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ORIGINAL ARTICLE

Competence in performing emergency skills: How good do doctors really think they are?

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ABSTRACT

Introduction: Despite the differences in exposure and experience in dealing with medical emergencies, all doctors should nevertheless be competent to assist a patient in need of resuscitation. The objective of this study was to describe the level of self-assessed emergency skill competence that specialist trainees in various disciplines possessed as well as to identify factors that may have contributed to their level of self-perceived competence.

Methods: A prospective, cross-sectional, questionnaire study of various specialist trainees' self-perceived levels of competence in emergency skills was conducted across three academic hospitals in Johannesburg, South Africa. Trainees from General Surgery and Internal Medicine (Clinical) and Psychiatry and Radiology (Non-Clinical) rated their self-perceived level of competence in a list of basic, intermediate and advanced emergency skills according to a five-point Likert ranking scale.

Results: Ninety-four specialist trainees participated in the study – a response rate of 36%. The overall median competence rating for cardiac arrest resuscitation was 3.0 [IQR 3.0, 4.0] (i.e. intermediate). The median competence rating for cardiac arrest resuscitation in the clinical group (4.0) [IQR 3.0, 4.0] was higher than in the non-clinical group (3.0) [IQR 2.0, 3.0] ($p < 0.001$). Current or expired certification in Paediatric Advanced Life Support (PALS) or Advanced Paediatric Life Support (APLS) courses increased perceived competence and delays in starting specialisation resulted in a decrease in overall competence composite scores for each year of delay after internship.

Discussion: General Surgery and Internal Medicine trainees had a higher level of self-perceived competence in various emergency skills than their non-clinical counterparts. Current certification in advanced life support courses had a positive impact on trainees' self-perceived levels of competence in emergency skills. Specialist trainees who had less delay before starting their specialist training also demonstrated higher levels of perceived competence.

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African relevances

- All doctors should be competent to assist a patient in need of resuscitation.
- Non-clinical specialities may limit specialist trainees' exposure to emergency skills.
- Advanced life support short courses and simulation training is crucial for all disciplines.

Introduction

Doctors are at times called upon to resuscitate patients, but in order for them to be able to function effectively in these resuscitations, they should possess the competence and skills to do so [1]. Life-saving emergency skills range from basic Cardiopulmonary Resuscitation (CPR) with the use of an Automated External Defibrillator (AED) to more advanced skills such as the performance of a cricothyroidotomy or the insertion of a central venous catheter. There are many short courses available that may provide doctors with the requisite knowledge and skills to resuscitate patients in an emergency but this may not necessarily lead to competence or confidence [2–6].

Due to the nature of medical specialisation, doctors in certain non-clinical specialities, such as radiology and psychiatry, will

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Table 1
Scores used by specialist trainees to rate their level of competence in each emergency skill.

| Level | Competency | Explanation |
|-------|--------------|---|
| 1 | Poor | No knowledge or ability in the skill and would not be able to perform the skill |
| 2 | Basic | Some knowledge and ability in the skill and would be able to perform the skill only if supervised |
| 3 | Intermediate | Adequate knowledge and ability in the skill and would be able to perform the skill unsupervised |
| 4 | Advanced | Advanced knowledge and ability in the skill and would be able to perform as well as teach the skill |
| 5 | Expert | Expert knowledge and ability in the skill and would be able to perform the skill even in difficult and complicated patients |

Table 2
Division of Emergency Skills.

| Basic skills | Intermediate skills | Advanced skills |
|------------------------------|------------------------------------|---------------------------|
| Adult CPR | Defibrillation | CV catheter insertion |
| Child CPR | Synchronised cardioversion | Arterial line insertion |
| Infant CPR | Endotracheal intubation | Venous cutdown |
| Use of an AED | Insertion of Laryngeal Mask Airway | Escharotomy |
| Relief of choking in adults | Transcutaneous pacing | Cricothyroidotomy |
| Relief of choking in infants | Needle thoracocentesis | Pericardiocentesis |
| Bag-mask ventilation | Intercostal drain insertion | Thoracotomy Fasciotomy |

CPR, cardiopulmonary resuscitation; CV, central venous; AED, automated external defibrillator.

have limited exposure to managing patient emergencies. Despite the differences in exposure and experience in dealing with medical emergencies, all doctors should nevertheless be competent to assist a patient in need of emergency treatment or resuscitation. The objective of this study was to describe the level of self-assessed emergency skill competence that specialist trainees in various disciplines possessed as well as to identify factors that may have contributed to their level of self-perceived competence.

