procedural skills improves medical students' self-assessment of proficiency, confidence, and anxiety. Am J Surg 2007;193(6):771-773. [http://dx.doi.org/10.1016/j.amjsurg.2007.01.019]
14. Li Q, Ma EL, Liu J, Fang LQ, Xia T. Pre-training evaluation and feedback improve medical students' skills in basic life support. Med Teach 2011;33(10):e549-e555. [http://dx.doi.org/10.3109/0142159X.2011.600360]
15. DeAngelis T. Why we overestimate our competence? American Psychological Association 2003;34(2). http://www.apa.org/monitor/feb03/overestimate.aspx (accessed 13 November 2012).