WHAT LEVEL OF COMPETENCE IN EMERGENCY SKILLS DO REGISTRARS IN VARIOUS SPECIALITIES POSSESS?

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A research report submitted to the Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, in partial fulfilment of the requirements for the degree of Master of Medicine in the Division of Emergency Medicine.

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DECLARATION

I, Nicholas Dufourq, declare that this research report is my own work. It is being submitted for the degree of Master of Medicine (Emergency Medicine) at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at this or any other University.

Dr Nicholas Dufourq

On this 12th day of September 2013.

DEDICATION

To Tanu.

The love of my life. Thank-you for always being there for me.

ABSTRACT

Objectives: To determine the level of self-assessed competence various registrars possessed in emergency skills as well as to identify any factors that may have contributed to their level of competence.

Materials and Methods: Questionnaires were completed by registrars working in General Surgery, Internal Medicine, Psychiatry and Radiology in three academic hospitals in Johannesburg. Information regarding demographic data, educational background, work experience in emergency-related environments and resuscitation courses attended were collected. Registrars rated their level of perceived competence in a list of 25 emergency skills according to a ranking scale of 1 to 5.

Results: A total number of 94 registrars participated in the study which amounted to an estimated response rate of 35%. General Surgery registrars had the highest mean competence scores of 3.7 and 3.9 for the respective basic and advanced skills groups. General Surgery and Internal Medicine registrars had the highest mean competence scores of 3.7 for the intermediate skills group. Psychiatry registrars had the lowest mean competence scores of 2.7, 2.4 and 1.5 in each of the skill groups.

Registrars who had current certification in a PALS course had competence scores 0.6 units higher than others in both basic ($p=0.027$) and advanced ($p=0.035$) emergency skills.

Conclusions: General Surgery and Internal Medicine registrars have a higher level of perceived competence in various emergency skills. The General Surgery group rated themselves the highest in levels of competence in the basic and advanced emergency skills groups. Current certification in BLS, ACLS, PALS and AMLS has a positive impact on registrars' self-perceived levels of competence in emergency skills. Registrars who had spent less time between community service and starting their specialist training had higher levels of self-perceived competence in intermediate and advanced emergency skills.

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NOMENCLATURE

Abbreviations

ACLS	Advanced Cardiac Life Support
ACLS EP	Advanced Cardiac Life Support for Experienced Providers
AED	Automated External Defibrillator
AHA	American Heart Association
AIME	Airway Interventions and Management in Emergencies
AMLS	Advanced Medical Life Support
ATLS	Advanced Trauma Life Support
BLS	Basic Life Support
BMV	Bag-mask ventilation
CPD	Continuing Professional Development
CMSA	Colleges of Medicine of South Africa
CPR	Cardiopulmonary Resuscitation
CS	Competence score
CV	Central venous
ECC	Emergency Cardiovascular Care
ECG	Electrocardiogram
ED	Emergency Department
ET	Endotracheal
GS	General Surgery

ICD	Intercostal drain
ICU	Intensive care unit
IM	Internal Medicine
IO	Intraosseous
LMA	Laryngeal Mask Airway
P	Psychiatry
PALS	Paediatric Advanced Life Support
R	Radiology
UCT	University of Cape Town
UKZN	University of KwaZulu-Natal
UP	University of Pretoria
Wits	University of the Witwatersrand

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Chapter 1 INTRODUCTION

1.1 Motivation and rationale for this research

Doctors are frequently called upon to assist in the resuscitation of patients. Whether they are called upon to function as a team leader or a team member, the way in which they conduct their specific emergency resuscitation duties has a significant impact on the patient's outcome[1,2]. Current studies show survival rates after in-hospital cardiac arrest to be less than 20 per cent[3]. In order for doctors to be able to function effectively in these resuscitations they should be competent in certain life-saving emergency skills[1].

Life-saving emergency skills have been developed, refined and simplified in order to aid doctors when faced with critical decision-making situations. They range from basic Cardiopulmonary Resuscitation (CPR) and the use of an Automated External Defibrillator (AED) to more advanced skills such as the performance of a cricothyrotomy or the placement of a central venous (CV) catheter. They include simple and advanced airway skills as well as skills aimed at achieving rapid intravascular access.

The amount of time doctors spend practising these skills is minimal and inadequate competency can be attributed to a lack of training and poor skills retention[4].

A host of relevant training courses are available that can provide doctors with the knowledge and skills on how to treat patients with life-threatening emergencies. They can however be both time-consuming and costly. These courses purport to equip doctors with guidelines that include interventions aimed at preventing cardiac arrest as well as treating patients in cardiac arrest[5 - 9]. The type of speciality in which a doctor is training in will usually dictate whether or not they choose to attend these courses.

Due to the nature of a specialist degree, some doctors have a limited amount of exposure to certain pathologies. Doctors working in specific disciplines may be faced with patients in cardiac arrest more often than others. In a study by Hope *et al.* the incidence of patients sustaining a cardiac arrest whilst in the radiology department was 0.002 per cent[10]. Physicians and surgeons on the other hand have to deal with such emergencies on a far more regular basis. Despite this difference in clinical exposure and subsequent frequency of management opportunities, all doctors should be able to deal with a patient in need of emergency treatment if called upon to do so.

It is important to keep in mind that doctors come from different academic backgrounds and have followed different routes before choosing a specialisation. The years between Community Service and registrar time may have been spent working in a setting where knowledge of emergency skills may have been a prerequisite for employment. Many doctors are required to be certified in Basic Life Support (BLS), Advanced Cardiac Life Support (ACLS) and Advanced Trauma Life Support (ATLS) before undertaking employment in the private sector and the

regulations of the Colleges of Medicine of South Africa (CMSA) state that certain registrars need to be certified in some of these abovementioned courses before writing their examinations[11]. All of these factors may play a role in how competent certain doctors are in various emergency skills regardless of the nature of their specialisation.

1.2 Statement of the problem

The resuscitation of a severely ill patient can occur at any time and place and is not necessarily isolated to one particular discipline. Registrars in those disciplines that are not commonly faced with the resuscitation of patients may feel less competent in the skills required to provide adequate treatment than those doctors who deal with life-threatening situations on a daily basis. Even those doctors who perform resuscitations on a regular basis may feel incompetent as certain skill sets may be felt to be out of their scope of practise or may include those that they have not performed in a long time or have never performed at all.

All doctors have come through a similar type of medical education with the only real differences being the university at which they have studied and the hospitals at which they did their Internship and Community Service. After this point many different paths may have been taken. Following compulsory Internship and Community Service, the choice to go straight into a specialisation post, work as a medical officer, work in the private sector or even work abroad is totally in the hands of the individual doctor.

Time spent working in emergency-related environments or doing emergency-orientated training courses could possibly equip doctors with a sense of competence that would allow them to perform better in a resuscitation scenario than others. If this experience was gained before a doctor started specialising or possibly even during their time as a registrar, being in a less clinical discipline would then potentially have no impact on how competent they felt about their resuscitation skills.

The assumption is that all doctors should be able to treat a patient in need of a life-saving intervention if called upon to do so. Yet members of the lay public are not necessarily aware of the distinction between a “doctor” who is a Radiologist and a “doctor” who is an Emergency Physician. Do members of the public have the right to expect every doctor to be competent in resuscitation skills? It can be argued that society has a legitimate expectation for all doctors to be competent in resuscitation skills. This study seeks to find how registrars in different disciplines rate their level of competence in emergency skills and to determine what factors predispose certain doctors to have more self perceived competence than others.

1.3 Aim and objectives

1.3.1 Study aim

The aim of this study was to describe the level of self-assessed competence various registrars possessed in emergency skills as well as to identify any factors that may have contributed to their level of self-perceived competence.

1.3.2 Study objectives

1. To describe and compare the level of self-assessed competence in various emergency skills of registrars in selected disciplines.

2. To determine whether certain factors (age, sex, educational background, time since qualification, previous exposure in emergency-related environments and emergency courses attended) had an effect on the self-assessed level of competence registrars had in emergency skills.

Chapter 2 LITERATURE REVIEW

2.1 Introduction

This literature review aims to explore some of the pivotal concepts in medical education. Competence, competency, knowledge and performance are all terms that are frequently used in medical literature. This study focuses on self-assessment, the various emergency skills with regards to their contributions in emergency situations and the ability for registrars to retain these skills once learnt.

2.2 Competence

2.2.1 Defining competence

The concept of competence has undergone much analysis in medical literature. Despite these attempts, even though it is a key element in medical education, there is no consensus definition of competence that covers all aspects of medical practice[12]. A proper understanding of clinical competence and its multi-faceted components is important to authentically allow the construct to serve as a validation tool for medical educational programs and to assure basic levels of competence amongst registrars[13]. The public at large also needs assurance that the doctors whom they consult are competent enough to treat them well. The perception, context and consensus understanding of this term are thus important for professional and lay people alike[14].

Scientific knowledge and clinical acumen form part of the foundation upon which competence is built[12]. Thus, in order to be competent in a particular skill, one should possess an adequate amount of knowledge and ability in the skill in order to perform it correctly.

Hager *et al.* regarded competence as a holistic entity, one that includes both cognitive and interpersonal skills[15]. When attributes from both were combined, this allowed for a more integrated approach to understanding competence which in turn aided its vocational application[15].

The Oxford English Dictionary defines competence as "an ability to do something successfully or efficiently"[16]. When viewed from a clinical perspective, this could be the capacity a doctor has to undertake a certain skill successfully or efficiently[17]. Epstein *et al*. defines competence in clinical contexts as the "habitual and judicious use of communication, knowledge, technical skills, clinical reasoning, emotions, values and reflection in daily practise for the benefit of the individual and community being served"[12]. Expanding on this definition Epstein *et al.* listed multiple dimensions, similar to those that Hager *et al.* studied, that contributed to professional competence[12]. These included several different domains[12]:

- Cognitive skills: acquiring core knowledge, being able to apply this knowledge to solve problems, recognising deficiencies in one's knowledge, using resources to attain more knowledge and learning from experience.
- Practical skills: having the ability to perform patient examinations and clinical skills.

- Integrative and relative skills: being able to use clinical reasoning as well as managing indecision.
- Relationship skills: being able to communicate effectively with patients and colleagues as well as handling conflict resolution and being able to teach others.
- Emotional and moral skills: having tolerance and respect for patients as well as being caring and attentive to the needs of others.

Regardless of these numerous studies and attempts at definition, clinical competence is a complex construct which cannot be easily characterised or understood by a simple dictionary definition[13].

2.2.2 Competence and competency

Medical competence and competency are core concepts in medical teaching[18]. Despite being used interchangeably, medical assessment and education literature has highlighted a difference between competence and competency[15,17]. The term "competency" denotes an actual skill while "competence" is the capacity to carry out that skill and the traits of the performer[17]. For example, the skill of performing CPR is the "competency" while the person able to perform CPR has the "competence" to do so.

2.2.3 Knowledge and performance

Knowledge can be regarded as an established entity that represents information and processes that exist in a certain field[17]. Application of knowledge is when this information is used in a meaningful and reasonable way[17]. In order to process this knowledge, one must use higher order activities or cognitive skills such as logic and analysis[17].

Performance – defined in the Oxford English Dictionary as "the action or process of performing a task or function" – is dependent on these cognitive skills[17,19]. Many factors including working environment, physical state, psychological state and personality traits play a role in how someone performs[17]. Performance levels may be improved by enhancing motor, cognitive and decision-making skills[17]. These combinations of factors that can either hinder or help one's level of performance thus make performance an inconsistent attribute whereas knowledge is a more established entity[17]. In 1976 Senior differentiated performance from competence, and proposed that competence is the ability to perform a skill while performance is the actual carrying out of the skill[13].

2.2.4 Models of competence and performance

Several models have been published aiming to illustrate how competence can be attained through educational processes and the growth of information[20]. Rasmussen described the initial stage in practical learning as the acquisition of a skill[21,22]. He suggested that one could be competent in a skill before acquiring the full knowledge pertaining to that skill[21,22]. He theorised that with time practical experience would naturally increase and that this would be enhanced with

knowledge[21,22]. Carr felt that this construct would have a negative impact towards medical education as it would not stimulate development of professional skills amongst doctors[20].

In the early 1980s Dreyfus and Dreyfus described a model initially used for the training of pilots showing the acquirement of skills to be an ongoing process ranging from novice to expert[23]. When they applied their model to clinical medicine, they further described these five stages as well as appointing a medically relevant example to each stage[24]. These stages included the “novice” medical student, the “advanced beginner” intern, the “competent” registrar, the “proficient” newly qualified consultant and the “expert” well-established specialist[24].

Khan *et al.* added two more points on either end of this Dreyfus model[17]. The first being “incompetent” on the bottom end of the spectrum, since most people who learn a skill in the first place are actually unable to perform this skill prior to learning about it[17]. The second addition, “mastery”, was placed at the top end of the spectrum and was used to indicate that learning never really ends and people should be motivated to constantly improve on their ability to perform[17]. In aiming to achieve mastery in a skill, Peyton described four stages in the cycle of learning[25]. Learners work their way through these four stages until a skill becomes second nature. These include; an initial stage where they are completely unaware of their lack of competence in a skill, as this awareness changes they become conscious of their lack of competence, once they begin to learn how to perform a certain skill they start realising their competence and eventually they become so well trained that they are unconsciously competent in that particular skill[25]. Khan *et al.* goes on

to show that through training and practise, competence is in fact a point on the continuum of enhancing performance[17].

In 1990, George Miller identified four hierarchical layers of development: - “knows (knowledge), knows how (competence), shows how (performance) and does (action)”[26]. From this model shown in Figure 2.1, one can deduce that knowledge is required as a basis to be effective when performing clinical skills. Thus knowledge itself functions as a prerequisite for being clinically competent. Competence would imply that a doctor would know how to use his or her knowledge to perform a skill, and performance would be the ability to use this knowledge to practically perform a skill[13]. The final layer of the framework would be actually performing the skill on a day-to-day basis[13].

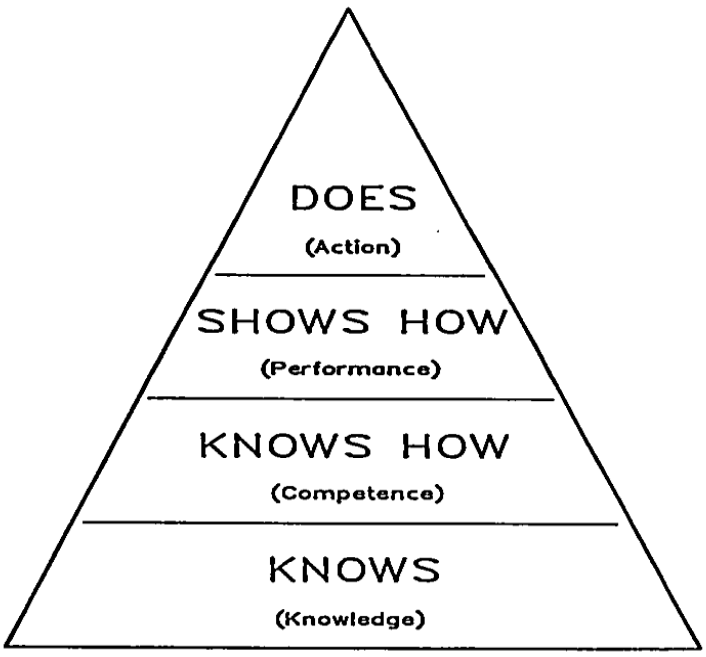

Figure 2-1: Miller's triangle (Miller GE. The assessment of clinical skills/competence/performance. *Academic Medicine* 1990; 65: 563 - 567, published with permission).

Carr pointed out that Miller's triangle seemed to make the assumption that competence predicts performance, yet knowing a skill does not necessarily mean that a doctor will be able to perform the skill when called upon to do so[20]. Thus the introduction of the Cambridge model by Rethans *et al.* shown in figure 2.2 below which inverts Miller's triangle and looks at performance as a result of competence along with many of the influential factors mentioned earlier[27].

Taking all these studies into account it seems as though Khan *et al*. provides the clarity that is needed to see that competence and performance form part of one continuous spectrum and are not opposing entities[17].

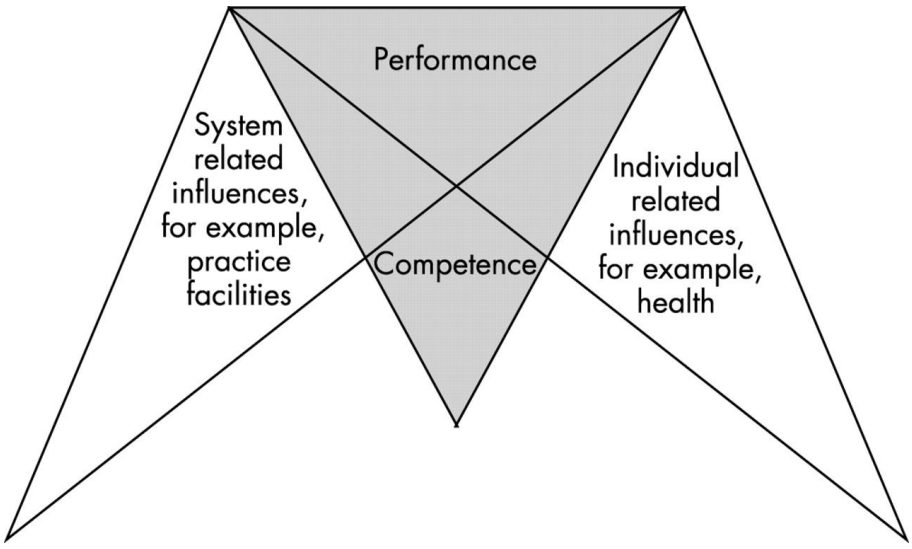

Figure 2-2: The Cambridge model for delineating performance and competence (Rethans JJ et al. The relationship between competence and performance: implications for assessing practise performance. *Medical Education* 2002; 36: 901 - 909, published with permission).

2.2.5 Assessment of competence

Hager *et al.* postulated that the assessment of competence should be based on performance[15]. Other forms of assessment were proposed by Rethans *et al.* in which they suggested that competence be assessed as part of a more rigid examination-like process and performance be assessed in a more contextualised clinical environment[27].

These forms of assessment, however, went against previous propositions that competence forms part of performance and they are in fact both part of one spectrum. Regardless, these newer models of performance assessment demonstrated in different settings, are now being implemented by the General Medical Council in the United Kingdom[17]. “Observed Performance in Workplace Settings” is an assessment of performance in the workplace and “Observed Performance in Simulated Settings” is an assessment of performance in a structured clinical examination[17].

2.3 Self-assessment

Self-assessment is an extremely important tool in medical education. It has been identified as an essential part of professional self-regulation, allowing someone to recognise deficiencies in their skills and abilities[28]. The potential to acknowledge one’s strengths and weaknesses then serves as a platform for the professional to set appropriate learning objectives, this is reflected by the Health Professions Council of South Africa’s philosophy towards Continuing Professional Development (CPD)[28,29]. In order for this form of self-education to be valid, doctors

must be aware of their own potential, boundaries and areas in need of development[30].

Studies suggest that doctors are in fact very poor at assessing their own capabilities and are usually unaware of their lack of knowledge in certain areas[30,31]. Fitzgerald *et al*. postulated that those doctors who are unable to correctly identify gaps in their knowledge or clinical ability could in fact do a disservice when providing treatment to patients in need of their care[32]. Accurate self-assessment can thus be seen as a skill in its own right: one that requires teaching and practise[33].

Fitzgerald *et al*. went on to examine the variables that may affect one's ability to accurately perform self assessment[32]. They found that there was no relationship between demographic or academic variables and the accuracy in which self-assessment was performed[32]. They went on to show that regardless of the task being assessed, whether it is interpreting an electrocardiogram (ECG) or performing focused clinical examination on a patient with chest pain, there was no difference in self-assessments made[32]. From this they termed self-assessment a "generalisable skill"[32]. A major limitation to this study was that the tasks being performed were not independent of each other[32]. As it was only the tasks that made self-assessment a "generalisable skill", other entities could possibly impact the way someone performed in assessing their capabilities.