Methods

This was a prospective, cross-sectional, questionnaire study of various specialist trainees' self-perceived levels of competence in emergency skills. It was conducted across three academic hospitals, in Johannesburg, South Africa. The study sample was comprised of specialist trainees working in four specialities: internal medicine, general surgery, radiology and psychiatry. The internal medicine and general surgery groups were combined to form the clinical group while psychiatry and radiology were combined to form the non-clinical group. In order to detect a 20% difference between the clinical and non-clinical groups, a minimum of 40 specialist trainees was required in each group. This sample size was calculated for a power of 80% at a significance level of 0.05. All specialist trainees, in each of the disciplines, attending their respective weekly academic meetings, were invited to participate. Data was collected in the form of anonymous questionnaires. Specialist trainees were asked to rate their own level of competence in a list of emergency skills by using a five-point Likert scale as shown in Table 1. The emergency skills were divided into basic, intermediate and advanced as shown in Table 2.

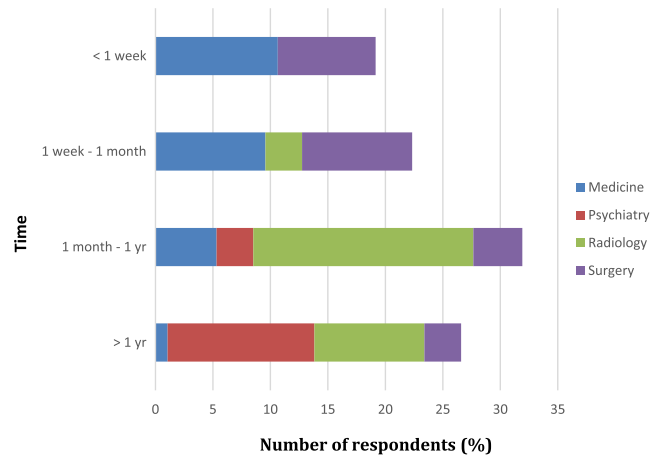


Fig. 1. Time since last resuscitation attempt.

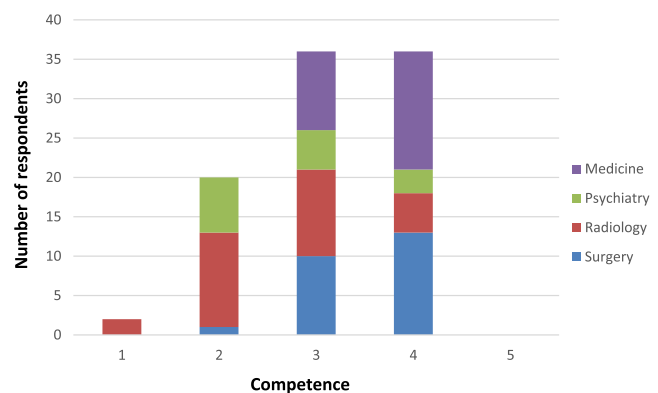


Fig. 2. Frequency distribution of competence in most recent resuscitation of a patient in cardiac arrest.

The basic skills chosen were those included in the Basic Life Support (BLS) course – i.e. skills that any doctor might be expected to possess. The intermediate skills were chosen based on skills that would be learnt in an advanced life support course, such as the Advanced Cardiovascular Life Support (ACLS) course, as well as being similar to procedures that doctors are expected to perform during internship in South Africa [7,8]. The advanced skills included those skills taught on the Advanced Trauma Life Support (ATLS) course and are considered to be technical skills more specific to the experienced practitioner.