A review by Gordon has shown that certain other factors can indeed influence the way in which self-assessment is performed[33]. One of these factors was knowledge; those students who were less familiar with the subject matter tended to be overconfident in their self-assessment whereas those students who knew more about the subject matter were less confident[33].

In 1999 David Dunning and Justin Kruger proposed a set of predictions which hypothesised that the unskilled and incompetent individual would incorrectly overrate his or her capability and performance in a set of skills[34]. It was also hypothesised that these individuals failed to recognise skills in others and were unable to perceive the extremity of their inadequacy[34]. This was said to be due to a lack of metacognitive skills needed for accurate self-assessment and the inability of the unskilled to identify their own mistakes[34]. The so-called Dunning-Kruger effect was tested on undergraduates at the Cornell University in the United States of America and it was shown that those students who scored the lowest marks grossly overestimated their test performance and ability[34]. Conversely, those students who scored the highest marks were the ones who underestimated their own ability[34].

In spite of all these limitations, valid self-assessment is still a key tool in Continuing Professional Development (CPD) and when used correctly it can be part of a system which aids in lifelong learning[33,35].

2.4 Emergency skills

A variety of emergency skills can be utilised by doctors when faced with decision-making for patients in life-threatening situations. A certain skill may be easier to perform than another, yet this does not change the fact that even the most basic skills are extremely important and can potentially be the ones that save a patient's life. This makes it difficult to categorise skills into basic, intermediate and advanced. A more suitable classification could potentially be: most commonly used skills, less commonly used skills and least commonly used skills. One may hypothesise that the more often a doctor performs a skill, the more competent they will become. This can be argued: they may be performing the skill poorly each time and merely practising and repeating bad principles. However, no database was found by the researcher that demonstrates the frequency at which certain skills are performed by specialists-in-training and thus for the purpose of this study the skills analysed were divided into three categories: basic, intermediate and advanced.

2.4.1 Basic emergency skills

Basic emergency skills form the core of most resuscitation guidelines. Adequate knowledge and competence in these skills will aid a doctor when faced with a patient in need of resuscitation. BLS is one such skill set that includes fundamental tools that will help save a patient's life following cardiac arrest and should be mastered by every doctor[5]. The 2010 American Heart Association (AHA) Guidelines for CPR and Emergency Cardiovascular Care (ECC) recognised early CPR and rapid defibrillation with an AED as two essential aspects of BLS[5]. The adult BLS algorithm for healthcare providers is made up of the following steps[5]:

- recognising that a patient is unresponsive
- looking for any signs of normal breathing
- calling for help
- accessing an AED or defibrillator
- checking for a pulse
- commencing CPR with chest compressions (if no pulse is present)
- making use of an AED or defibrillator as soon as it is available

CPR is made up of both chest compressions and ventilations. In order for chest compressions to be effective they should be performed hard and fast, at a depth of at least five cm and at a rate of least one hundred per minute[5]. After every thirty compressions two ventilations are given[5]. Modifications are then made to this ratio for a child or an infant.

These evidence-based guidelines emphasise the need and importance of such skills to be frequently revised by healthcare providers in order to improve the success of resuscitation[6]. Despite the courses that are available to teach doctors these life-saving skills, current literature affirms the rapid decline in retention of knowledge within six months of certification[4].

The performance of high quality CPR and early defibrillation are important if return of spontaneous circulation and neurologically intact survival is to be achieved[5,7]. Defibrillation is the standard of care for ventricular fibrillation, the rhythm most frequently observed in witnessed cardiac arrest[36]. In order to be effective,

defibrillation needs to be done swiftly and accurately[37]. In a study done by Louw *et al*. only 14% of personnel knew the correct energy setting for their Emergency Department's defibrillator[37]. Healthcare providers should therefore be familiar with the use of the AED or manual defibrillator in their Emergency Department (ED).

From a newly qualified doctor working as an intern or to a long-practising consultant, core knowledge in basic emergency skills is crucial and indeed expected.

2.4.2 Intermediate emergency skills

Building upon this basic knowledge and expertise doctors should also develop competence in skills that are slightly more advanced yet vital when resuscitating a patient. For example, knowledge in the use of a manual defibrillator could be regarded as a basic skill while being familiar with the additional functions it can serve would require a more intimate knowledge of the device and the pathologies which it can treat, hence making its use an intermediate skill.

A defibrillator can be used to treat unstable tachycardias and bradycardias as well as dysrhythmias that are not as common as cardiac arrest but are nonetheless life-threatening and reversible if the correct procedure is promptly carried out. It is reasonable to expect doctors to be able to commence transcutaneous pacing in patients with an unstable bradycardia and to perform synchronised cardioversion on a patient with an unstable tachycardia[7,8]. If doctors are the first to respond to an in-hospital unstable peri-arrest patient who presents with such life-threatening

rhythms, then competence in both transcutaneous pacing and synchronised cardioversion is an important determinant to the outcome of the patient.

In order to recognise the rhythms that require such interventions, doctors should also be competent in interpreting a 12-lead ECG. The ECG is a readily available bedside investigation that can provide important information to the treating doctor. For some, the interpretation of an ECG may be regarded as a basic skill yet for those doctors who are not commonly faced with patients who require this investigation; it could be classified as an intermediate or even an advanced skill. For the purposes of this study, ECG interpretation has been situated in the intermediate category

In order to maintain and sustain competency in ECG interpretation skills the American College of Cardiology as well as the AHA have suggested that registrars analyse and interpret a minimum of 500 ECGs during initial training and 100 ECGs annually[38]. Studies have shown a wide range of competencies in ECG interpretation skills ranging from 42.2% in junior Emergency Medicine registrars to 98.8% in Cardiologists[39,40].

Airway management is another extremely important life-saving skill in which doctors should be competent. Despite the complexities of airway management, it has now become a core skill amongst many specialities[41]. However, knowledge of some of the more basic concepts and skills should span all specialities, since airway compromise is pervasive and is often required in the management of emergency patients.

The 2010 AHA guidelines for CPR and ECC states that "all healthcare providers should be familiar with the use of the bag-mask device"[8]. Bag-mask ventilation (BMV) is a life-saving skill which provides a suitable means of ventilating a patient in cardiac arrest[8]. It allows the doctor to ventilate and oxygenate the patient before the insertion of an advanced airway[42]. There are, however, many hindrances to successful bag-mask ventilation and for the untrained provider it can be a difficult skill to master and thus requires practice in order to maintain competency[8,43].

Knowledge of endotracheal (ET) tube insertion is another useful skill as successful placement allows ventilation via a more protected route[8]. However, the incidence of complications is rising due to intubation being attempted by inexperienced providers[8].

A supraglottic airway device such as the laryngeal mask airway (LMA) is an adjunct designed to maintain a patent airway and provide a port for ventilation[8]. Advantages of this device include easier training and maintenance of skills and most importantly it allows insertion without interrupting chest compressions[8]. Once doctors have received training in the use of the LMA, it has proven to be an acceptable substitute to BMV or ET intubation during CPR[8].

2.4.3 Advanced emergency skills

Advanced emergency skills are defined here as those which, although not commonly performed by doctors in resuscitation scenarios, may be equally as vital to the medical practitioner's repertoire especially when life-threatening conditions require definitive intervention. These more advanced skills are not only used in extreme cases but also form part of routine procedures in trauma resuscitation. They include: performing needle decompression and the insertion of an intercostal chest drain (ICD) for a tension pneumothorax; the performance of a fasciotomy or an escharotomy for a limb-threatening compartment syndrome and a thoracotomy for those patients arriving to the ED with penetrating chest trauma with imminent cardiac arrest[44].

A cricothyrotomy is a procedure used in the management of a failed airway. In adult patients it can be carried out quickly and easily with minimal complications[45]. However, in a study done by Reid *et al*, only 0.2% of patients undergoing ED intubation required a surgical airway[46]. Thus, due to the nature of its use in emergency situations, most doctors have limited experience with this rarely required albeit potentially life-saving skill[45].

Rapid intravascular access is an important skill in the management of the patient in need of intravenous fluids or drugs[47]. Since peripheral venous access may be difficult to establish in the haemodynamically compromised patient, doctors should be competent in other ways of obtaining vascular access[47]. Central venous (CV) cannulation offers an alternative route, allowing for both fluid resuscitation and

haemodynamic monitoring[47]. Intraosseous (IO) cannulation is a safe and reliable alternative option in both adult and paediatric patients in need of resuscitation[47].

Undergraduate medical training now provides medical students with the opportunity to be exposed to some of the above mentioned emergency skills[48]. Not only are they required to be familiar with these skills but they are also required to be competent in applying these skills[48]. Some qualified doctors may not have had the opportunity to gain experience in the use of some of these skills, however, several courses are now available providing healthcare professionals both exposure and training in a range of emergency skills.

2.5 Training courses

Numerous training courses have been designed to help teach and continually reinforce current competency of healthcare professionals in the skills needed to both recognise and manage patients in life-threatening situations. The AHA ECC courses are the most readily available short course CPD offerings available in South Africa. The most fundamental of these courses is the BLS course where skills such as CPR, the use of an AED and the management of a choking patient are taught over a 5 hour period. Students undertaking this course are assessed in the form of pre-course and post-course multiple choice question tests as well as an observed practical simulation test. The focus of the course is hands-on training and exposure to equipment used in resuscitation scenarios. After successful completion of the course the newly trained BLS providers are given a certificate of completion valid for two years.

Building upon this knowledge are the Advanced Cardiac Life Support (ACLS), the Advanced Cardiac Life Support for Experienced Providers (ACLS EP) and the Paediatric Advanced Life Support (PALS) courses. The very first AHA endorsed ACLS course was introduced in the United States of America in 1974 followed by the first PALS course in 1988[49]. These courses are aimed at taking the healthcare provider to the next level such that they are competent in not only providing CPR and BLS but further managing the causes that may have precipitated a cardiac arrest. Teamwork and leadership skills are taught aiming at improving the communication between healthcare providers when faced with a chaotic resuscitation scenario.

In 1980, the American College of Surgeons developed and conducted the first ever Advanced Trauma Life Support (ATLS) course[50]. Since then, 47 countries ranging from Argentina to Pakistan are teaching their doctors this course, the textbook for which is now currently in its 9th edition[50]. With its focus on the trauma patient, this course instructs doctors to perform numerous life-saving emergency skills such as venous and IO access, ICD insertion, needle decompression, cricothyrotomy, use of peritoneal lavage and the performance of pericardiocentesis. Similar to other CPD training courses, once medical practitioners have successfully completed both theoretical and practical assessments they will then be certified as ATLS providers.

A training course recently introduced into South Africa aimed at providing health-care providers with the knowledge and skills required for definitive airway management is the Airway Interventions and Management in Emergencies (AIME)

programme. Skills ranging from how to decide when to intubate a patient to which drugs to use in certain conditions are taught, providing an opportunity to build confidence to manage both simple and difficult airways.

Numerous other training courses including Basic Surgical Skills, Neonatal Resuscitation, ECG interpretation and various advanced life support courses, eg. Advanced Medical Life Support (AMLS), are available for doctors to improve their knowledge and skills in certain areas.

With a plethora of courses available for health professionals to attend, it could reasonably be presumed that having successfully completed such a list of courses makes one doctor more competent than another. Yet, it is has been shown that simply doing these courses does not translate into improved competence to resuscitate a patient in an emergency[51]. Clinical experience and real-life application, however, does appear to improve both competence and skill retention[52].

Doctors are unfortunately faced with many obstacles when it comes to participating in these training courses. Time away from work is sometimes difficult to arrange and some doctors are required to take annual leave in order to attend these courses. Other departments offer their registrars “course leave” as part of their special leave agreements (Goldstein LN 2013, oral communication, 24th January). The cost of these courses is high and this expense usually has to be borne by the individual doctor seeking the training.

2.6 Skill retention

The AHA recommends that BLS and ACLS courses be refreshed every two years[49]; however numerous studies have documented poor retention of skills as early as three to six months post training[53 - 56]. A study done by Na *et al*. showed a significant decline in certain BLS skills when students were retested six months after initial training[52]. Na *et al.* also suggested that in order for skills to be retained more effectively, providers should receive constructive feedback about the performance of their skills as well as practise their skills more frequently[52]. Woollard *et al.* added to this by stating that if the initial skill training was inadequate then any future refresher courses would not likely improve performance[57]. Other factors that influence the level of skill retention include hands-on practise as well as instructor supervision, feedback and competence[58].

2.7 Conclusion

For the purposes of this study the term competence was defined as the ability a registrar has to carry out an emergency skill and the term competency was used for an actual skill[17]. Referring back to a pertinent example; the skill of performing CPR is the “competency” while the person who has the ability to perform CPR displays the “competence” to do so.

Self-assessment in the form of perceived levels of competence can be influenced by many factors including one’s own knowledge of the content being assessed[33]. After reviewing the literature and analysing the various models of competence the researcher developed a rating scale which was used to aid the registrars in determining their level of competence in certain emergency skills. There are a

large number of emergency skills, many of them overlapping in levels of difficulty. Those commonly used in resuscitation scenarios and those taught on training courses were chosen for this study and then further categorised into basic, intermediate and advanced.

Chapter 3 MATERIALS AND METHODS

3.1 Ethics

This research was approved by the Human Research Ethics Committee of the Faculty of Health Sciences of the University of the Witwatersrand (protocol approval number M120316 - see Appendix A). Permission was obtained from the Chief Executive Officers from the three participating hospitals (see Appendix B). Permission was obtained from the Clinical Heads of Departments of the four participating disciplines. Informed consent was obtained from all registrars participating in the study (see Appendix C). Registrars were given the opportunity to read an information sheet before they signed consent and completed the questionnaire (see Appendix D).

3.2 Study Design

Prospective cross-sectional descriptive study.

3.3 Study Setting and Population

Registrars working at the following hospitals were surveyed:-

- Chris Hani Baragwanath Hospital
- Charlotte Maxeke Johannesburg Academic Hospital
- Helen Joseph Hospital

Registrars across four disciplines were surveyed:-

- Internal Medicine (IM)
- General Surgery (GS)
- Radiology (R)
- Psychiatry (P)

3.3.1 Inclusion criteria

Registrars in the above disciplines at the three selected academic hospitals, in any year of study, who consented to participating in the study, were included.

3.4 Study Protocol

3.4.1 Data collection

Data was collected by the researcher in the form of an anonymous questionnaire (see Appendix E) which was completed by the participant.

The following steps were followed:

1. Questionnaires were distributed amongst the study population in the venue in which their routine departmental academic meetings were being held.
2. Before answering the questionnaire, all participants read the information sheet and completed a consent form.
3. Participants were given a sufficient amount of time to complete the questionnaire.
4. Participants placed their questionnaires in the collection box provided.

3.4.2 Outcome Measures

Registrars were asked to rate their level of competence in a list of emergency skills by using a Likert scale designed by the researcher as shown in Table 3.1.

Table 3-1: Scores used by registrars to rate their level of competence in emergency skills.

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

3.4.3 Description of sample

Based on the knowledge of the approximate number of registrars in each discipline in the three hospitals forming part of the study, the estimated population sizes are indicated below. The researcher then targeted all of the available registrars at each hospital.

- Internal Medicine 90
- General Surgery 80
- Radiology 50
- Psychiatry 45

3.4.4 Data Analysis

The IM and GS registrar groups were combined to form the clinical group. The P and R registrar groups were combined to form the non-clinical group. Various emergency skills were identified and then divided into the following skill groups.

- Basic skills, consisting of:-
    - adult CPR
    - child CPR
    - infant CPR
    - use of an AED
    - relief of choking in adults
    - relief of choking in infants
    - BMV

- Intermediate skills, consisting of:-
    - defibrillation
    - synchronised cardioversion
    - ET intubation
    - insertion of an LMA
    - transcutaneous pacing
    - needle thoracocentesis
    - ICD insertion
    - interpretation of a 12-lead ECG

- Advanced skills:-
    - CV line insertion
    - arterial line insertion
    - IO line insertion
    - venous cut down
    - cricothyrotomy
    - pericardiocentesis
    - thoracotomy
    - fasciotomy
    - escharotomy
    - delivery of a baby

In order to determine if it was necessary to analyse each emergency skill separately, or whether grouping them as basic, intermediate and advanced skills and analysing the average scores across the skills in each of these subgroups was justified, the validity of the three proposed constructs was examined. The validity of the measurements was assessed by looking at their reliability and construct validity.

The internal consistency (reliability) of the multiple indicators of each construct, i.e. the variables making up each group, was assessed to see if taking the mean of that group of indicators for further analysis could be justified. The reliability of each construct was assessed by means of Cronbach's α.

The reliability of all three constructs, as measured by Cronbach's α, was very good; however, low factor loadings for some of the items in the intermediate and advanced groups indicated that they should be removed from their respective constructs. Their removal resulted in a further increase in reliability of the constructs (see Appendix F). It was thus decided to retain the basic, reduced intermediate and advanced constructs and to evaluate ECG, IO insertion and delivery of a baby on their own.

Factor analysis across all 25 skills to determine the underlying dimensions in the data was not done due to the low sample size.

3.4.4.1 Analysis of competency in each skill versus potentially influencing factors

The factors which could contribute to the level of competence were:-

- Age
- Sex
- Educational background
- Time since qualification
- Previous exposure to an emergency-related environment
- Current exposure to an emergency-related environment
- Time since most recent resuscitation of a patient in cardiac arrest
- Emergency skills course attendance

Preparation of variables for analysis was performed as follows:-

- Discipline was included as an independent variable in the analysis.
- Time since qualification: the two variables, years since graduation or years post-Community Service, were highly correlated with each other, and also with age; the correlation coefficients lay in the range 0.79-0.80. Thus only one of these variables could be used in the analysis, to avoid multicollinearity. Years post Community Service was chosen as it was the most meaningful.

- Educational background: University was chosen since no respondents had completed any emergency-related degrees prior to studying medicine. The six universities with one respondent each were grouped as 'Other'. For further analysis, categories with less than 10% of the overall sample were also included in the 'Other' group. The following groups were retained:-
    - University of the Witwatersrand (Wits)
    - University of Pretoria (UP)
    - Medunsa
    - Other
- Previous or current exposure to an emergency-related environment was measured in three ways: yes or no, type of environment, duration of exposure. The type of exposure was considered less relevant than the presence or absence and duration of exposure, so a combination of the two latter variables was created, with the categories being less than or equal to 1 year, more than 1 year and none.
- Emergency skills courses attended: All three categories (current, expired and never) were used.

For each of the six competencies (three constructs and three stand-alone skills) a General Linear Model was run with the competence as the dependent variable and the following independent variables:-

- Discipline (GS as the reference category)
- Sex (Male as the reference category)
- Years post-Community Service
- University (Wits as the reference category)

- Previous exposure to emergency-related environment (None as the reference category)
- Current exposure to emergency-related environment (None as the reference category)
- Time since most recent resuscitation of a patient in cardiac arrest (more than 1 year as the reference category)
- Emergency skills courses attended (Never as the reference category).

3.4.5 Methods of analysis

The student's t-test or the Wilcoxon rank-sum test was used to test for differences in two continuous variables, depending on the distribution of the data. Tests for significant relationships between two categorical variables were carried out using Pearson's X^2 test at the 95% confidence level. Fisher's exact test was used in the case of 2x2 tables, or where the requirements for Pearson's X^2 test could not be met. The strength of the associations was determined by Cramer's V (the Phi coefficient was used in the case of 2x2 tables). The absolute values of these coefficients were interpreted as follows:-

- ≥0.50 high/strong association
- 0.30 to 0.49 moderate association
- 0.10 to 0.29 weak association
- < 0.10 little if any association

3.4.6 Significance level

A P-value <0.05 was considered to be significant for all statistical tests. The 95% confidence level was used throughout, unless otherwise specified.

3.5 Software

All data was entered and stored in a Microsoft Excel® (Microsoft Office 2007, Microsoft Corporation) spreadsheet. All analysis was conducted using SAS[59].

3.6 Methodological limitations of this study

Questionnaires were handed out to registrars at their various academic meetings. Attendance of these meetings was relatively poor which thus resulted in poor response rates. Poor attendance was due to some of the following reasons:-

- Data collection was done around the time that registrars were either preparing for or writing their CMSA examinations.
- Registrars who were either on-call or post-call would not attend their academic meetings.
- It was not compulsory for the registrars to attend these academic meetings.

Some questionnaires were not correctly completed which resulted in the researcher being unable to capture certain data. The questionnaire was relatively long which may have made some of the study participants reluctant to complete it or may have lead to them becoming less interested as they neared the end of the questionnaire.

Chapter 4 RESULTS

4.1 Response rate

The overall response rate was 35%. Table 4.1 shows the response rates for each discipline.

Table 4-1: Response rate of each discipline

Discipline	Estimated number of registrars	Questionnaires answered	Response rate
IM	90	25	28%
GS	80	24	30%
R	50	30	60%
P	45	15	33%

The total sample size was 94 registrars with 49 registrars forming the clinical group and 45 registrars forming the non-clinical group.

4.2 Demographic data

4.2.1 Age

The mean age was 31 years and the median age was 30 years. The frequency distribution of ages is shown in Figure 4.1.

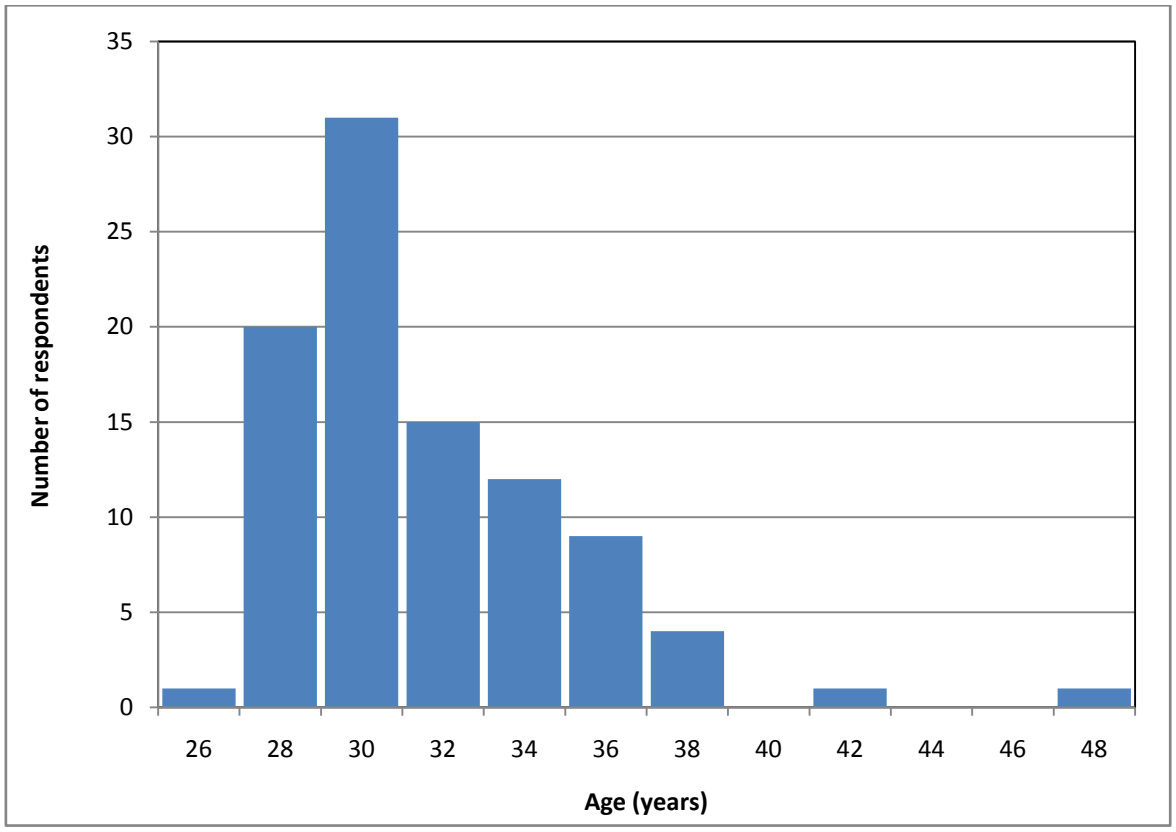

Figure 4-1: Frequency distribution of age of respondents.

There was a significant difference between the mean ages of the registrars in the different disciplines (Kruskal-Wallis test: p=0.020): the mean age of the R group (32.2 years) was slightly higher than that of the IM group (29.9 years). The mean ages of the GS and P groups were 31.0 and 31.3 years respectively.

There was no significant difference between the mean ages of the registrars in the clinical group (30.5 years) versus the registrars in the non-clinical group (31.9 years) (Wilcoxon rank sum test: p=0.085).

4.2.2 Sex

The overall sample was 39% male. There was a significant association between sex and discipline in the P group (Pearson's X^2 test: p=0.041, Cramer's V=0.30) which had a female preponderance (93.3%). There was no significant association between sex and the clinical and non-clinical groups (Fisher's exact test: p=0.14).

4.3 Educational data

4.3.1 University

Fifty-one percent of students had obtained their medical degree from Wits as shown in Figure 4.2. There was a significant association between university and discipline (Pearson's X^2 test: p=0.0020, Cramer's V=0.30): the IM discipline consisted of more than average Wits graduates (44%); the R discipline had more than average graduates (67%) from the University of Pretoria (UP). There was no significant association between university and the clinical and non-clinical groups (Pearson's X^2 test: p=0.23).

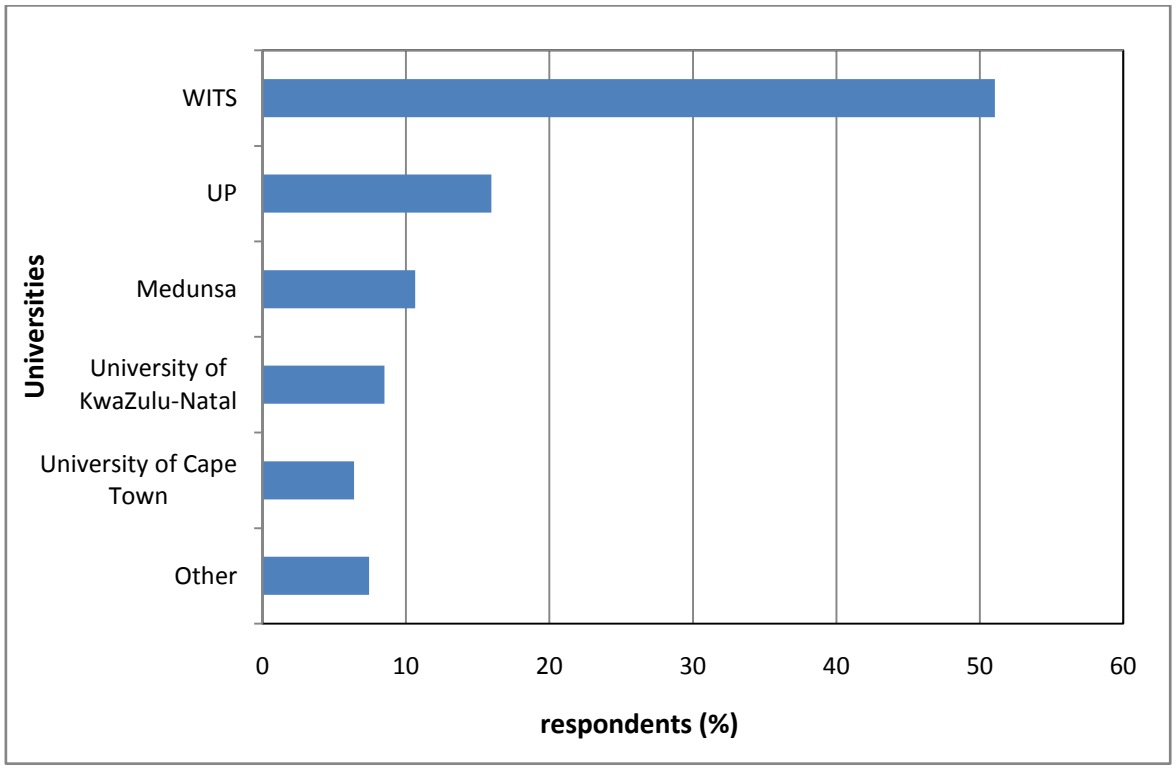

Figure 4-2: Universities at which registrars obtained their primary medical degree.

4.4 Work experience

4.4.1 Years since primary qualification as a doctor

The mean years since primary qualification as a doctor was 7. The frequency distribution is shown in Figure 4.3 below.

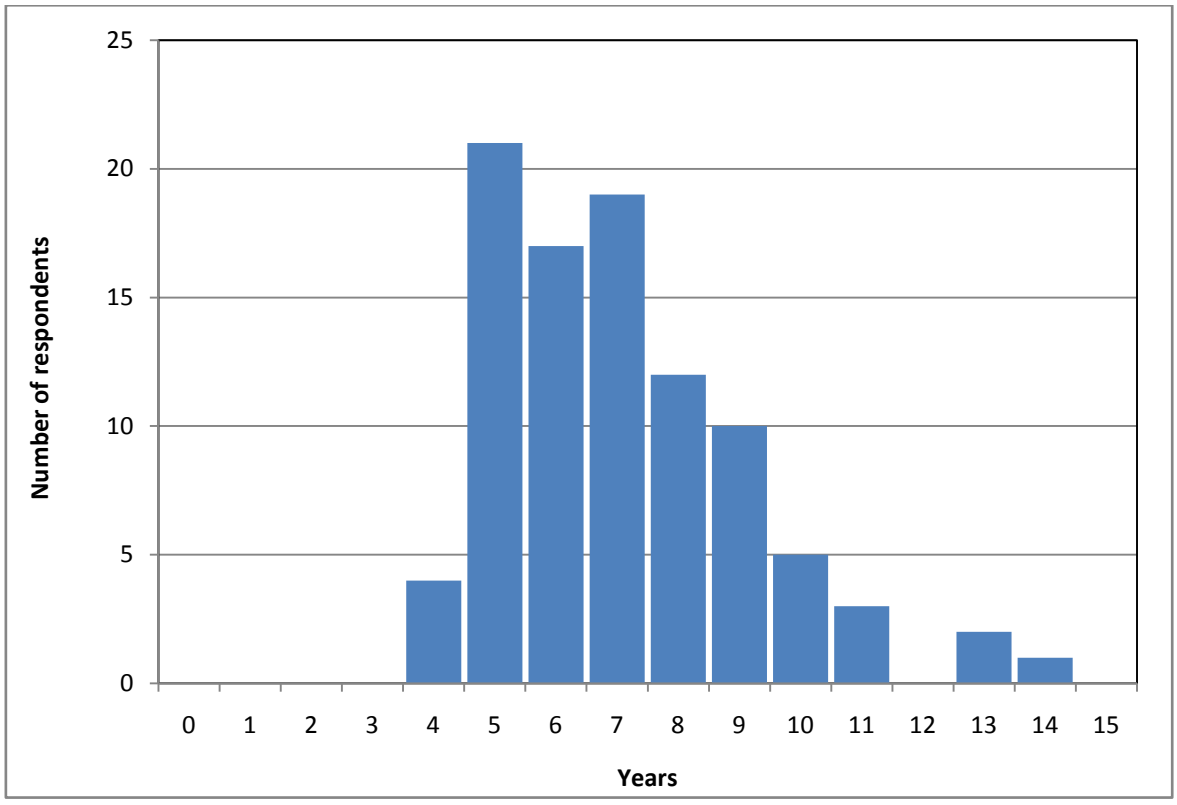

Figure 4-3: Frequency distribution of years since qualification as a doctor.

There was a significant difference between the mean years since qualification of the registrars in the different disciplines (Kruskal-Wallis test: p=0.0031): the mean years since qualification of the R group (7.9 years) was slightly higher than that of the IM group (6.2 years). The mean years since qualification of the GS and P groups were 6.9 and 7.2 years respectively.

The mean years since qualification of the registrars in the non-clinical group (7.7 years) was slightly higher than that of the registrars in the clinical group (6.5 years) (Wilcoxon rank sum test: p=0.060).

4.4.2 Emergency-related degrees completed prior to studying medicine

No registrars in the sample completed any emergency-related degrees prior to studying medicine.

4.4.3 Years since completing Community Service

The mean was 2.5 years. The frequency distribution is shown in Figure 4.4.

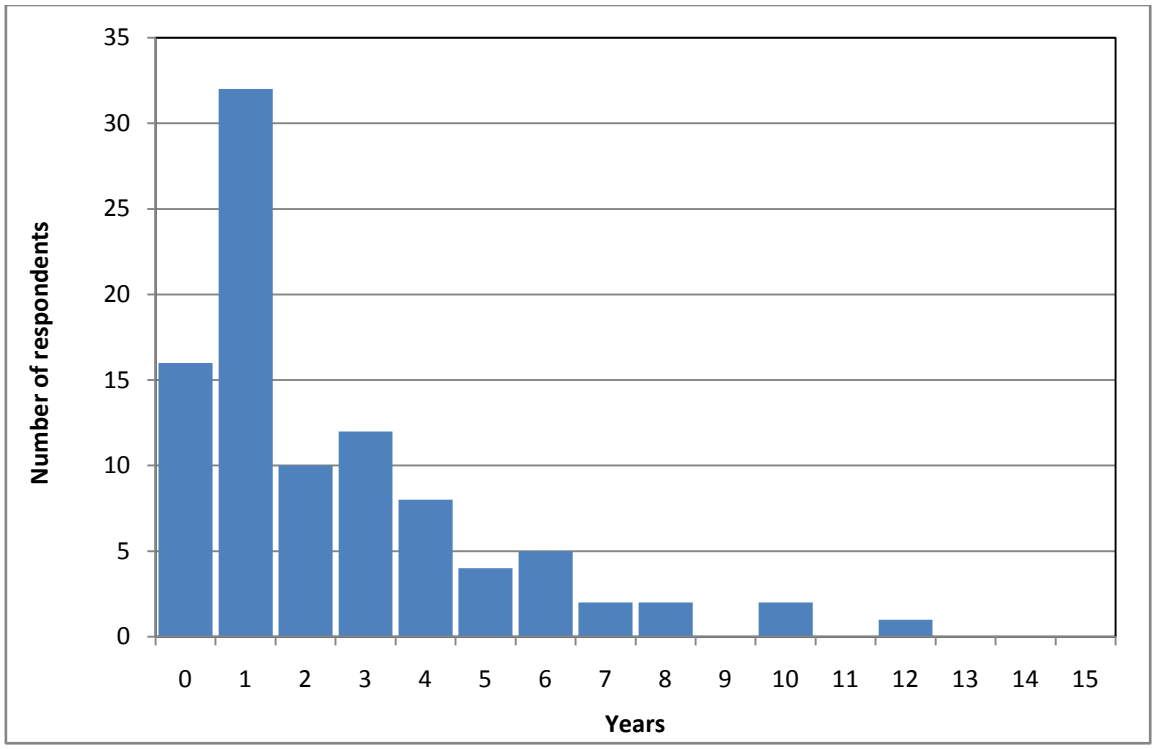

Figure 4-4: Frequency distribution of years since completing Community Service until starting registrar training.

There was a significant difference between the mean years since completing Community Service until starting registrar training of the registrars in the different disciplines (Kruskal-Wallis test: p=0.0073): the mean years since Community Service of the P (3.5 years) and R (2.9 years) groups was longer than that of the IM group (1.2 years). The mean years since completing Community Service until starting registrar training in the GS group was 2.6 years.

The mean years since Community Service of the registrars in the non-clinical group (3.1 years) was longer than that of the registrars in the clinical group (1.9 years) (Wilcoxon rank sum test: p=0.031).

4.4.4 Previous work experience in an emergency-related environment

Overall, 61% of respondents had previous work experience in an emergency-related environment. Of the respondents who had previous work experience in an emergency-related environment, 75% had worked in a public ED, while 46% had worked in a private ED environment.

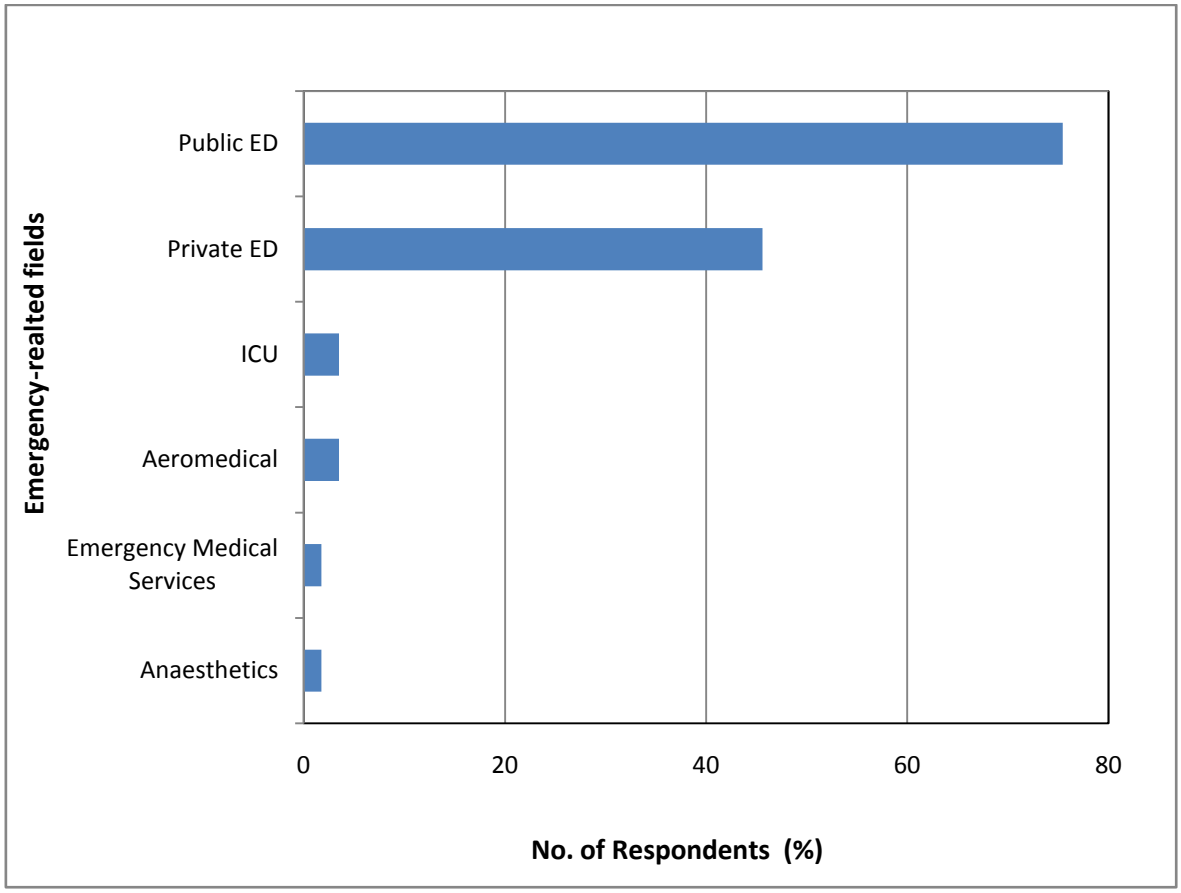

Figure 4-5: Percentage of respondents who had previously worked in an emergency-related environment.

The frequency distribution of the number of years of this work experience is shown in Figure 4.6. The mean and median numbers of years were 1.6 years and 1 year respectively.