Data analysis was carried out using SAS version 9.3 (copyright, SAS Institute Inc., Cary, North Carolina, USA). Composite scores for the self-assessed competency in basic, intermediate and advanced emergency skills were calculated from the median scores of the

Table 3
Division of specialist trainees between disciplines.

| Discipline | Number of eligible specialist trainees | Questionnaires returned | Response rate |
|--------------------|--|-------------------------|---------------|
| Clinical group | | | |
| Internal Medicine | 90 | 25 | 28% |
| General Surgery | 80 | 24 | 30% |
| Non-clinical group | | | |
| Radiology | 50 | 30 | 60% |
| Psychiatry | 45 | 15 | 33% |

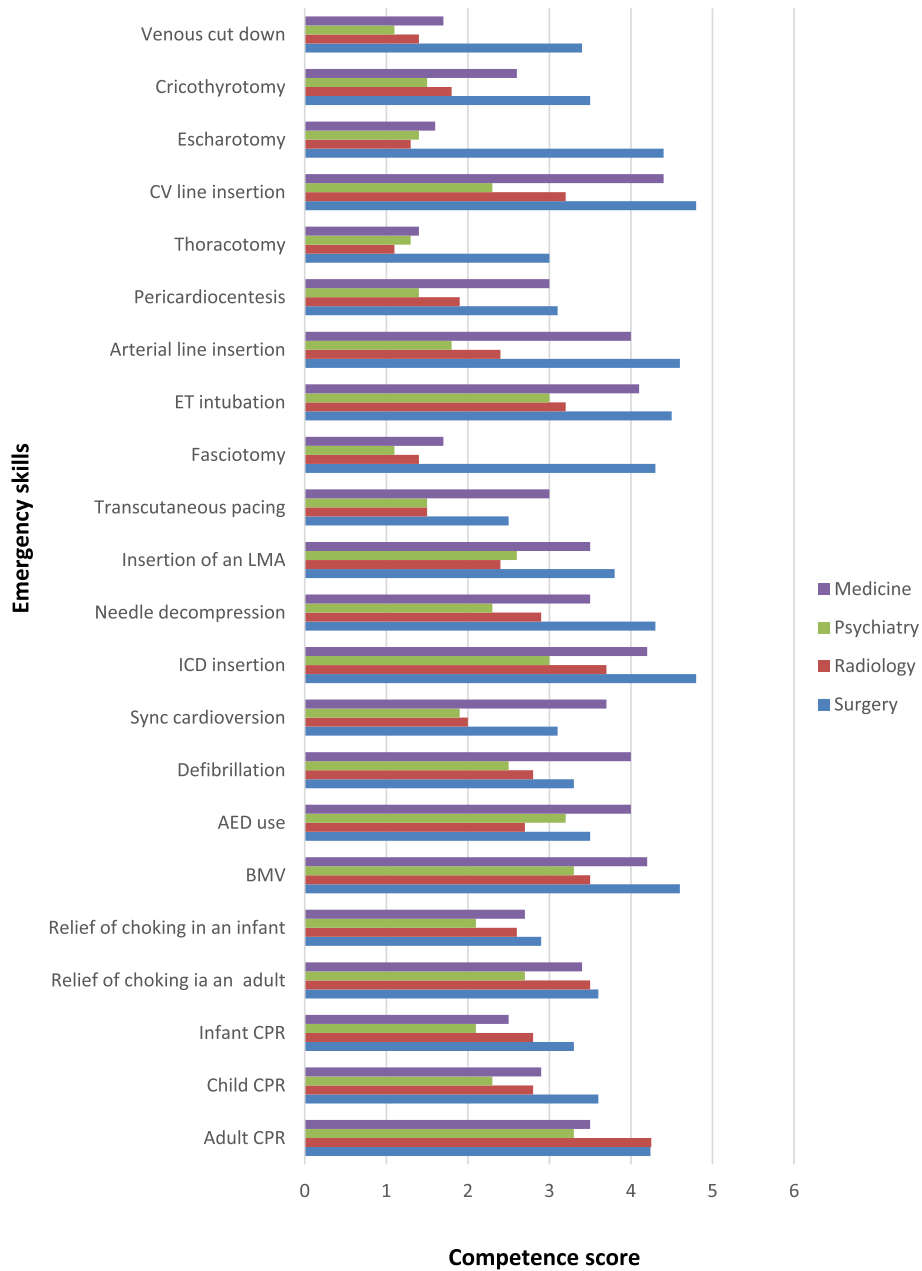


Fig. 3. Competence scores of various skills. Note: CV, central venous; ET, endotracheal; LMA, laryngeal mask airway; ICD, implantable cardioverter defibrillator; AED, automated external defibrillator; BMV, bag valve mask; CPR, cardiopulmonary resuscitation.