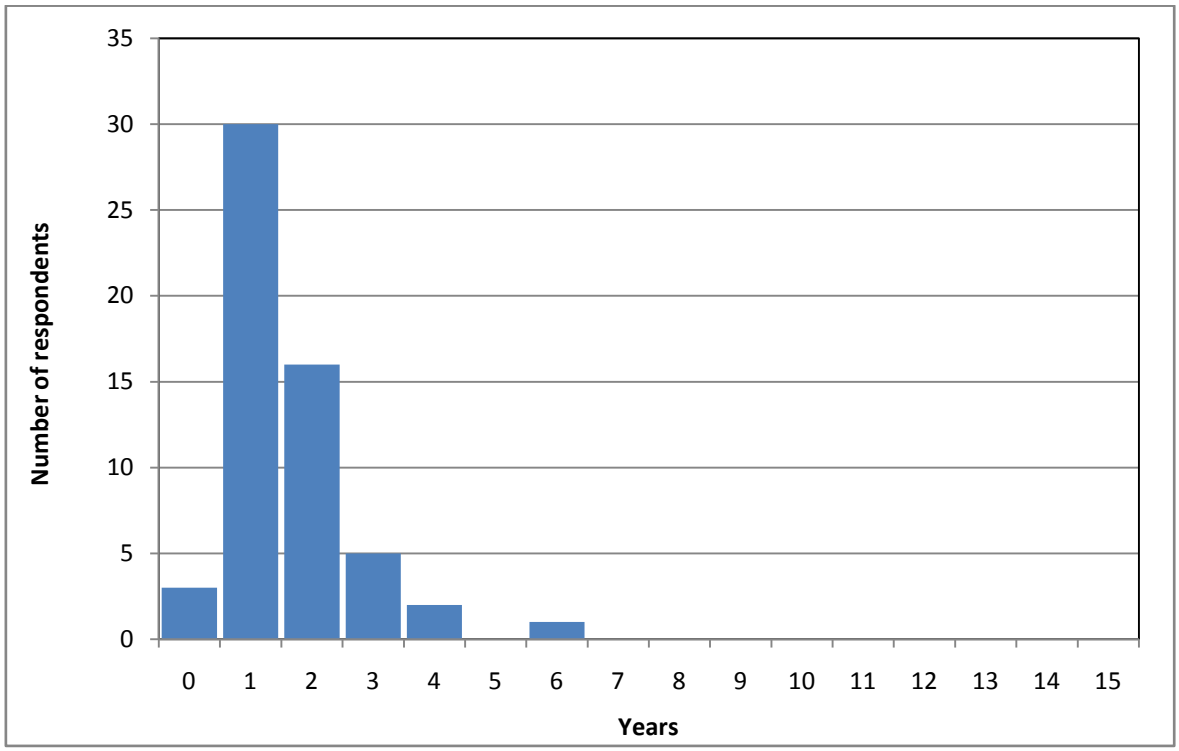

Figure 4-6: Frequency distribution of the number of years previously spent working in an emergency related environment.

There was a significant association between registrars having had this work experience and discipline (Pearson's X^2 test: p=0.047, Cramer's V=0.29): there were fewer registrars in the IM group (17%) who had this work experience when compared to the GS (25%), P (21%) and R (37%) groups.

There was a significant association between registrars having had this work experience and the clinical and non-clinical groups (Fisher's exact test: p=0.020): fewer registrars in the clinical group (42%) had had this work experience than those in the non-clinical group (58%).

There was no significant association between the type of this work experience (private ED or public ED) and either the discipline, the clinical or the non-clinical groups. There was no significant difference in the mean duration of this work experience and either the discipline, the clinical or the non-clinical groups.

4.4.5 Current work experience in emergency-related environment

Overall, 9% of respondents were working in an emergency-related environment at the time of the study. Of the respondents who were working in an emergency-related environment at the time of the study, 89% were working in a private ED and 11% were working in a public ED. There was no significant association between whether or not registrars had this work experience and discipline (Fisher's exact test: p=0.17) or the clinical and non-clinical groups (Fisher's exact test: p=0.30). The mean and median numbers of years were both 2 years.

4.5 Most recent resuscitation of a patient

The length of time since respondents' most recent resuscitation of a patient is illustrated in Figure 4.7.

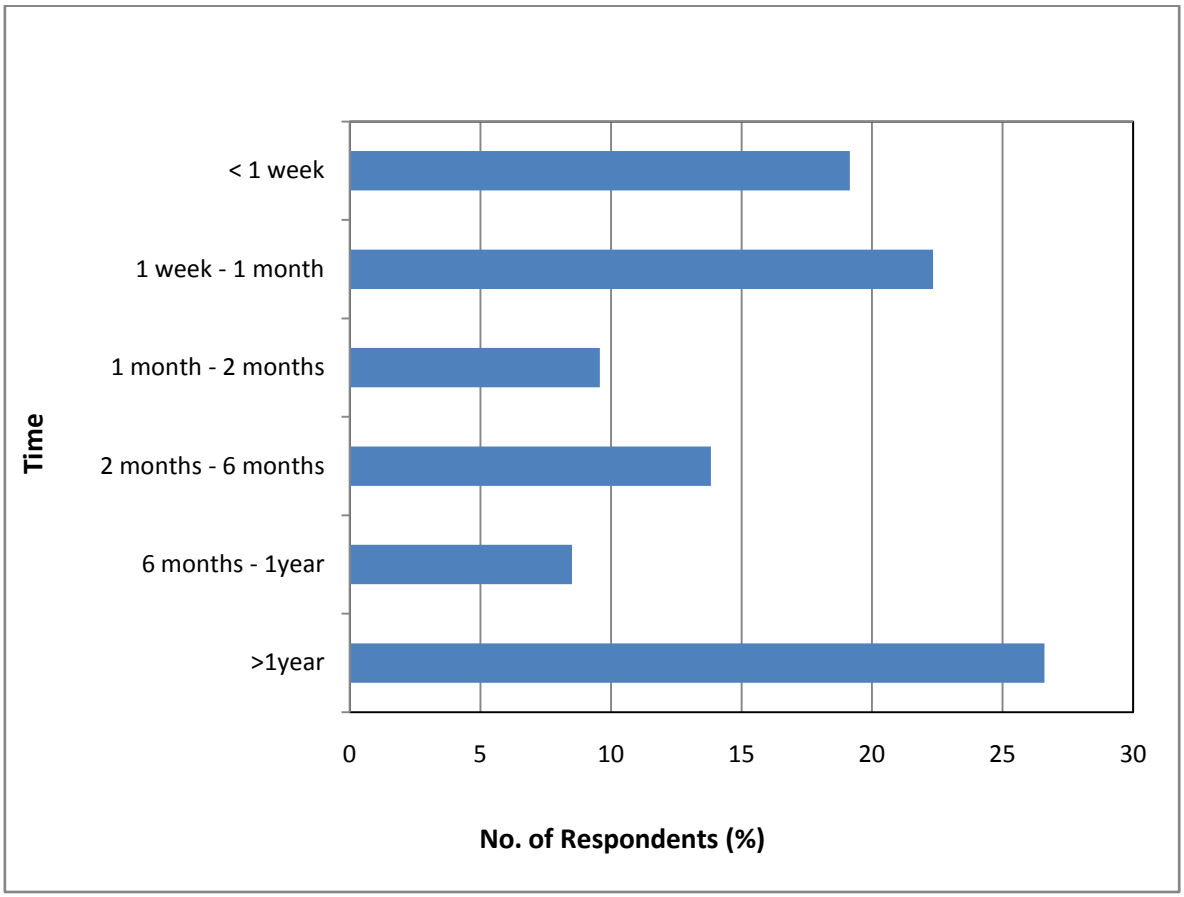

Figure 4-7: Length of time since last resuscitation.

There was a significant association between the length of time since the most recent resuscitation and discipline (Pearson's X^2 test: $p<0.0001$, Cramer's $V=0.46$): all registrars whose most recent resuscitation had been in the previous week were from the IM and GS disciplines (none from R and P). Only 14% of those registrars whose most recent resuscitation had been in the 1 week to 1 month period were in the R discipline (none in P), the rest being the IM and GS registrars. Conversely, a much higher proportion of R and P registrars reported

having done their most recent resuscitation more than 1 month ago and more than 1 year ago, respectively.

There was a significant association between the length of time since the last resuscitation and clinical and non-clinical groups (Pearson's X^2 test: $p<0.0001$, Cramer's $V=0.69$). Seventy-three percent of the clinical group reported that their most recent resuscitation had been in the previous month (37% in the previous week), while 93% of the non-clinical group reported that their most recent resuscitation had been more than a month ago (47% over 1 year ago).

4.5.1 Level of competence in most recent resuscitation

The competence scores (CS) for the levels of competence in the most recent resuscitation were rated from 1 to 5. The frequency distribution of the scores is shown in Figure 4.8.

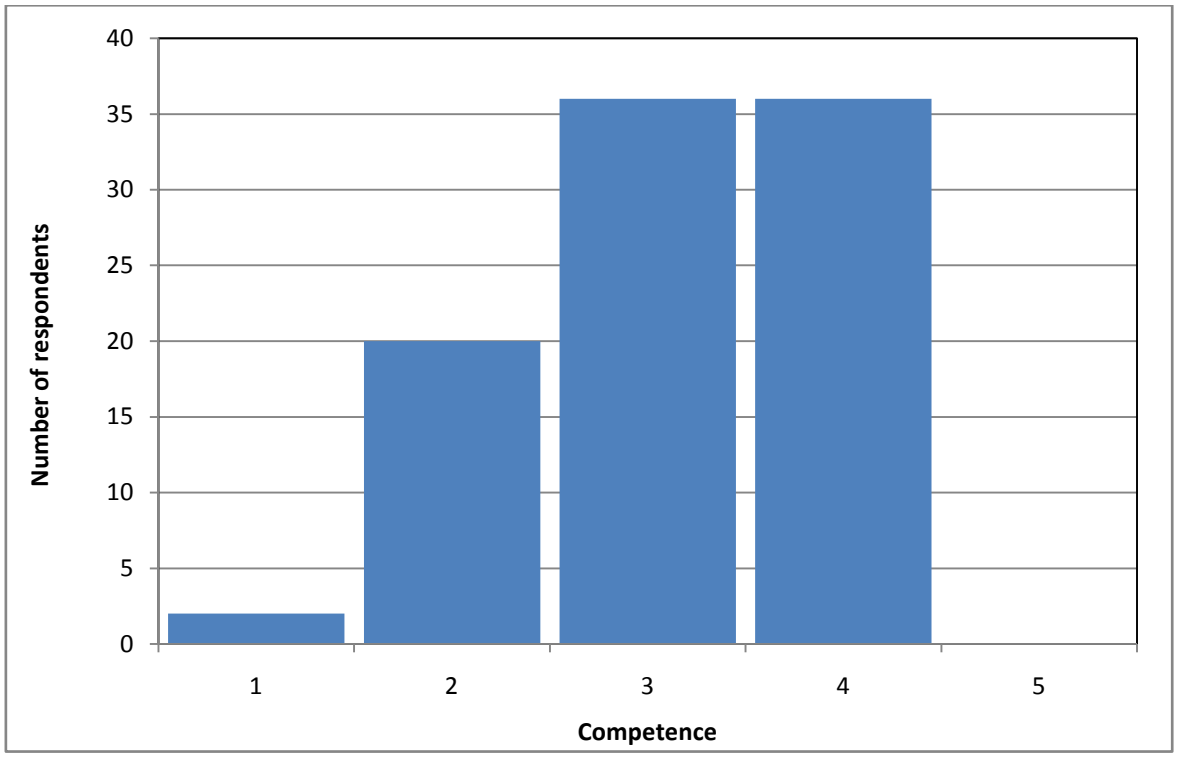

Figure 4-8: Frequency distribution of competence in most recent resuscitation of a patient in cardiac arrest.

The mean response was 3.1 (intermediate). No respondents rated their level of competence as expert.

There was a significant difference between the mean scores of the registrars in the different disciplines (ANOVA: $p<0.0001$): the mean score of the IM (3.6) and GS (3.5) groups were higher than that of the P (2.7) and R groups (2.6). Rounding the mean scores, those in the IM and GS groups rated their competence as advanced, while those in the P and R groups rated their competence as intermediate.

The mean score of the registrars in the clinical group (3.6) was higher than that of the registrars in the non-clinical group (2.7) (t-test with unequal variances: $p<0.001$).

There was a significant difference in competence rating between the groups indicating when their most recent resuscitation was done (ANOVA; $p<0.0001$): The competence rating for those who had done a resuscitation in the previous week was higher than those who had most recently done a resuscitation in the 1 month to 1 year and the more than 1 year periods. The competence rating for those who had done a resuscitation in the 1 week to 1 month period was higher than those who had most recently done a resuscitation in the more than 1 year period. This is further illustrated in Figure 4.9.

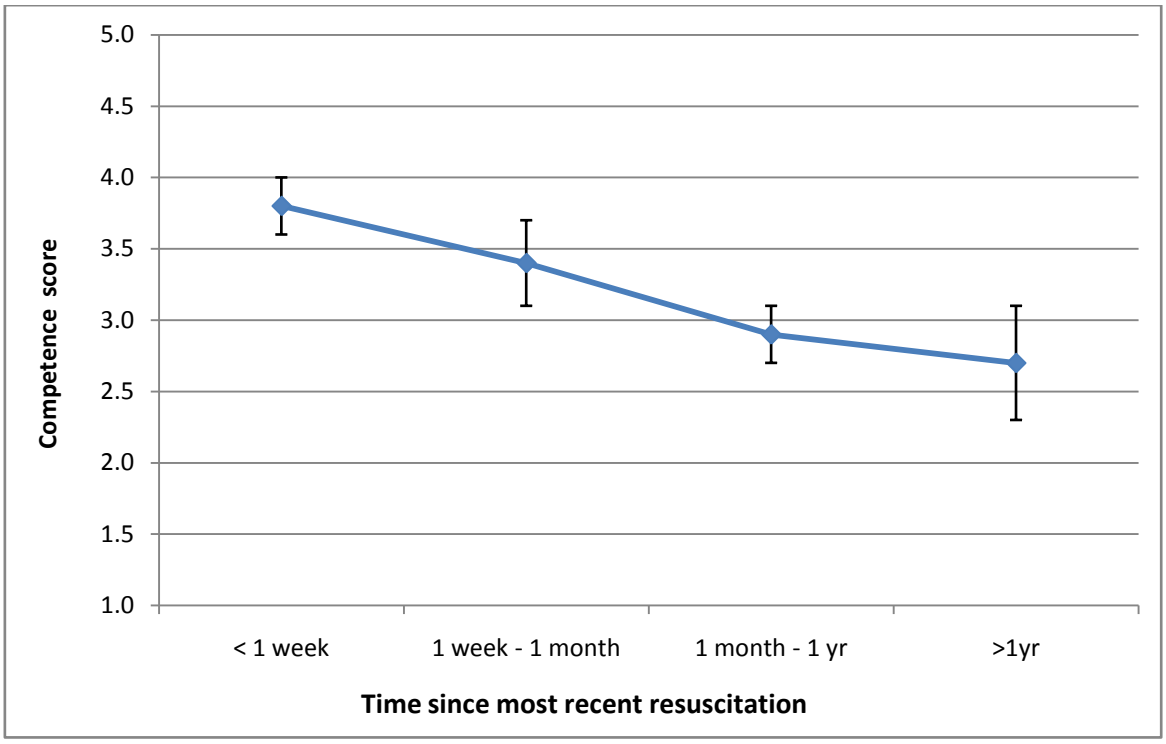

Figure 4-9: Competence scores in relation to the most recent resuscitation (error bars show the 95% confidence interval for the mean).

4.6 Competence scores

4.6.1 Individual skills

The mean scores for each skill, arranged in descending order, are illustrated in Figure 4.10. The colour coding represents the skill category.

Skills which had an overall competence rating of advanced (3.5 or more) were: ICD insertion, adult CPR, BMV, CV line insertion and ET intubation.

Skills which had an overall competence rating of basic (less than 2.5) were: thoracotomy, fasciotomy, venous cut down, escharotomy, transcutaneous pacing, cricothyrotomy and pericardiocentesis.

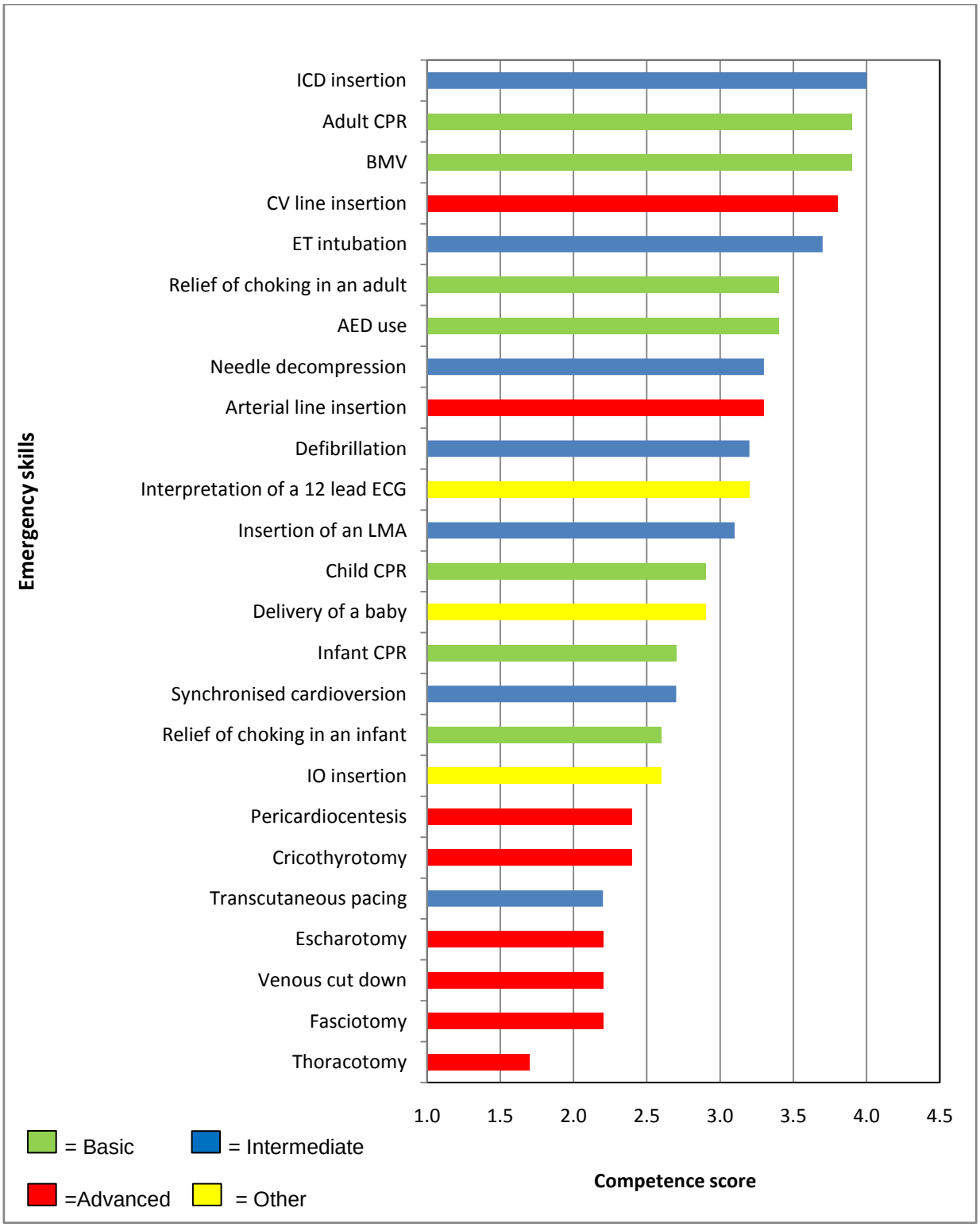

Figure 4-10: Competence scores of various skills.

4.6.2 Grouped skills

The mean scores for each skill group, arranged in descending order, are illustrated in Figure 4.11.

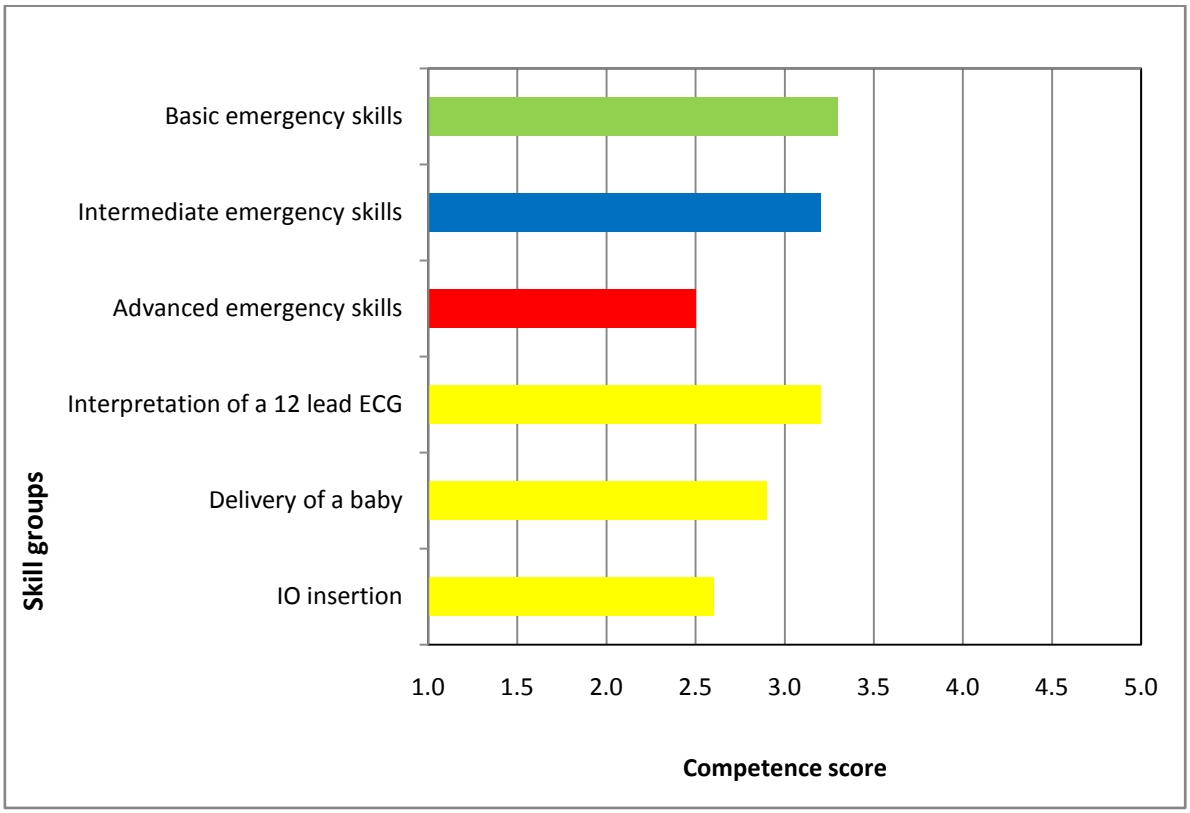

Figure 4-11: Competence scores for each skill group.

The overall competence rating of all these skills was intermediate. When analysing the mean CS for each skill by group the following results were seen:

4.6.2.1 Basic emergency skills

Adult CPR and relief of choking received higher mean scores than the corresponding child and infant skills. Competence in BMV rated highly across all groups.

4.6.2.2 Intermediate emergency skills

Insertion of an ICD was given the highest mean CS of all the skills, whereas performing transcutaneous pacing was given the lowest mean CS of all the skills. ECG interpretation did not fit the response pattern of the other skills and was excluded from the intermediate skills construct.

4.6.2.3 Advanced emergency skills

Insertion of CV and arterial lines were both given high competence ratings. All the other advanced skills received low competence ratings. IO line insertion and delivery of a baby did not fit the response pattern of the other skills and they were excluded from the advanced skills construct.

4.6.3 Competency score differences between different registrar groups

The following results were found after analysing the between-group differences for the three constructs and the three stand-alone skills:

4.6.3.1 Basic emergency skills

There was a significant difference between the mean scores of the registrars in the different disciplines as illustrated in Figure 4.12 (ANOVA: p=0.0004): the mean scores of the IM and GS groups were higher than that of the P and R groups. The mean score of the registrars in the clinical group (3.6) was higher than that of the registrars in the non-clinical group (2.9) (t-test with equal variances: p<0.001).

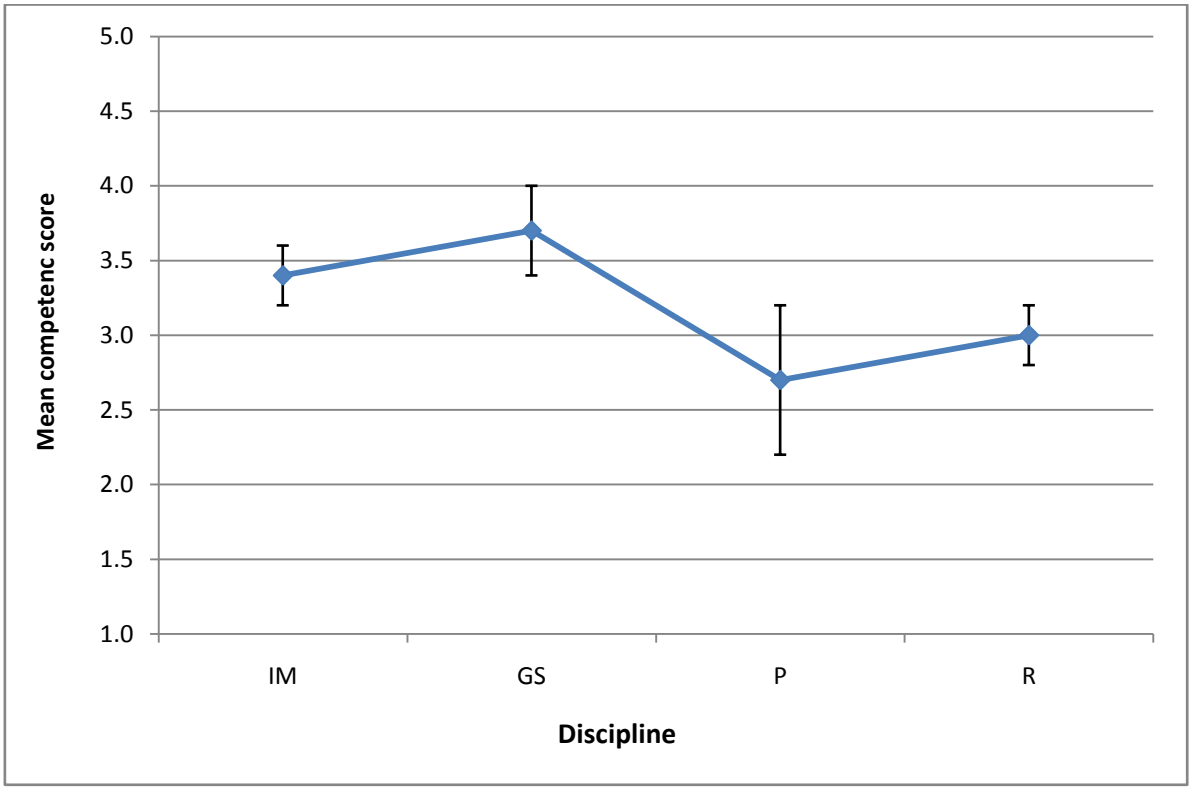

Figure 4-12: Mean competence scores in basic emergency skills of each discipline (error bars show the 95% confidence interval for the mean).

4.6.3.2 Intermediate emergency skills

There was a significant difference between the mean scores of the registrars in the different disciplines as illustrated in Figure 4.13 below (ANOVA: $p<0.0001$): the mean scores of the GS and IM groups were higher than those of the P and R groups. The mean score of the registrars in the clinical group (3.7) was higher than that of the registrars in the non-clinical group (2.6) (t-test with unequal variances: $p<0.001$).

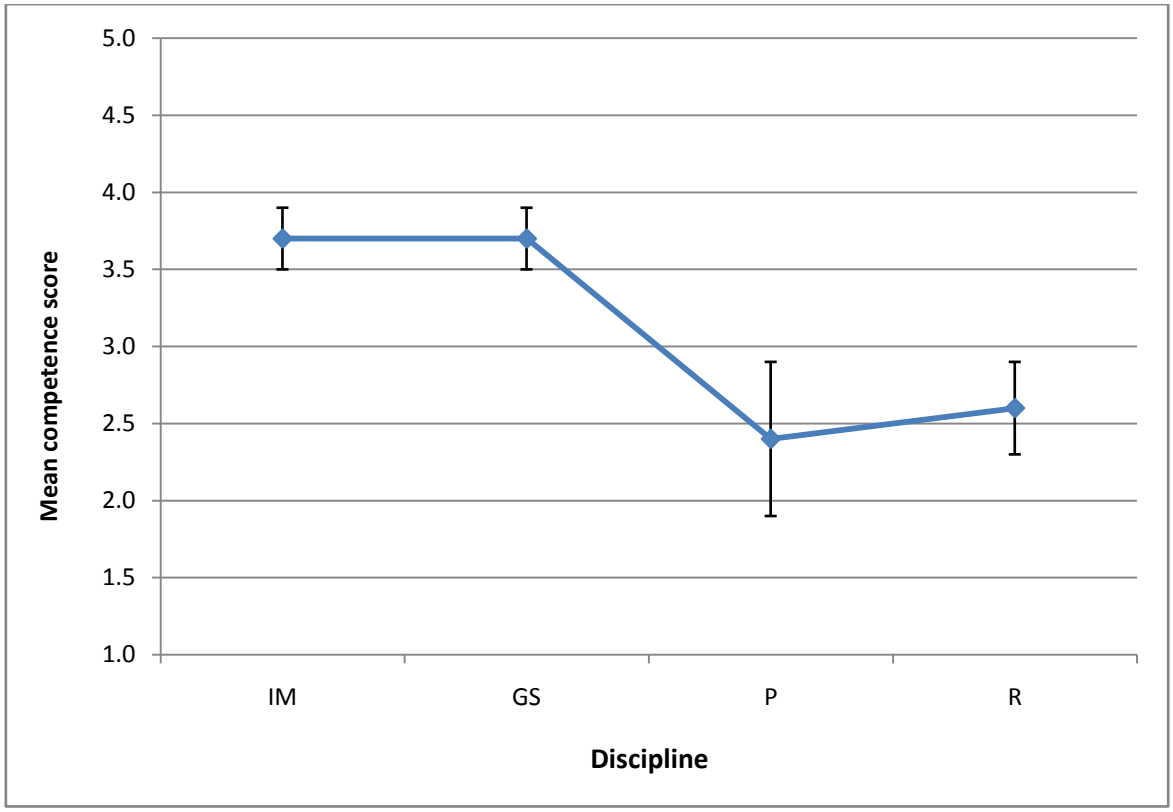

Figure 4-13: Mean competence scores in intermediate emergency skills of each discipline (error bars show the 95% confidence interval for the mean).

4.6.3.3 Advanced emergency skills

There was a significant difference between the mean scores of the registrars in the different disciplines as illustrated in Figure 4.14 (ANOVA: $p<0.0001$): the mean score of the GS group was higher than that of the IM group, which in turn was higher than that of the P and R groups. The mean score of the registrars in the clinical group (3.3) was higher than that of the registrars in the non-clinical group (1.7) (t-test with unequal variances: $p<0.001$).

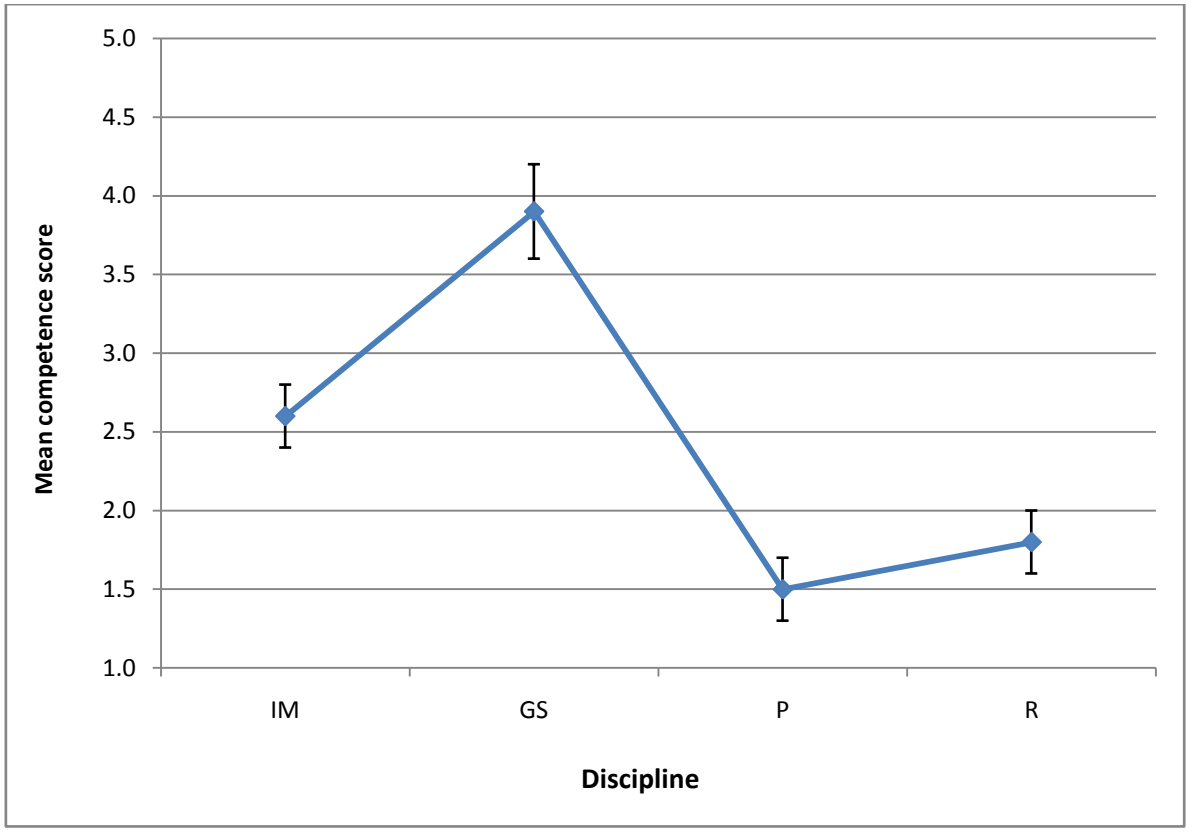

Figure 4-14: Mean competence scores in advanced emergency skills of each discipline (error bars show the 95% confidence interval for the mean).

4.6.3.4 Interpretation of 12-lead ECG

There was a significant difference between the mean scores of the registrars in the different disciplines as illustrated in Figure 4.15 (ANOVA: $p<0.0001$): the mean score of the IM group was higher than that of the other three groups. The mean score of the registrars in the clinical group (3.7) was higher than that of the registrars in the non-clinical group (2.8) (t-test with unequal variances: $p<0.001$).

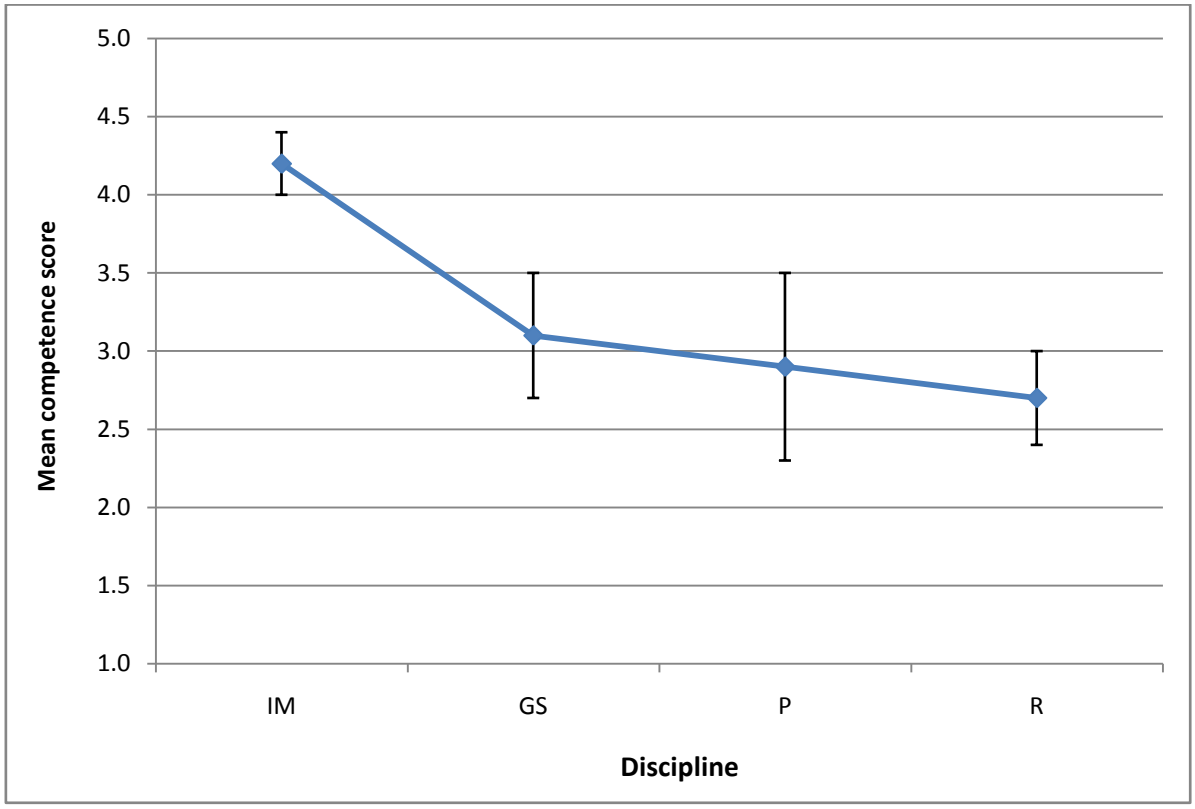

Figure 4-15: Mean competence scores in the interpretation of a 12 lead ECG of each discipline (error bars show the 95% confidence interval for the mean).

4.6.3.5 IO insertion

There was a significant difference between the mean scores of the registrars in the different disciplines as illustrated in Figure 4.16 (ANOVA: p=0.0095): the mean score of the GS group was higher than that of the R group. The mean score of the registrars in the clinical group (2.9) was higher than that of the registrars in the non-clinical group (2.2) (t-test with equal variances: p=0.0027).

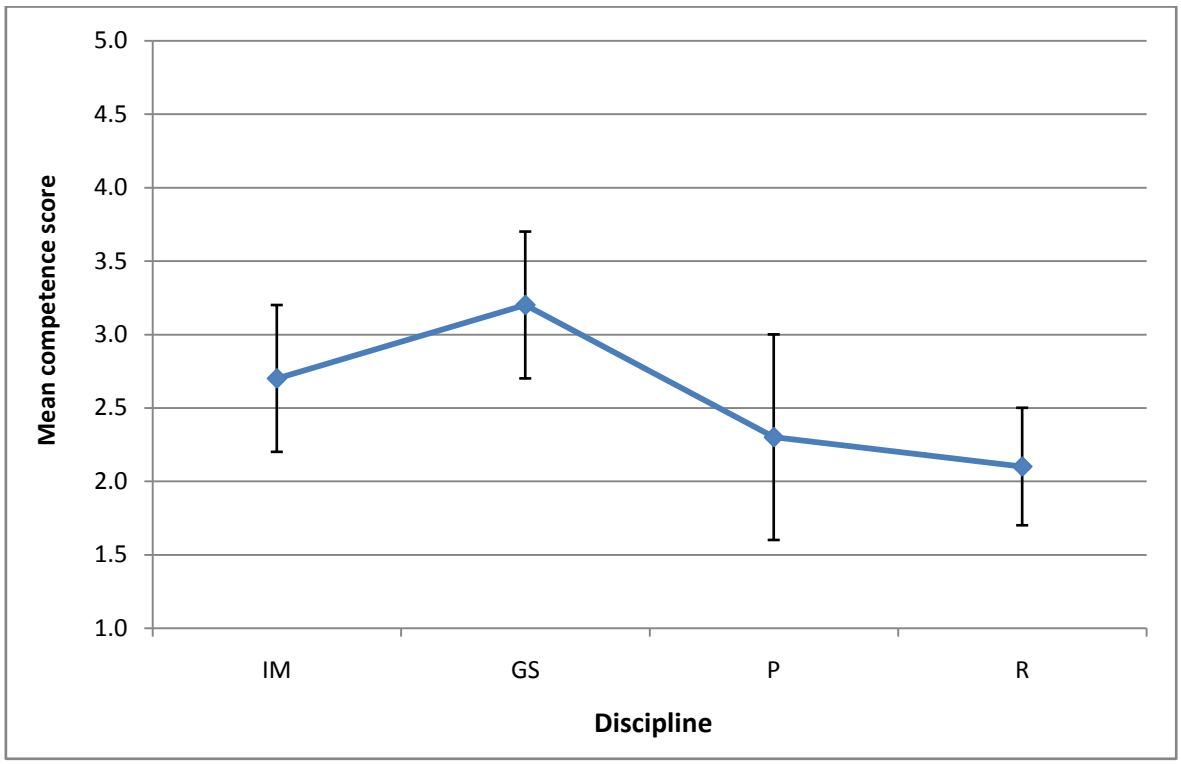

Figure 4-16: Mean competence scores in the insertion of an IO line of each discipline (error bars show the 95% confidence interval for the mean).