individual emergency skills. The association between categorical variables was determined using the chi-squared test (or Fisher’s exact test). The association between individual competence ratings and categorical variables was determined by the Wilcoxon rank sum test (for two groups) or the Kruskal-Wallis test (for more than two groups). For each of the three skill group composite scores, a general linear model was used to determine the relationship between the scores and the independent variables age, sex, time elapsed since qualification, time since most recent resuscitation of a patient in cardiac arrest and short courses attended. The strength of the associations was determined by Cramer’s V. The absolute values of these coefficients were interpreted as follows: 0.50 and above, high/strong association; 0.30 to 0.49, moderate association; 0.10 to 0.29, weak association; below 0.10, little if any association. The 5% significance level was used throughout. This study was approved by the Human Research Ethics Committee

of the Faculty of Health Sciences of the University of the Witwatersrand. Informed consent was obtained from all participants.

Results

The overall specialist trainee response rate was 94/265 (35%). The response rate in the clinical group was 49/170 (29%) and 45/95 (47%) in the non-clinical group. The median age was 30 years and 37/94 (39%) were male. Table 3 shows the division of the specialist trainees between the disciplines.

The distribution of the length of time since the respondents’ most recent resuscitation of a cardiac arrest patient is illustrated in Fig. 1. There was a significant association between the length of time since the most recent resuscitation and discipline (p < 0.001, Cramer’s V = 0.46); all specialist trainees whose most recent resuscitation had been in the previous week were from

Table 4
Self-assessed competence ratings for the various emergency skills per discipline.

| Skills | General surgery Median [IQR 25; 75] | Internal medicine Median [IQR 25; 75] | Radiology Median [IQR 25; 75] | Psychiatry Median [IQR 25; 75] |
|-----------------------------|--|--|----------------------------------|--------------------------------|
| Basic | | | | |
| Adult CPR | 4 (4.0; 5.0) | 4 (4.0; 5.0) | 3.5 (3.0; 4.0) | 3 (2.5; 4.0) |
| Child CPR | 4 (3.0; 4.0) | 2 (2.0; 4.0) | 3 (2.0; 3.0) | 2 (1.0; 3.0) |
| Infant CPR | 3 (3.0; 4.0) | 2 (2.0; 3.0) | 3 (2.0; 3.0) | 2 (1.0; 3.0) |
| Relief of choking - adults | 4 (3.0; 4.0) | 4 (3.0; 4.0) | 3 (3.0; 4.0) | 3 (2.0; 3.5) |
| Relief of choking - infants | 3 (3.0; 3.0) | 3 (2.0; 3.0) | 2 (2.0; 3.0) | 2 (1.5; 2.5) |
| Bag mask ventilation | 5 (4.0; 5.0) | 4 (4.0; 5.0) | 3 (3.0; 4.0) | 4 (2.0; 4.5) |
| Use of an AED | 4 (3.0; 4.0) | 4 (4.0; 4.0) | 3 (2.0; 3.0) | 3 (2.0; 4.0) |
| Intermediate | | | | |
| Defibrillation | 3 (3.0; 4.0) | 4 (4.0; 4.0) | 3 (2.0; 3.0) | 3 (1.5; 3.0) |
| Synchronised cardioversion | 3 (2.0; 4.0) | 4 (3.0; 4.0) | 2 (1.0; 3.0) | 2 (1.0; 2.0) |
| Endotracheal intubation | 4.5 (4.0; 5.0) | 4 (4.0; 5.0) | 2 (2.5; 4.0) | 3 (2.5; 4.0) |
| Insertion of a LMA | 4 (3.0; 4.3) | 3 (3.0; 4.0) | 2 (1.0; 3.0) | 3 (1.5; 3.5) |
| Transcutaneous pacing | 2.5 (2.0; 3.0) | 3 (2.0; 4.0) | 1 (1.0; 2.0) | 1 (1.0; 2.0) |
| Needle thoracocentesis | 4 (4.0; 5.0) | 3 (3.0; 4.0) | 3 (2.0; 3.8) | 2 (1.0; 3.5) |
| Intercostal drain insertion | 5 (4.75; 5.0) | 4 (4.0; 5.0) | 2 (2.0; 4.0) | 3 (2.0; 4.0) |
| Advanced | | | | |
| CV catheter insertion | 5 (5.0; 5.0) | 4 (4.0; 5.0) | 3 (3.0; 4.0) | 2 (1.5; 3.0) |
| Arterial line insertion | 5 (4.0; 5.0) | 4 (4.0; 5.0) | 2 (1.0; 3.0) | 2 (1.0; 2.5) |
| Venous cutdown | 3.5 (3.0; 4.0) | 2 (2.0; 3.0) | 1 (1.0; 2.0) | 1 (1.0; 1.5) |
| Escharotomy | 5 (4.0; 5.0) | 1 (1.0; 2.0) | 1 (1.0; 1.0) | 1 (1.0; 1.5) |
| Pericardiocentesis | 3 (2.75; 4.0) | 3 (2.0; 4.0) | 1 (1.0; 1.0) | 1 (1.0; 2.0) |
| Thoracotomy | 3 (2.0; 4.0) | 1 (1.0; 2.0) | 1 (1.0; 1.0) | 1 (1.0; 1.0) |
| Fasciotomy | 5 (4.0; 5.0) | 1 (1.0; 2.0) | 1 (1.0; 2.0) | 1 (1.0; 1.0) |
| Cricothyroidotomy | 3.5 (3.0; 4.0) | 2 (2.0; 3.0) | 2 (1.0; 2.0) | 1 (1.0; 2.0) |