4.6.3.6 Delivery of a baby

There was no significant difference between the mean scores of the registrars in the different disciplines (ANOVA: p=0.29). There was no significant difference between the mean scores between the registrars in the clinical and non-clinical groups (ANOVA: p=0.29).

4.7 Frequency of use of different emergency skills

4.7.1 Whether each skill had ever been performed

The overall percentage of respondents who had ever performed each of the emergency skills is illustrated in order of descending proportion in Figure 4.17. The colour coding represents the skill category.

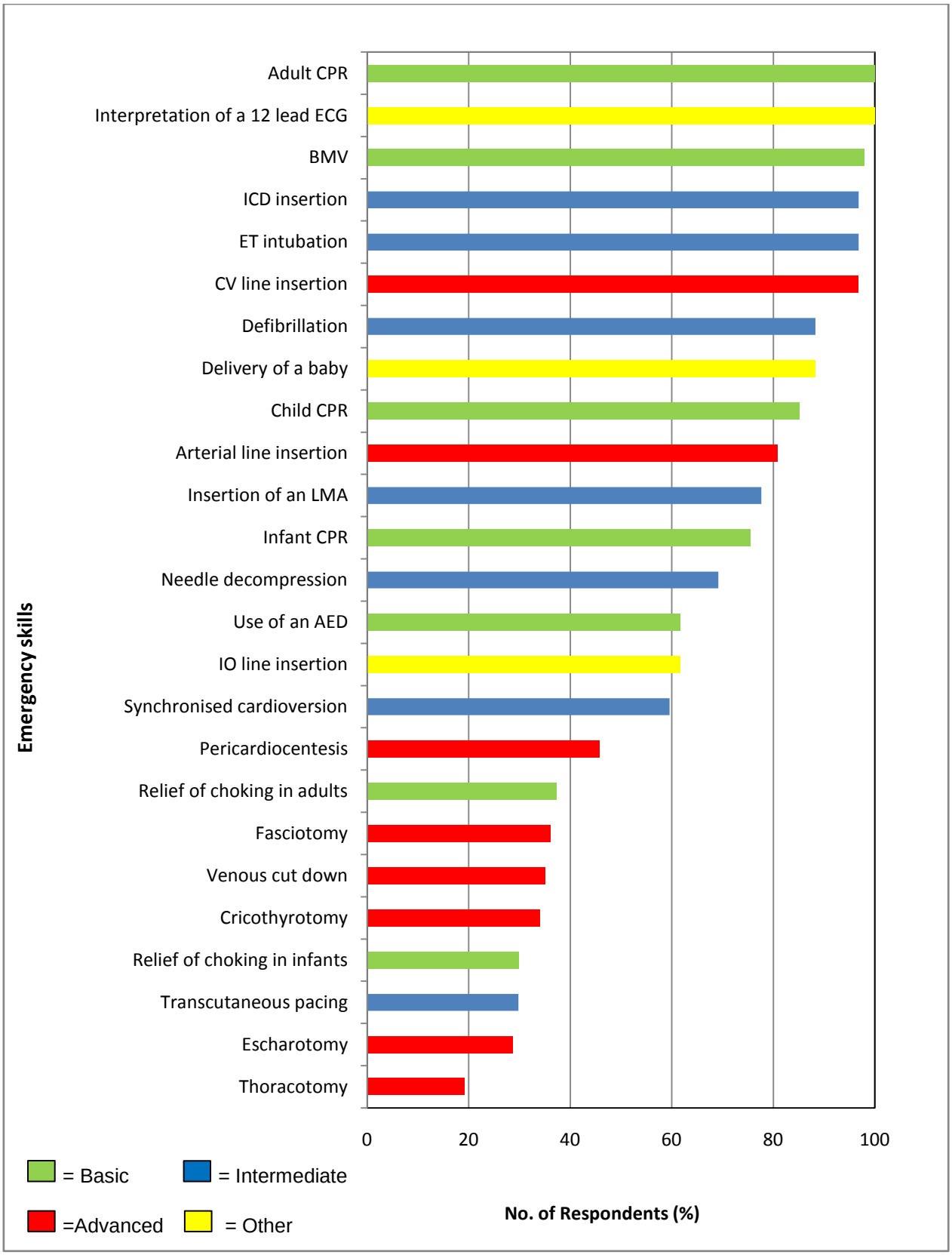

Figure 4-17: Percentage of registrars who had ever performed various emergency skills.

The percentage of respondents in each discipline and in each clinical and non-clinical group who had ever performed each of the emergency skills is shown in Table 4.2 below.

Table 4-2: Percentage performance of each emergency skill amongst each discipline and clinical and non-clinical groups.

Emergency skill	Discipline				Group		Total
	IM	**GS**	**P**	**R**	**Clinical**	**Non-clinical**	
Adult CPR	100	100	100	100	100	100	100
Child CPR	80	100	80	80	90	80	85
Infant CPR	64	92	67	77	78	73	76
Relief of choking in adults	28	50	47	30	39	36	37
Relief of choking in infants	32	38	33	20	35	24	30
Bag mask ventilation	100	100	93	97	100	96	98
Use of an AED	84*	58	67	43*	71	51	62
Defibrillation	100*	92	87	77*	96*	80*	88
Synchronised cardioversion	100*	63	33*	36*	82*	36*	60
ICD insertion	100	100	93	93	100	93	97
Needle decompression	84*	88*	67	43*	86*	51*	69
Insertion of an LMA	88	79	87	63	84	71	78
Transcutaneous pacing	56*	21*	20*	20*	39	20	30
Interpretation of a 12 lead ECG	100	100	100	100	100	100	100
ET intubation	100	100	93	93	100	93	97
IO line insertion	72	88*	53	37*	80*	42*	62
Pericardiocentesis	76*	54	27	23*	65*	24*	46
Thoracotomy	4*	58*	13*	3*	30*	7*	19
CV line insertion	100	100	93	93	100	93	97
Escharotomy	8*	79*	20*	10*	43*	13*	29
Cricothyrotomy	32	67*	7*	23*	49*	18*	34
Venous cut down	28	71*	20*	20*	49*	20*	35
Arterial line insertion	96*	100*	53*	67*	98*	62*	81
Delivery of a baby	80	88	100	90	84	93	88
Fasciotomy	12*	83*	20*	27*	47*	24*	36

* indicates a significant difference

4.7.2 How many times the skill had been performed

The following between-discipline differences were found:-

- IM and GS registrars performed adult CPR, use of an AED, defibrillation, insertion of an LMA, transcutaneous pacing, IO insertion and pericardiocentesis more often than both R and P registrars.
- IM and GS registrars interpreted 12 lead ECGs more often than P registrars who in turn performed this skill more often than R registrars.
- Child CPR, infant CPR, BMV, ICD insertion, needle decompression, ET intubation, CV line insertion and arterial line insertion were all performed more frequently by the GS registrars when compared to the IM, P and R registrars. The IM registrars in turn performed these skills more often than either of the R or P registrars.
- Relief of choking in an infant, thoracotomy, escharotomy, cricothyrotomy, venous cut down and fasciotomy were all performed more frequently by the GS registrars compared to all other specialities.
- IM registrars performed synchronised cardioversion more often than GS registrars who in turn performed this skill more often than both P and R registrars.
- Relief of choking in an adult patient was a skill performed most frequently by the IM registrars.
- There were no differences across all four groups with regards to the frequency of having delivered a baby.

The following between-group differences were found:-

- The clinical group performed all of the listed skills more frequently than the non-clinical group, except for the delivery of a baby in which there was no difference.

4.7.3 When last the skill had been performed

The percentage of respondents in each category, by discipline and clinical and non-clinical group are shown in Appendix F. Pearson's X^2 test and Fisher's exact test were used to test for differences between the disciplines as well as for differences between the clinical and non-clinical groups, respectively.

4.8 Resuscitation courses

4.8.1 Attendance of resuscitation courses

The percentage of respondents in each discipline and in each of the clinical and non-clinical groups who had a current certification for, expired certification for or who had never attended each of the resuscitation courses is shown in the Table 4.3. A few respondents had attended courses not listed in the questionnaire which are also listed in the table.

Table 4-3: Percentage attendance of resuscitation courses amongst the various disciplines.

	Discipline				Group		Total
	IM	GS	P	R	Clinical	Non-clinical	
BLS							
current	48*	33	40	13*	41*	22*	32
expired	52	67	53	77*	59	69	64
never	0	0	7	10	0	9	4
ACLS							
current	48*	33	27	10*	41*	16*	29
expired	52	50	53	73*	51	67	59
never	0	17	20	17	8	18	13
ACLS EP							
current	12	4	7	7	8	7	7
expired	32	25	20	43	29	36	32
never	56	71	73	50	63	58	61
PALS							
current	20	29	20	3*	24*	9*	17
expired	36	25	27	67*	31*	53*	41
never	44	46	53	30	45	38	41
ATLS							
current	24	92*	27	3*	57*	11*	35
expired	24	8	33	63*	16*	53*	34
never	52	0*	40	33	27	36	31
AIME							
current	8	0	0	0	4	0	2
expired	12	4	7	10	8	9	9
never	80	96	93	90	88	91	89
AMLS							
current	20	0	0	3	10	2	6
expired	40*	8	7	20	24	16	20
never	40*	92	93	77	65	82	73
Other							
basic surgical skills	0	4	0	0	2	0	1
neonatal resuscitation course	12	4	0	0	8	0	4
surgical skills	0	0	7	0	0	2	1

* indicates a significant difference

The following results with regards to the differences between disciplines were seen:

- While a similar proportion of all disciplines had done the BLS and ACLS courses (96% and 87% overall respectively), the IM registrars had a higher than average proportion of current certification in these courses (both 48%) while the R registrars had a much lower than average proportion of current certification in these courses (13% and 10% respectively).
- While a similar proportion of all disciplines had done the ATLS course (69% overall), the GS registrars had a higher than average proportion of current certification (92%) while the R registrars had a much lower than average proportion of current certification in this course (3%).
- While a similar proportion of all disciplines had done the PALS course (58% overall), the R registrars had a much lower than average proportion of current certification in this course (3% versus the overall average of 17%).
- A lower than average proportion of IM registrars had never done the AMLS course (40% vs. 73% overall) and a higher than average proportion of those IM registrars who had done the AMLS course had an expired certification for this course (40% vs. 20% overall).
- There was no significant difference between disciplines regarding attendance of or current certification in the ACLS-EP and AIME courses. Overall, only 39% and 11% (respectively) of respondents had ever attended these courses.

The following results with regards to the differences between the clinical and non-clinical groups were seen:

- While a similar proportion of both groups had done the BLS and ACLS courses (96% and 88% overall respectively), the clinical group had a higher than average proportion of current certification in these courses (both 41%) while the non-clinical group had a lower than average proportion of current certification in these courses (22% and 16% respectively).
- While a similar proportion of both groups had done the PALS and ATLS courses (58% and 69% overall respectively), the non-clinical group had a much lower proportion of current certification in these courses compared to the clinical group (9% versus 24% and 11% versus 57% respectively).

4.8.2 Rating of resuscitation courses

The ratings were coded on a scale of 1 to 3 with 1 indicating that the course was not beneficial, 2 indicating that the course was slightly beneficial and 3 indicating that the course was very beneficial.

Overall, all the courses received a mean rating in excess of 2.5 (very beneficial) from those who attended them. There were no significant differences between disciplines or between the clinical and non-clinical groups with regards to the rating given for any of these courses by the registrars who attended them.

4.9 Final questions

The percentage of respondents in each discipline and in each clinical and non-clinical group who answered yes to the four questions is shown in Table 4.4. Fisher's exact test was used to test for differences between the disciplines as well as for differences between the clinical and non-clinical groups.

Table 4-4: Positive response to questions.

Question		Discipline				Group		Total
		IM	GS	P	R	Clinical	Non-clinical	
Question 4	Resuscitation courses should be compulsory for registrars	100*	96	93	77*	98*	82*	90
Question 5	All registrars should be competent in life-saving emergency skills	100	96	93	90	98	91	95
Question 6	I am able to be team leader in the next cardiac resuscitation	100*	96*	53*	37*	98*	42*	71
Question 7	I am competent to treat life-threatening emergencies on the side of the road	84*	96*	53*	53*	90*	53*	72

* indicates significant difference

There was no significant difference between disciplines or the clinical and non-clinical groups regarding question 5: 95% of respondents agreed that all registrars should be competent in life-saving emergency skills. However, a lower proportion of those in the non-clinical group were confident that they could act competently in an emergency situation (question 6 and question 7). Despite this, a lower proportion of R registrars (and thus those in the non-clinical group) compared to those in other groups agreed that resuscitation courses should be compulsory for all registrars (question 4).

4.10 Analysis of competence in each skill versus potentially influencing factors

4.10.1 Basic Emergency Skills

The effects of discipline (p=0.017) and attendance of the PALS course (p=0.027) were significant. The results were as follows:-

- Discipline: GS registrars had a CS of 1.0, 0.9 and 0.8 units higher than those of the P, R and IM registrars, respectively.
- PALS course: those who had a current or an expired certification for this course had a CS 0.6 and 0.5 units higher than those who had not.

4.10.2 Intermediate Emergency Skills

The effects of discipline (p=0.001) and number of years post-Community Service (p=0.024) were significant. The results were as follows:-

- Discipline: GS registrars had a CS 1.0 and 1.3 units higher than those of the P and R registrars respectively.
- Years post Community Service: Every year post Community Service resulted in a 0.1 unit decrease in CS.

4.10.3 Advanced Emergency Skills

The effects of discipline (p<0.0001), sex (p=0.0004), years post-Community Service (p=0.047), PALS course attendance (p=0.035) and AMLS course attendance (p=0.021) were significant. The results were as follows:-

- Discipline: GS registrars had a CS 1.9, 2.3 and 2.4 units higher than those of IM, P and R registrars respectively.
- Sex: Females had a mean CS 0.5 units lower than males.
- Years post-Community Service: Every year post Community Service resulted in a 0.1 unit decrease in CS.
- PALS course: those who had current certification for this course had a CS 0.6 units higher than those who had not.
- AMLS course: those who had current certification for this course had a CS 0.9 units higher than those who had not.

4.10.4 Interpretation of ECG

The effect of discipline (p=0.012) was significant. The result was as follows:-

- Discipline: IM registrars had a CS 1.3 units higher than those of R registrars.

4.10.5 IO insertion

The effect of ACLS course attendance (p=0.004) was significant. The result was as follows:-

- ACLS course: those who had a current or an expired certification for this course had a CS 1.8 and 1.5 units higher than those who had not.

4.10.6 Delivery of a baby

There were no significant results.

Chapter 5 DISCUSSION

5.1 Aim

The aim of this study was to evaluate the self-assessed level of competence in various emergency skills of registrars in selected disciplines, and to determine what factors, if any, contributed to this. Respondents were asked to rate their perceived level of competence in specified emergency skills in the form of a questionnaire. Additional questions included demographics, background educational information, frequency of skill use, resuscitation courses attended and their perceived level of competence in their most recent resuscitation. In predicting what factors may influence the level of one doctor's self-perceived competence in an emergency skill versus another, modifiable factors may be identified which could then improve competence in emergency skills and thereby improve patient outcome in a resuscitation scenario.

5.2 Response rate

The overall response rate was low (35%). In comparison, a similar study by O' Connor *et al.* demonstrated a response rate of 68%[1]. Analysis of the individual disciplines in the present study demonstrated a good response rate in the R group (60%). This was most likely attributable to the fact that their academic meetings were generally well-attended. The response rates for the IM (28%), GS (30%) and P (33%) groups were all relatively low. Poor response rates may have been due to the questionnaire being too long, responders may have found some of the questions ambiguous or difficult to understand or responders may have been reluctant to share their opinions on their level of competence. Attendance of the

IM, GS and P academic meetings at which the questionnaires were distributed and collected, was also generally poor. This may have been due to the fact that during this time registrars were either preparing for or writing their CMSA examinations. Registrars may either have been on-call or post-call and thus would not attend their academic meetings or registrars may have chosen not to attend their academic meetings as attendance was not compulsory.

5.3 Competence and Demographics

The mean age of the respondents was 31 years. Doctors usually qualify from medical school around the age of 24 years and tend to start their registrar time within four to five years of completing their Internship and Community Service. Whilst a significant difference between the mean ages of the registrars in the different disciplines was demonstrated, this is of no practical significance.

There was no correlation between age and the level of competence. However, in advanced emergency skills, females perceived themselves to be less competent than males. 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[60]. This finding could also be in keeping with Gordon's view on how knowledge can influence self-assessment and that those students who knew more about the subject matter were less confident and subsequently perceived themselves to be less competent[33]. Ehrlinger *et al*. showed that females had more negative opinions

regarding their scientific abilities as compared to males and that females' levels of self-evaluation were less positive than their male counterparts[61].

5.4 Competence and Education

More than half of the respondents had obtained their primary medical degree from the University of the Witwatersrand. The study cohort was comprised of registrars who were working in the three main academic hospitals in Johannesburg, to which University of the Witwatersrand is academically affiliated, thus providing a possible explanation to this finding. There was no correlation between education and competence.

5.5 Competence and Work experience

The mean number of years since primary qualification as a doctor was seven years. In South Africa, it is compulsory to complete two years of Internship and an additional year of Community Service post-graduation. Some doctors may choose to delay specialising immediately after completing Community Service, preferring a medical officer post in their area of interest. Other doctors may opt to work in the private sector or gain experience by working overseas. A study done by de Vries *et al.* highlighted both of these points. Firstly, 55% of South African final-year medical students plan on spending up to two years working abroad and secondly 41% intend on spending most of their careers working in the private sector[62]. Both of these factors can potentially postpone the commencement of registrar training. Smith *et al.* showed similar results in medical graduates from the United Kingdom, where less than 25% of junior doctors were not in specialist training posts four years after completing their primary qualification[63].

The mean years since qualification of the R group was slightly higher than that of the IM group and the mean years since primary qualification as a doctor was slightly higher in the non-clinical group when compared to the clinical group. This could potentially be due to the fact that those doctors who eventually formed part of the non-clinical group spent more time waiting for a specialist post in those disciplines. Another explanation may be that there were a large number of IM posts available during the time that those doctors who formed the IM group were applying to train as registrars.

The mean number of years since completing Community Service to starting registrar training was lower in the IM group, when compared to the other disciplines. Possible hypotheses could be that there were more registrar posts available during this period, or that greater exposure to IM as a speciality prompted more doctors to apply for it earlier.

The study showed a *decrease in competency* in the intermediate and advanced skill groups for every year post Community Service. Since it has been well documented that retention of emergency skills rapidly declines after initial training[53 - 56], the same principle can be applied to those doctors who complete Community Service and only start a registrar post many years later. Essentially, the longer a doctor does not practise and reinforce clinical emergency-related skills, the more likely their competence in those skills decline.

Overall, 61% of the study population had previous work experience in an emergency-related environment, either in private or public EDs. Doctors commonly spend time working in EDs before specialising or when they are “in-between” jobs, as this allows them to gain invaluable experience in a variety of specialities. This is usually temporary, as was illustrated in our study. The study found that an average of 1.6 years was spent working in these emergency-related fields.

Neither the type of work experience in an emergency-related environment nor the duration of this work experience had any impact on the perceived level of competence in emergency skills. This seems to be an incongruent finding. It is reasonable to expect that time spent working in an emergency-related environment would in fact make a doctor feel more competent when faced with emergency procedures. It would further be expected that the longer a doctor spends working in an emergency-related environment the more competent they would become in emergency skills. This finding may however be due to a potential lack of supervision when performing emergency skills in an emergency-related environment. Furthermore, the urgency to refer a patient to a specific speciality may prevent a doctor working in an ED to perform a certain emergency skill on a patient or a doctor may elect to have that specific speciality perform the emergency procedure themselves. Another potential reason for this incongruent finding is that not all EDs function on the same level. Doctors working in EDs that are not exposed to critically ill patients may not have had the opportunity to become competent in life-saving emergency skills.

Fewer registrars in the clinical group (42%) had had previous work experience in an emergency-related environment when compared to the non-clinical group (58%). It would be expected that those doctors who eventually entered a more clinical field like IM and GS (clinical group) would have been the ones who spent their time working in emergency-related environments or possibly in this case those doctors who did work in emergency-related environments realised that they did not enjoy this field of work and thus chose to specialise in more non-clinical disciplines.

A small percentage of registrars (9%) were concurrently working in emergency-related environments when the study was done. Current work experience in an emergency-related environment had no significant correlation with the level of competence in emergency skills. This finding is also incongruent. One would presume that if a doctor is working in an emergency-related environment where he or she is exposed on a daily basis to patients requiring emergency procedures then this exposure would increase their level of competence in these skills.

5.6 Competence and most recent resuscitation of a patient

GS and IM registrars are faced with patients in need of resuscitation more often than registrars in R and P. The study supported this by demonstrating that only those registrars from the clinical group (IM 56% and GS 44%) had performed resuscitations within seven days prior to answering the questionnaire.

R (36%) and P (48%) registrars made up the majority of those registrars who had last been involved in a resuscitation more than one year ago.

Those registrars whose most recent resuscitation had been in the preceding week felt more competent (CS of 3.8 out of 5) than those who had resuscitated a patient more than one month ago (CS 2.9/5) and more than one year ago (CS 2.7/5) respectively. This is consistent with previous studies by Niles, Gass, Curry and Graham regarding the rapid decline in the retention of emergency skills[53 - 56]. If resuscitations are performed on a regular basis, then these skills are consistently reinforced enabling the attending doctor to feel more confident. The more time that has elapsed since last performing a skill, the less competent the attending clinician potentially will feel. This, however, was not demonstrated in this study in those respondents who worked in EDs.

5.7 Competence in emergency skills

ICD insertion had the overall highest perceived competency (CS 4.0/5) ostensibly because it is commonly performed by GS and IM registrars. Adult CPR (CS 3.9/5), BMV (CS 3.9/5), CV line insertion (CS 3.8/5) and ET intubation (CS 3.7/5) also received high competence ratings, and are commonly performed in resuscitation scenarios. Basic paediatric emergency skills like child CPR (CS 2.9/5), infant CPR (CS 2.7/5) and relief of choking (CS 2.6/5) in the infant patient did not rate well. These skills form a key element of BLS. This may be due to the fact that none of the studied disciplines are regularly involved in paediatric emergencies.

Less commonly performed skills such as escharotomy (CS 2.2/5), venous cut down (CS 2.2/5), fasciotomy (CS 2.2/5) and thoracotomy (CS 1.7/5) all received low overall competence scores.

When analysed as skill groups (basic, intermediate and advanced), the study showed that basic emergency skills (CS 3.3/5) received a higher overall competence score when compared to intermediate (CS 3.2/5) and advanced skills (CS 2.5/5). Basic emergency skills form the foundation of resuscitation principles, and consequently should be mastered before 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[17]. This may also reflect a greater emphasis on basic skills teaching in undergraduate curricula, and the emergence of Emergency Medicine as a specialty.

5.8 Competence and Frequency of performance of emergency skills

All respondents had previously performed adult CPR, implying that they had been active participants in the management of a patient in cardiac arrest. Interpretation of a 12-lead ECG was another skill that had been performed by all the respondents. This routine test is carried out on many patients, not only those requiring resuscitation.

Skills that were performed by a large proportion of the respondents were those skills commonly utilised in the management of critically ill patients. These skills were performed more by registrars in the clinical disciplines than the non-clinical disciplines reinforcing that these registrars are more exposed to critically ill patients, and are therefore required to use these skills more often than their less clinical counterparts.

Along with the frequency of performing the enumerated emergency skills, registrars in the clinical group had also performed these skills more recently than the non-clinical group. Skills such as adult CPR, BMV, ICD insertion, interpretation of a 12 lead ECG, CV line insertion, ET intubation and defibrillation were all performed within the last month by the GS and IM registrars. The paediatric skills had been performed more than one year ago in all the disciplines, most likely due to the fact that these skills are more often performed by Paediatricians. A large proportion of R and P registrars had never performed some of the skills, such as transcutaneous pacing, pericardiocentesis, cricothyrotomy, escharotomy, venous cut down, fasciotomy and thoracotomy.

Despite the fact that the more clinically orientated registrars demonstrated increased frequency in skill use and decreased duration since the skill had last been performed, these factors did *not* contribute significantly to their self-assessed perceived level of competence.

5.9 Competence and Resuscitation courses

All of the disciplines in the study had a high proportion of current or expired certifications in both BLS and ACLS courses. This is a positive trend as such courses aim to equip doctors with the skills necessary to successfully resuscitate a patient. A higher proportion of IM registrars were certified in these courses (48% with current certification for BLS and ACLS and 52% with expired certification for BLS and ACLS). This large proportion of certification is possibly due to the inherent nature of their specialisation. It was also noted that even though 52% had expired certification in BLS and ACLS 100% of this same group commented that

they would be able to be a team leader in the next resuscitation of a patient in cardiac arrest. This may due to the fact that IM doctors are commonly involved in resuscitations and thus feel that they are more competent in resuscitation scenarios.

Conversely, R registrars (13% for BLS and 10% for ACLS) had a much lower proportion of current certification. These courses were most likely attended during Internship or Community Service, and were potentially not renewed due to less patient interaction and the perception that resuscitation requirements in their discipline may not be required.

ATLS is a course that is compulsory for all GS registrars to have attended and successfully completed before writing their intermediate CMSA examinations[64]. Consequently, the entire GS study cohort had a current (92%) or an expired certification (8%). IM registrars had a high proportion of either current or expired certification in AMLS when compared to other disciplines; this can be explained by the expectation and responsibility of IM doctors to be proficient in skills pertaining to common medical emergencies.

All courses were rated as being very beneficial by those registrars who attended them. Furthermore a large proportion of the registrars (90%) felt that resuscitation courses should be compulsory.

This study has shown that those registrars with current PALS certification have more self-perceived competence (CS 0.6/5) in performing both basic and advanced emergency skills. The PALS course teaches emergency skills such as child CPR, infant CPR, defibrillation, IO insertion as well as relief of choking in the infant patient. Quan *et al.* also demonstrated an increase in the successful performance of certain skills, such as BMV, ETT, IO access and defibrillation after completing a PALS course[65]. It is often the case that those who have undertaken a PALS course have previously participated in a BLS and ACLS course, PALS then being the culminating course. The finding makes more sense in this context as the PALS course offers an opportunity to reinforce previously learnt skills.

This study also showed that current (increase CS 1.8/5) or expired (increase CS 1.5/5) certification in ACLS improved perceived competence in the insertion of an IO line. However this skill is not routinely taught in ACLS courses.

Perceived competence levels amongst those registrars who were currently certified in AMLS were higher (increase CS 0.9/5) in advanced emergency skills, despite this course not teaching any skills whatsoever. Certain skills such as CV access are taught in theory during AMLS, empowering registrars who have completed this course to potentially have more confidence in these skills. Langhan *et al.* showed similar observations of improved self-assessed competence in skills after successful completion of resuscitation courses[66].

5.10 Competence and Discipline

The study showed that the GS registrars felt that they were more competent than other disciplines in both the basic and advanced emergency skills. They also had more self-perceived competence than the P and R registrars in the intermediate emergency skills. GS is a discipline whose doctors are exposed to resuscitations on a regular basis. Advanced emergency skills, such as cricothyrotomy, thoracotomy, escharotomy, fasciotomy and venous cut down are more relevant to the surgical than the medical disciplines. Hence the GS group's higher overall CS versus the IM group in these skills is expected.

IM registrars had more self perceived competence in interpreting 12-lead ECGs in comparison to other disciplines. The interpretation of a 12-lead ECG is part of their daily practise and is one in which they are expected to be extremely proficient, which could account for this trend.

In general, the study demonstrated that the clinical registrars in GS and IM felt more competent in all emergency skill groups than their non-clinical counterparts in R and P. Registrars in the clinical disciplines felt more confident that they could act competently in a resuscitation scenario. Those registrars in the clinical group also felt that they would be competent enough to treat a life-threatening emergency on the side of the road if necessary.

5.11 The Dunning-Kruger effect

In the context of this study it could be argued that potential barriers to learning do exist. The fact that the GS group rated themselves as highly competent in a range of emergency skills does not necessarily mean that they are more competent than those doctors in the other groups who rated themselves less competent. The GS group may think they know how to perform certain skills and may believe they are competent in certain skills because they perform these skills more often than other doctors, yet this does not necessarily make them more competent. The group of doctors in this study who perceived their level of competence to be higher in certain skills may have been demonstrating the Dunning-Kruger effect.

Dunning *et al.* also found that students who were overconfident and who had overinflated preconceived ideas about their skill levels would often fall short in objective performance tests[67]. 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[61]. If someone is constantly given positive feedback about a skill they perform then they will perceive themselves to be competent in that skill[61].

This can be further reinforced using Peyton's cycle of learning which describes the four basic stages towards perfecting a skill[25]. Doctors in this study may be oblivious to their lack of competence (unconsciously incompetent); they may be aware about their lack of competence (conscious incompetence), they may also be aware of the fact that they are indeed competent (conscious competence) or

lastly they may be so well trained that they are unconscious about their competence (unconscious competence)[25].

5.12 Table of comparison

Table 5.1 compares both similarities and differences between this study and two others, “Emergency Medicine Skills: Are primary care physicians adequately prepared?” by O’Connor *et al.*[1] and “Evaluation of staff’s retention of ACLS and BLS skills” by KK Smith *et al.*[58]

Table 5-1: Comparison between present study and other related studies.

	Present Study	O'Connor *et al.*[1]	Smith *et al*.[58]
Sample size	265	132	763
Study design and methods	Prospective study using a questionnaire to assess the level of competence in various emergency skills and any contributing factors	Prospective study using a questionnaire to assess (amongst other things) perceived competence in important skills	Prospective study looking to see at what point competency in skills and/or knowledge of ACLS and /or BLS decline to below AHA standards
Response rate	94 (35%)	90 (68%)	103 (13%) met inclusion criteria
Study population	General Surgeons Internal Medicine physicians Radiologists Psychiatrists	Family physicians	Registered nurses
Number of skills assessed	25	26	18
Comparative skills	Adult CPR Relief of choking in adults BMV Defibrillation Use of an AED Synchronised cardioversion Transcutaneous pacing Child CPR Infant CPR Relief of choking in infant	ACLS principles Paediatric resuscitation	BLS skills ACLS skills

O' Connor *et al.* showed that 46% of their study population felt adequately competent in ACLS principles[1]. In comparison we found that 73% of responding registrars rated their level of competence in the comparative skills as 3 or more (i.e. adequate, advanced or expert knowledge/ability in the skill). This could be due to the fact that our study population was comprised of registrars working in an academic setting where the exposure to patients requiring life-saving emergency skills is more than a Family Physician treating patients at their private practise. It may also be due to a more current understanding of emergency related skills as O'Connor *et al.* conducted their study more than 25 years ago. ACLS principles have been updated numerous times over the past few decades and with simplified and better understood guidelines there may indeed be an improved level of competency. Currently, there is a far greater tangible expectation for doctors to have these credentials.

Similarly, our study demonstrated that 58% of registrars felt competent in paediatric resuscitation as compared to 32% in O'Connor *et al's* study[1]. Similar arguments could be made as above like working in an academic setting and more current guidelines leading to improved competence. It could also be expected, however, that Family Physicians would be confident and competent in the basic resuscitation of paediatric patients.

Smith *et al.* evaluated specific BLS and ACLS skills in registered nurses and demonstrated a 29% and 24% pass rate respectively[58]. Our study showed that 74% of the registrars rated the comparative BLS skills as 3 or more, reflecting a perceived competence in BLS principles. Our study, however, did not objectively

assess participants' levels of competency in contrast to Smith *et al.* Objective assessment would be more accurate and could potentially be done in a future study comparing perceived levels of competence with an objective assessment.

Furthermore, our study population group comprised specialists in training whereas O'Connor *et al.* evaluated qualified Family Physicians and Smith *et al*. examined registered nurses.

5.13 Limitations of this study

A major limitation of this study lay in the subjective nature of the questionnaire. The participants were required to rate their own level of competence. The researcher acknowledges the potential bias inherent in this approach, where some registrars could have possibly overrated their perceived competence by inflating their answers to "advanced" or "expert". Similarly, other registrars may have underrated their level of competence as not to be seen as being overconfident. Furthermore, any confusion to what a particular skill may have meant or represented may have resulted in registrars underestimating their level of competence.

The four different disciplines were chosen as they represented registrars with diverse clinical exposure. IM and GS registrars are exposed to a wide variety of emergencies specific to their discipline and should be reasonably competent in various life-saving skills. R and P registrars work in highly specialised disciplines and are less exposed to patients in need of life-saving skills. As a result the R and P registrars may not be expected to be as competent in life-saving skills as the IM

and GS registrars. However, four other disciplines may have generated completely different outcomes and the researcher is aware that the level of competence in emergency skills resulting from this study is unique to these particular groups and thus may not be generalisable.

Within the chosen disciplines, registrars in different years of study may have had varying levels of perceived competence. First year registrars may have had less exposure to emergency skills and thus may have had a lower perceived level of competence when compared to final year registrars. However, as the objective of this study was to describe and compare the level of self-assessed competence in various emergency skills of registrars in selected disciplines and not within each discipline, the researcher chose not to include the year of study in the data collection.

Certain advanced emergency skills were also very unique to the GS registrars; this may have resulted in their level of competence being higher than the other groups. Certain emergency skills were also very paediatric orientated. Seeing that IM registrars may not treat paediatric patients, this is a recognised limitation in this group.

The emergency skills surveyed in this study were determined by the researcher based on personal knowledge and on the background literature review of skills which are commonly used in the management of a resuscitation scenario. The researcher acknowledges that skills which are necessary in an emergency in one discipline may not be viewed as being equally as important in other disciplines.

Radiologists, for example, may attribute more importance to the emergency skill required to manage a patient having an anaphylactic reaction to contrast given during a CT scan. The researcher could argue that if the patient then develops cardiac arrest as a result of this anaphylactic reaction, then competence in the appropriate emergency skills required to manage the subsequent resuscitation is of paramount importance.

5.14 Strengths of this study

This was a prospective study and after an extensive literature review it was found to be unique in its nature. No similar studies regarding self-assessed levels of competence in emergency skills have been conducted in the South African setting. Emergency skills and the training in these skills are an important element of medical education. If registrars feel positively that resuscitation courses should be compulsory and that all doctors should be competent in life-saving emergency skills, then this study has the potential to motivate for certain courses to be included in registrar training or undergraduate study.

5.15 Further research

Further studies are necessary to evaluate how registrars' level of self-assessed competence in emergency skills compares to the actual level of competence they possess. Objective versus subjective studies would aid in the determination of the accuracy of self-assessed competence.

Future research should also be directed at what constitutes an emergency skill in specific disciplines. In doing so, these precise skills can be prioritised amongst the doctors working in particular disciplines. Moreover, research and consensus in terms of what is regarded as expected fundamental emergency skills for all medical practitioners would be useful and could inform undergraduate and CPD offerings alike. Basic proficiency in any emergency medical situation is expected of any registered medical practitioner.

Chapter 6 CONCLUSIONS

Registrars in the clinical disciplines of GS and IM regard themselves as having a higher level of perceived competence in various emergency skills when compared to those registrars in the non-clinical disciplines of P and R. The GS registrars rated themselves the highest overall of the four disciplines in their level of perceived competence in the basic and advanced skills groups.

The following variables were found to have had a significant influence on the registrars' perceived level of competence in various emergency skills:-

- Resuscitation courses: specifically current rather than expired certification in ACLS, PALS and AMLS courses.
- Number of years post Community Service: those registrars who had spent less time between Community Service and starting their specialist training demonstrated higher levels of perceived competence.

Recommendations

Attendance of resuscitation courses should be made compulsory for all registrars. This research has shown that current certification in the available courses improves the level of perceived competence in emergency skills amongst registrars. This strategy of continuous clinical learning to enhance emergency medical preparedness is likely to apply to all medical practitioners and not only registrars.

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APPENDIX A: Human Research Ethics Committee clearance

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG
Division of the Deputy Registrar (Research)

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
R14/49 Dr Nicholas J Dufourq

CLEARANCE CERTIFICATE	**M120316**
PROJECT	What Level of Competence in Emergency Skills Do Registrars in Various Specialities Possess?
INVESTIGATORS	Dr Nicholas J Dufourq.
DEPARTMENT	Department of Emergency Medicine
DATE CONSIDERED	30/03/2012
+DECISION OF THE COMMITTEE*	Approved unconditionally

Unless otherwise specified this ethical clearance is valid for 5 years and may be renewed upon application.

DATE 09/05/2012 **CHAIRPERSON** .....
(Professor PE Cleaton-Jones)

*Guidelines for written 'informed consent' attached where applicable
cc: Supervisor : Dr Lara Goldstein

DECLARATION OF INVESTIGATOR(S)
To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10004, 10th Floor, Senate House, University.
I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to a completion of a yearly progress report.**

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES...

APPENDIX B: Permission letters

health and social development
Department: Health and Social Development
GAUTENG PROVINCE

CHARLOTTE MAXEKE JOHANNESBURG ACADEMIC HOSPITAL

Office of the CEO
Enquiries: L. Mngomezulu
(011): 488-3793
(011) 488-3753
01st June 2012

Dr.Nicholas Dufourq
Emergency Medicine Registrar

Dear Dr.Dufourq

RE: "What Level of competency in Emergency skill Do registrars in various specialties possession"

Permission is granted for you to conduct the above research as described in your request provided:

1. Charlotte Maxeke Johannesburg Academic hospital will not in anyway incur or inherit costs as a result of the said study.
2. Your study shall not disrupt services at the study sites.
3. Strict confidentiality shall be observed at all times.
4. Informed consent shall be solicited from patients participating in your study.

Please liaise with the Head of Department and Unit Manager or Sister in Charge to agree on the dates and time that would suit all parties.

Kindly forward this office with the results of your study on completion of the research.

Yours sincerely

Dr. T.E. Selebano
Chief Executive Officer

MEDICAL ADVISORY COMMITTEE

CHRIS HANI BARAGWANATH ACADEMIC HOSPITAL

PERMISSION TO CONDUCT RESEARCH

Date: 28 May 2012

TITLE OF PROJECT: What level of competence in emergency skills do registrars in various specialties possess?

UNIVERSITY: Witwatersrand

Principal Investigator: Dr N J Dufourq

Department: Emergency Medicine

Supervisor (If relevant): Dr L N Goldstein

Permission Head Department (where research conducted): No

Date of start of proposed study: May 2012

Date of completion of data collection: July 2012

The Medical Advisory Committee recommends that the said research be conducted at Chris Hani Baragwanath Hospital. The CEO /management of Chris Hani Baragwanath Hospital is accordingly informed and the study is subject to:-

- **The investigator is to discuss the project with the relevant Heads of Department before discussing with registrars in the departments.**
- Permission having been granted by the Committee for Research on Human Subjects of the University of the Witwatersrand.
- the Hospital will not incur extra costs as a result of the research being conducted on its patients within the hospital
- the MAC will be informed of any serious adverse events as soon as they occur
- permission is granted for the duration of the Ethics Committee approval.

.....

Recommended

(On behalf of the MAC)

Date: 28 May 2012

.....