AED, automated external defibrillator; CPR, cardiopulmonary resuscitation; CV, central venous LMA, laryngeal mask airway.

the clinical group. There was a strong association between the length of time since the last resuscitation and the groups ($p < 0.001$, Cramer's $V = 0.69$). Seventy-three per cent of the clinical group reported that their last resuscitation had been in the previous month, while 93% of the non-clinical group reported that their last resuscitation had been more than a month previously (with 47% more than one year previously).

The frequency distribution of the specialist trainees' self-assessed competence of their knowledge and performances in their most recent cardiac arrest resuscitation experience is shown in Fig. 2. No respondents rated their level of competence as expert.

The overall median competence rating for cardiac arrest resuscitation was 3.0 [IQR 3.0, 4.0] (i.e. intermediate). The median competence rating in the clinical group (4.0) [IQR 3.0, 4.0] was higher than in the non-clinical group (3.0) [IQR 2.0, 3.0] ($p < 0.001$).

The median competence rating for those who had conducted a cardiac arrest resuscitation in the previous month was higher than those who had most recently resuscitated in the one month to one year and the more than one year periods. The median self-assessed competence ratings for each skill, arranged by skill group and discipline, are illustrated in Table 4, and Fig. 3. The overall median composite scores for the basic, intermediate and advanced skills groups were 3.2, 3.1 and 2.5 respectively.

Basic emergency skills

General Surgery trainees had a significantly higher composite score in basic emergency skills – 1.0, 0.9 and 0.8 units higher than those of the Psychiatry, Radiology and Internal Medicine trainees respectively ($p = 0.017$). Those specialist trainees who had attended a Paediatric Advanced Life Support (PALS) or Advanced Paediatric Life Support (APLS) course had a composite score 0.6 (current certification) and 0.5 (expired certification) units higher than those who had not attended one ($p = 0.027$).

Intermediate emergency skills

General Surgery trainees also had composite scores of 1.0 and 1.3 units higher than those of the Psychiatry and Radiology trainees respectively ($p = 0.001$) with respect to the intermediate skills. Intermediate skills also decreased when there was a delay between internship and the trainees starting specialist training – a decrement in the composite score of 0.1 units per year ($p = 0.024$).

Advanced emergency skills

General Surgery trainees had a composite score 1.9, 2.3 and 2.4 units higher than those of Internal Medicine, Psychiatry and Radiology trainees respectively for the advanced skills ($p < 0.001$). Female trainees had a mean composite score 0.5 units lower than males ($p = 0.0004$). As with the intermediate skills, delays in starting specialisation resulted in a 0.1 unit decrease per year in overall composite score ($p = 0.047$). Specialist trainees with a current certification in PALS/APLS had a composite score 0.6 units higher than those who did not ($p = 0.035$).