Approved/Not Approved

Hospital Management

Date: 29/05/2012

health and social development
Department: Health and Social Development
GAUTENG PROVINCE

Umyango Wezwmpilo no Kuthuthukiswa Komphakathi
Lefapha La Maphelo le Tshebeletso le Ntshetsopele ya Sechaba
Department of Health and Social Development
Departmente van Gesondheid en Maatsplike Ontwikkelig

PERMISION FOR RESEARCH

DATE: 19/06/2012

NAME OF RESEARCH WORKER: DR NICHOLAS DUFOURQ

CONTACT DETAILS OF RESEARCH (INCLUDE ALTERNATE RESEARCHER):

Cell 082 3225548

e-mail nic-duf@yahoo.co.uk

TITLE OF RESEARCH PROJECT WHAT LEVEL OF COMPETENCE IN EMERGENCY SKILLS DO REGISTRARS IN VARIOUS SPECIALITIES POSES?

OBJECTIVES OF STUDY (Briefly or include a protocol): SEE ATTACHED PROTOCOL

METHODOLOGY (Briefly or include a protocol): SEE ATTACHED PROTOCOL

THE APPROVAL BY THE SUPERINTENDENT IS STRICTLY ON THE BASIS OF THE FOLLOWING:

(i) CONFIDENTIALITY OF PATIENTS MAINTAINED: YES

(ii) NO COSTS TO THE HOSPITAL: NIL

(iii) APPROVAL OF HEAD OF DEPARTMENT: YES

(iv) APPROVAL BY ETHICS COMMITTEE OF UNIVERSITY: YES

SUPERINTENDENT PERMISION

Signature: _____ Date: 19/06/2012

SUBJECT TO ANY RESTRICTIONS

GAUTENG PROVINCIAL GOVERNMENT
HELEN JOSEPH HOSPITAL
PRIVATE BAG X47
19 JUN 2012
AUCKLAND PARK 2006 JHB

Helen Joseph Hospital
Perth Road
Tel: 011 489 1011

Private Bag X47
Auckland Park
2006

APPENDIX C: Consent form

WHAT LEVEL OF COMPETENCE IN EMERGENCY SKILLS DO REGISTRARS IN VARIOUS SPECIALITIES POSSESS?

I, _____, being 18 years or older, consent to participating in the research project entitled:

"WHAT LEVEL OF COMPETENCE IN EMERGENCY SKILLS DO REGISTRARS IN VARIOUS SPECIALITIES POSSESS?"

The questionnaire has been explained to me and I understand and appreciate its purpose and the extent of my involvement. I have read and understand the attached information sheet.

I understand that the questionnaire forms part of a research project, and may not provide any direct benefit to me. I understand that the questionnaire has been sanctioned by the Human Research Ethics Committee of the University of the Witwatersrand.

I understand that my participation is voluntary and I am not obliged to answer a particular question if I so choose.

_____	_____	_____
Registrars Name	Registrars Signature	Date
__Nicholas Dufourq__	_____	_____
Researcher Name	Researcher Signature	Date

APPENDIX D: Information sheet

WHAT LEVEL OF COMPETENCE IN EMERGENCY SKILLS DO REGISTRARS IN VARIOUS SPECIALITIES POSSESS?

Hi!

My name is Nicholas Dufourq. I am a registrar in the Division of Emergency Medicine conducting this study for the completion of my Master of Medicine degree.

Thank you for taking the time to read this information leaflet.

Emergency skills such as CPR and defibrillation, amongst many others, can help save a patient's life. Competency in these skills is important if they are to be carried out correctly. Even though certain doctors are faced with patients in need of resuscitation more than others, does it mean that other doctors need not be as competent in these potentially life-saving skills? Along with this, many doctors come from different backgrounds. Some have spent time working in emergency settings and others having done numerous emergency related courses.

In light of this, I would like to see at what level various registrars rate their competency in certain emergency skills as well as what factors may contribute to their level of competency.

In order to do this, I would like to invite you to participate in my study on a purely voluntary basis. It will require approximately 20 minutes of your time which will be

spent answering a questionnaire. Please be as honest as possible when answering the questionnaire. Once you have completed the questionnaire please place it in the box provided. As to further ensure complete anonymity, the box will only be opened once all questionnaires from the session have been collected.

All the data obtained during this study will be analysed and the results presented in my Masters research report as well as published in a research written paper for the scientific community. Your confidentiality will be protected at all times. Any information made public (e.g. in publications or at congresses) will not reveal any details about individuals in the study.

I have obtained approval for my study from the Human Research Ethics Committee of the University of the Witwatersrand. They can be contacted via Anisa Keshav, Wits Research Office, 10th Floor Senate House, East Campus at 011-717-1234 or via fax at 011-717-1265 or via e-mail on anisa.keshav@wits.ac.za.

If you have any questions, please feel free to ask me or contact me on 082 322 5548 or email me on nic_duf@yahoo.co.uk.

Yours sincerely

Dr Nicholas Dufourq

APPENDIX E: Questionnaire

WHAT LEVEL OF COMPETENCE IN EMERGENCY SKILLS DO REGISTRARS IN VARIOUS SPECIALITIES POSSESS?

Please note: The information that will be obtained from this questionnaire is anonymous and strictly confidential. Please answer as thoughtfully and honestly as possible.

Section A:

Please answer the following questions by either ticking the appropriate box or writing the answer if needed:-

1. What discipline are you specialising in?

☐ Internal Medicine ☐ Psychiatry

☐ General Surgery ☐ Radiology

2. What is your current age?

_____

3. Sex

☐ Male ☐ Female

4. At which University did you obtain your medical degree?

_____

5. In which year did you complete your medical degree?

_____

6. Did you complete any emergency related degrees prior to studying medicine?

☐ YES ☐ NO

If yes

i. Which degrees?

_____

_____

7. How many years after your community service or internship (if applicable) did you start specialising?

_____

8. Did you spend any time working in an emergency related environment before you started specialising?

☐ YES ☐ NO

If yes

i. Where?

☐ Private Emergency Department ☐ Emergency Medical Services

☐ Public Emergency Department ☐ Aeromedical

☐ Other _____

ii. For how long? _____

9. Are you currently doing any part time work in an emergency medical related environment?

☐ YES ☐ NO

If yes

i. Where?

☐ Private Emergency Department ☐ Emergency Medical Services

☐ Public Emergency Department ☐ Aeromedical

☐ Other _____

ii. For how long? _____

10. How long has it been since you were involved in the resuscitation of a patient in cardiac arrest?

☐ <1 week ☐ 1 week – 1 month

☐ 1month – 2 months ☐ 2 months – 6 months

☐ 6 months – 1 year ☐ > 1 year

11. How would you rate your level of competence in your last resuscitation of a patient in cardiac arrest?

☐ **Poor:** No knowledge or ability

☐ **Basic:** Some knowledge and ability

☐ **Intermediate:** Adequate knowledge and ability

☐ **Advanced:** Advanced knowledge and ability

☐ **Expert:** Expert knowledge and ability

Section B:

1. Rate your own personal level of competence in the following emergency skills by circling the appropriate number (use the scale below).

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

	Poor	**Basic**	**Intermediate**	**Advanced**	**Expert**
Defibrillation	1	2	3	4	5
Pericardiocentesis	1	2	3	4	5
Intercostal drain insertion	1	2	3	4	5
Relief of choking in adults	1	2	3	4	5
Intraosseous line insertion	1	2	3	4	5
Child CPR	1	2	3	4	5
Thoracotomy	1	2	3	4	5
Synchronised cardioversion	1	2	3	4	5
Central venous line insertion	1	2	3	4	5
Escharotomy	1	2	3	4	5
Adult CPR	1	2	3	4	5

CPR = Cardiopulmonary resuscitation

Continues to next page....

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

	Poor	**Basic**	**Intermediate**	**Advanced**	**Expert**
Cricothyrotomy	1	2	3	4	5
Relief of choking in infants	1	2	3	4	5
Needle decompression	1	2	3	4	5
Infant CPR	1	2	3	4	5
Bag mask ventilation	1	2	3	4	5
Venous cut down	1	2	3	4	5
Insertion of an LMA	1	2	3	4	5
Transcutaneous pacing	1	2	3	4	5
Arterial line insertion	1	2	3	4	5
Interpretation of a 12 lead ECG	1	2	3	4	5
Use of an AED	1	2	3	4	5
Delivery of a baby	1	2	3	4	5
Endotracheal intubation	1	2	3	4	5
Fasciotomy	1	2	3	4	5

CPR = Cardiopulmonary resuscitation, LMA = Laryngeal Mask Airway

AED = Automated External Defibrillator, ECG = Electrocardiogram

Section C:

1. With regards to the listed emergency skills please circle your response or write the answer if needed:-

   i. Have you ever performed this skill?
   ii. How many times **a month** do you perform this skill?
   iii. When last did you perform this skill?

SKILL	Have you ever performed this skill?	How many times **a month** do you perform this skill?	When last did you perform this skill?
Adult CPR	YES NO		
Child CPR	YES NO		
Infant CPR	YES NO		
Relief of choking in adults	YES NO		
Relief of choking in infants	YES NO		
Use of an AED	YES NO		
Defibrillation	YES NO		
Synchronised cardioversion	YES NO		
Transcutaneous pacing	YES NO		
Interpretation of a 12 lead ECG	YES NO		
Bag mask ventilation	YES NO		
Endotracheal intubation	YES NO		
Insertion of an LMA	YES NO		
Needle thoracocentesis	YES NO		
Intercostal drain insertion	YES NO		
Intraosseous line insertion	YES NO		
Central venous line insertion	YES NO		
Arterial line insertion	YES NO		

LMA = Laryngeal Mask Airway, CPR = Cardiopulmonary resuscitation

AED = Automated External Defibrillator, ECG = Electrocardiogram

2. With regards to the listed emergency skills please circle your response or write the answer if needed:-

   i. Have you ever performed this skill?
   ii. How many times **a year** do you perform this skill?
   iii. When last did you perform this skill?

SKILL	Have you ever performed this skill?	How many times **a year** do you perform this skill?	When last did you perform this skill?
Thoracotomy	YES NO		
Venous cut down	YES NO		
Escharotomy	YES NO		
Fasciotomy	YES NO		
Cricothyrotomy	YES NO		
Pericardiocentesis	YES NO		
Delivery of a baby	YES NO		

Section D:

1. Tick the appropriate box with regards to your own personal training in the resuscitation courses mentioned below:-

A. Basic Life Support (BLS)

☐ Currently up-to-date ☐ Expired ☐ Never attended

B. Advanced Cardiac Life Support (ACLS)

☐ Currently up-to-date ☐ Expired ☐ Never attended

C. Advanced Cardiac Life Support - Experienced Provider (ACLS - EP)

☐ Currently up-to-date ☐ Expired ☐ Never attended

D. Paediatric Advanced Life Support (PALS) or Advanced Paediatric Life Support (APLS)

☐ Currently up-to-date ☐ Expired ☐ Never attended

E. Advanced Trauma Life Support (ATLS)

☐ Currently up-to-date ☐ Expired ☐ Never attended

F. Airway course or Airway Interventions and Management in Emergencies (AIME)

☐ Currently up-to-date ☐ Expired ☐ Never attended

G. Advanced Medical Life Support (AMLS)

☐ Currently up-to-date ☐ Expired ☐ Never attended

2. Please list any other resuscitation courses that you have attended.

_____ ☐ Currently up-to-date ☐ Expired

_____ ☐ Currently up-to-date ☐ Expired

_____ ☐ Currently up-to-date ☐ Expired

3. Having attended the resuscitation courses listed below; how beneficial did you find them in your daily practise with regards to improving your competency in emergency skills?

A. Basic Life Support (BLS)

☐ Very beneficial ☐ Slightly beneficial ☐ Not beneficial ☐ Not applicable

B. Advanced Cardiac Life Support (ACLS)

☐ Very beneficial ☐ Slightly beneficial ☐ Not beneficial ☐ Not applicable

C. Advanced Cardiac Life Support - Experienced Provider (ACLS - EP)

☐ Very beneficial ☐ Slightly beneficial ☐ Not beneficial ☐ Not applicable

D. Paediatric Advanced Life Support (PALS) or Advanced Paediatric Life Support (APLS)

☐ Very beneficial ☐ Slightly beneficial ☐ Not beneficial ☐ Not applicable

E. Advanced Trauma Life Support (ATLS)

☐ Very beneficial ☐ Slightly beneficial ☐ Not beneficial ☐ Not applicable

F. Airway course or Airway Interventions and Management in Emergencies (AIME)

☐ Very beneficial ☐ Slightly beneficial ☐ Not beneficial ☐ Not applicable

G. Advanced Medical Life Support (AMLS)

☐ Very beneficial ☐ Slightly beneficial ☐ Not beneficial ☐ Not applicable

4. Do you think participation in resuscitation courses, like those previously mentioned, should be compulsory for all specialists in training?

☐ YES ☐ NO

Please explain your response.

_____

_____

_____

_____

_____

5. Do you think that all registrars, regardless of speciality, need to be competent in live-saving emergency skills?

☐ YES ☐ NO

Please explain your response.

_____

_____

_____

_____

_____

6. Would you be able to be team leader, if called upon, in the next resuscitation of a patient in cardiac arrest?

☐ YES ☐ NO

7. Would you feel competent if you were asked to stop on the side of the road and treat someone in need of life-saving emergency treatment?

☐ YES ☐ NO

END OF QUESTIONNAIRE

THANK-YOU

APPENDIX F: Cronbach's alpha and the number factors retained in Factor Analysis for the constructs developed from the initial skills groupings

Construct	Cronbach's alpha	Number of factors	Comments
Basic emergency skills (7)	0.901	1	Factor loadings all > 0.70
Intermediate emergency skills (8)	0.922	1	Low factor loading for ECG (0.67)
Intermediate emergency skills (7) excluding interpretation of ECG	0.923	1	Factor loadings all > 0.75
Advanced emergency skills (10)	0.916	1	Low factor loading for delivery of baby (0.33)
Advanced emergency skills (9) excluding delivery of a baby	0.930	1	Low factor loading for IO insertion (0.63)
Advanced emergency skills (8) excluding delivery of a baby and IO insertion	0.933	1	Factor loadings all > 0.74

APPENDIX G: When last a skill had been performed

	Discipline				Group		Total
	IM	GS	P	R	Clinical	Non-clinical	
Adult CPR							
< 1 month	100*	83*	0*	0*	92*	0*	48
1 month – 1 year	0*	8	20	43*	4	36	19
> 1 year	0*	8	80*	57*	4*	64*	33
never	0	0	0	0	0	0	0
Child CPR							
< 1 month	4	33*	0*	0*	18*	0*	10
1 month – 1 year	4	25	7	13	14	11	13
> 1 year	72*	42*	73*	67	57	69	63
never	20	0	20	20	10	20	15
Infant CPR							
< 1 month	0	29*	0	0	14	0	7
1 month – 1 year	4	21	0	7	12	4	9
> 1 year	44	42	67*	70*	43*	69*	55
never	52*	8*	33	23	31	27	29
Choking adult							
< 1 month	8	0	0	0	4	0	2
1 month – 1 year	0	8	7	0	4	2	3
> 1 year	20	42	40	30	31	33	32
never	72	50	53	70	61	64	63
Choking infant							
< 1 month	0	4	0	0	2	0	1
1 month – 1 year	0	4	0	0	2	0	1
> 1 year	32	25	33	20	29	24	27
never	68	67	67	80	67	76	71
BMV							
< 1 month	92*	92*	0*	3*	92*	2*	49
1 month – 1 year	0	4	33	27	2*	29*	15
> 1 year	8*	4*	60*	67*	6*	64*	34
never	0	0	7	3	0	4	2
AED							
< 1 month	24*	17*	0*	0*	20*	0*	11
1 month – 1 year	4	8	0	7	6	4	5
> 1 year	56	33	67	37	45	47	46
never	16*	42	33	57*	29*	49*	38
Defibrillation							
< 1 month	76*	50	0*	0*	63*	0*	33
1 month – 1 year	4	33*	0	7	18	4	12
> 1 year	20*	8*	87*	70*	14*	76*	44
never	0	8	13	23	4	20	12

*** indicates a significant difference**

Synchronised cardioversion							
< 1 month	64*	4	0*	0*	35*	0*	18
1 month – 1 year	4	25	0	3	14	2	9
> 1 year	32	33	33	33	33	33	33
never	0*	38	67*	63*	18*	64*	40
ICD insertion							
< 1 month	84*	83*	0*	0*	84*	0*	44
1 month – 1 year	0	13	0	0	6	0	3
> 1 year	16*	4*	93*	93*	10*	93*	50
never	0	0	7	7	0	7	3
Needle decompression							
< 1 month	24	38*	0*	3*	31*	2*	17
1 month – 1 year	4	29*	0	0	16*	0*	9
> 1 year	56*	21*	67*	40	39	49	44
never	16*	13*	33	57*	14*	49*	31
LMA insertion							
< 1 month	4	21*	0	0	12*	0*	6
1 month – 1 year	4	0	0	0	2	0	1
> 1 year	80	58	87	63	69	71	70
never	12	21	13	37*	16*	29*	22
Transcutaneous Pacing							
< 1 month	24*	4	0	0	14*	0*	7
1 month – 1 year	8	0	0	0	4	0	2
> 1 year	24	17	20	20	20	20	20
never	44*	79*	80*	80*	61*	80*	70
Interpretation of 12-lead ECG							
< 1 month	100*	92*	33*	0*	96*	11*	55
1 month – 1 year	0	4	33	17	2	22	12
> 1 year	0*	4*	33	83*	2*	67*	33
never	0	0	0	0	0	0	0
ET intubation							
< 1 month	92*	88*	0*	0*	90*	0*	47
1 month – 1 year	4	13	20	3	8	9	9
> 1 year	4*	0*	73*	90*	2*	84*	41
never	0	0	7	7	0	7	3
IO insertion							
< 1 month	0	8	0	0	4	0	2
1 month – 1 year	4	25*	0	0	14*	0*	7
> 1 year	68*	54	53	37*	61*	42*	52
never	28	13*	47	63*	20*	58*	38
Pericardiocentesis							
< 1 month	24	4	0	0	14	0	7
1 month – 1 year	4	13	0	0	8	0	4
> 1 year	48	38	27	23	43	24	34
never	24*	46*	73*	77*	35*	76*	54

*** indicates a significant difference**

Thoracotomy							
< 1 month	0	21*	0	0	10*	0*	5
1 month – 1 year	0	29*	0	0	14*	0*	7
> 1 year	4	8	13	3	6	7	6
never	96*	42*	87*	97*	69*	93*	81
CV line insertion							
< 1 month	92*	96*	0*	0*	94*	0*	49
1 month – 1 year	4	4	0	7	4	4	4
> 1 year	4*	0*	93*	83*	2*	87*	43
never	0	0	7	10	0	9	4
Escharotomy							
< 1 month	0	33*	0	0	16	0	9
1 month – 1 year	0	25*	0	0	12	0	6
> 1 year	8	21	20	10	14	13	14
never	92*	21*	80*	90*	57*	87*	71
Cricothyrotomy							
< 1 month	0	8	0	0	4	0	2
1 month – 1 year	0	25*	0	0	12	0	6
> 1 year	32	33	7	23	33	18	26
never	68	33*	93*	77*	51*	82*	66
Venous cut down							
< 1 month	0	8	0	0	4	0	2
1 month – 1 year	0	21	0	0	10	0	5
> 1 year	28	42*	20	20	35	20	28
never	72*	29*	80*	80*	51*	80*	65
A line							
< 1 month	28	67*	0*	0*	47*	0*	24
1 month – 1 year	4	8	0	0	6	0	3
> 1 year	64*	25*	53	67*	45	62	53
never	4*	0*	47*	33*	2*	38*	19
Delivery of a baby							
< 1 month	0	0	0	0	0	0	0
1 month – 1 year	0	4	0	0	2	0	1
> 1 year	80	83	100	90	82	93	87
never	20	13	0	10	16	7	12
Fasciotomy							
< 1 month	0	21	0	0	10	0	5
1 month – 1 year	0	38*	0	0	18*	0*	10
> 1 year	12	25	20	27	18	24	21
never	88*	17*	80*	73*	53*	76*	64

*** indicates a significant difference**