Resuscitation courses

While a similar proportion of both the clinical and non-clinical groups had done the BLS and ACLS courses (96% and 87% respectively), 41% of the clinical group had current certification in both these courses, while the non-clinical group had a lower than average proportion of current certification (22% and 16% respectively). Sixty-nine per cent of all the specialist trainees had done the ATLS course. General Surgery trainees had the highest proportion of current ATLS certification (92%) while Radiology trainees had the lowest current ATLS certification rate (3%). The other 8% of General Surgery trainees had attended the course but their certification had expired. There were 58% of specialist trainees who had attended either the PALS/APLS courses. The Radiology trainees

had a much lower than average proportion of current certification in this course (3% versus the overall average of 17%; $p < 0.001$). When asked if they thought that all specialist trainees irrespective of discipline should be competent in life-saving skills, 98% of the clinical group and 91% of the non-clinical group agreed with the statement.

Discussion

The aim of this study was to evaluate the self-assessed level of competence in various emergency skills of specialist trainees in selected clinical and non-clinical disciplines and to determine what factors, if any, contributed to this confidence perception. It is imperative that every medical doctor, irrespective of discipline, should be competent and feel confident to perform the skills of resuscitation.

Only clinical specialist trainees had performed cardiac arrest resuscitations within the seven days prior to answering the questionnaire. It stands to reason that General Surgery and Internal Medicine trainees are faced with patients in need of resuscitation more often than trainees in Radiology and Psychiatry. Those specialist trainees whose most recent resuscitation had been in the preceding week felt more competent than those who had resuscitated a patient more than one month as well as more than one year previously. This is consistent with previous studies regarding the rapid decline in the retention of emergency skills [9–12]. If resuscitations are performed on a regular basis or with the use of simulations, skills are consistently reinforced enabling the doctor to feel more confident and therefore have a higher self-perceived competence rating.

When analysed as skill groups, specialist trainees ranked their competence in basic emergency skills higher than the intermediate and advanced skills. Basic emergency skills form the foundation of resuscitation and consequently should be mastered before the more advanced skills. This parallels the Dreyfus and Dreyfus model discussed by Khan et al., where the acquisition of basic skills is part of the progression towards mastering more advanced skills [13].

Self-perceived competence in bag-mask ventilation was rated highly across all groups receiving “intermediate to expert” scores. Adult CPR and relief of choking received higher scores than the corresponding child and infant skills. Cardiac arrest occurs less frequently in children and CPR is often performed poorly in children in both in-hospital and out-of-hospital settings [14]. The resuscitation of children is also known to cause higher levels of stress [15]. Perhaps the lower competence scores reflect avoidance of paediatric resuscitation encounters and therefore less confidence in their performance. This may also be because none of the specialist trainees were regularly involved in paediatric emergencies. As the complexity and therefore difficulty of the skill groups increased, so the self-perceived competence diminished.

Female specialist trainees perceived themselves to be less competent in advanced emergency skills than did the male trainees. This could be as a result of females underestimating their perceived level of competence when compared to their male counterparts. A study by Beyer demonstrated similar findings where females underestimated their level of performance on certain tasks when compared to males [16]. Self-assessment in the form of perceived levels of competence can also be influenced by other factors including one’s own knowledge of the content being assessed. The female trainees may, in fact, have known more about the subject matter but were less confident and subsequently perceived themselves to be less competent [17]. Ehrlinger et al. showed that females had more negative opinions regarding their scientific abilities as compared to males and their levels of self-evaluation were less positive than their male counterparts [18].

There was a decrease in competency amongst the specialist trainees in the intermediate and advanced skill groups for every year delay in starting specialisation. Since it is well documented that retention of emergency skills declines rapidly after initial training, the same principle can speculatively be applied to those doctors who complete their internship training and only started specialising years later [9]. Essentially, the longer a doctor does not reinforce clinical emergency-related skills, the more likely their competencies in those skills are to decline.

Attendance and current certification in advanced life support short courses are only compulsory for certain specialities according to the Colleges of Medicine of South Africa. General Surgery trainees require ATLS certification prior to writing their intermediate specialist examinations [19]. Consequently, the entire General Surgery study cohort had a current or expired certification, which may have led to their higher perceived competency scores.

Radiology trainees had a much lower proportion of current certification in BLS and ACLS. Their attendance at these courses were most likely prior to starting residency and were potentially not renewed due to the perception that because they have less direct patient interaction and that resuscitation skills may not be required in their discipline. Financial constraints may also be a hindrance to maintaining certification as course costs are not covered by the employer.

Trainees with current PALS/APLS certification had more self-perceived competence in performing basic and advanced emergency skills. Quan et al. demonstrated an increase in the successful performance of certain skills such as bag-mask ventilation, endotracheal intubation and defibrillation after completing a PALS/APLS course [20]. Langan et al. showed similar observations of improved self-assessed competence in skills after successful completion of resuscitation courses [21].

General Surgery trainees felt more competent than the other disciplines in both the basic and advanced emergency skills. They also had more self-perceived competence than the Psychiatry and Radiology trainees in the intermediate emergency skills. General Surgery is a discipline whose doctors are generally exposed to resuscitations on a regular basis. Advanced emergency skills such as cricothyroidotomy, thoracotomy, escharotomy, fasciotomy and venous cutdown are also more relevant to the surgical than the medical disciplines. Thus, their higher overall competency assessment scores in these skills was expected. The surgical bias of the advanced skills is a potential limitation of this study.

In general, the clinical trainees felt more competent in all emergency skill groups than their non-clinical counterparts. Outcomes following sudden unexpected cardiac arrest, after good resuscitation, may be better than many other serious illnesses (e.g. cancer) [22]. Simply because a patient suffers a cardiac arrest in the radiology suite rather than the medical ward, should not prejudice the patient [22].

In the context of this study, it could be argued that the trainees’ self-perception is incorrect. The General Surgery group having rated themselves as highly competent in a range of emergency skills does not necessarily mean that they are more competent than the doctors in the other groups who rated themselves less competent. The General Surgery group may think they know how to perform certain skills and believe they are competent in those skills because they perform them more often than other doctors, but this does not necessarily make them more competent – the so-called Dunning-Kruger effect [23].

Dunning et al. found that students who were overconfident and who had overinflated preconceived ideas about their skill levels would often fall short in objective performance tests [23]. This was further emphasised by Ehrlinger et al. who noticed that the way in which someone perceives their own performance usually

influences the way in which they would rate themselves [18]. Perception does not equate to performance.

Ninety-five per cent of all the trainees thought that irrespective of discipline, trainees should be competent in life-saving skills. Based on the data, however, the non-clinical trainees would not be able to fulfil this.

Response rates were variable amongst the different disciplines. Questionnaires were handed out to specialist trainees at their various academic meetings, but attendance of these meetings was relatively poor which resulted in poor response rates. Poor attendance may have been due to data collection occurring around the time that specialist trainees were either preparing for or writing their specialist examinations; trainees who were either on call or post call did not attend their academic meetings and specialist trainee attendance at these academic meetings was not compulsory. The surgical bias of the advanced skills may have compounded the perceived lack of competence amongst the other specialities.

In conclusion, specialist trainees in the clinical disciplines of General Surgery and Internal Medicine had a higher level of self-perceived competence in various emergency skills when compared to trainees in the non-clinical disciplines of Psychiatry and Radiology. Of the four disciplines studied, the General Surgery trainees rated themselves highest overall in their level of perceived competence in the basic and advanced skills groups. Resuscitation course attendance and specifically current rather than expired certification in ACLS and PALS/APLS courses were found to have a significant influence on the specialist trainees' perceived level of competence in various emergency skills. Those specialist trainees who had less delay before starting their specialist training also demonstrated higher levels of perceived competence.

Attendance of advanced life support short courses as well as resuscitation simulation training should be strongly considered for all specialist trainees especially in those disciplines who are not exposed to patients in a resuscitation setting often. Whilst self-perceived confidence does not necessarily translate into practice, the confidence boost associated with having done a course may assist the doctors should the need arise. This strategy of continuous clinical learning to enhance emergency medical preparedness is likely to apply to all medical practitioners and not only specialist trainees.

Conflicts of interest

The authors declare no conflict of interest.

Dissemination of results

Results of the study were shared by the distribution of the MMed research report to the University of the Witwatersrand.

Authors' contributions

ND and LG conceived the original idea. ND, LG and MB designed the study. ND collected the data. ND drafted the original manuscript and LG revised it. ND, LG and MB approved the final version that was submitted.

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