The Development of Empirically Based Core Competencies for Emergency Medical Services in Saudi Arabia

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Abstract

In Saudi Arabia, Emergency Medical Services (EMS) education has shifted rapidly from on-the-job training to university degrees during the past decade. However, the fast pace of development has contributed to considerable disparities in educational approaches between university programs. This thesis used multiple studies to identify the most desirable core competencies of EMS Bachelor degree graduates in Saudi Arabia. Thus, offering the EMS educational system in Saudi Arabia an opportunity to standardise the academic curricula based on an empirically developed curricula model.

This thesis has produced important contribution to EMS in Saudi Arabia, by being the first to provide an overview of the evolution of Saudi EMS by describing its history, organisational service providers, governance, EMS statistics, and the educational development of the field, and disparities between educational approaches. It also provides the first scoping review to systematically identify core competencies for paramedic students internationally. A Delphi study was the first to represent the views of key experts and stakeholders in Saudi EMS with the aim of reaching consensus on a core competency framework. The Delphi study achieved the required recommendations for majority, consensus, stability, and response rate. Furthermore, a national study involved 927 completed questionnaires from health care professionals working for the Saudi Red Crescent Authority, the national Saudi EMS provider. The data were randomly divided, and the first half was analysed through exploratory factor analyses to generate a parsimonious theoretical model. The second half of the data was then utilised to confirm the proposed theoretical model through confirmatory factor analysis.

The results confirmed 27 items proposed by the Saudi ParamEdic Competency Scale (SPECS) model under five themes (professional, preparedness, communication, clinical, personal) and the higher order construct of paramedic competency. The results supported the SPECS as a reliable, valid, unidimensional, and psychometrically sound model for Saudi universities to standardise their EMS curricula based on empirical input from the industry. The SPECS model includes 84 enabling competencies to simplify the integration and alignment of the model into Saudi EMS Bachelor degree programs.

Declaration

This thesis is an original work of my research and contains no material which has been accepted for the award of any other degree or diploma at any university or equivalent institution and that, to the best of my knowledge and belief, this thesis contains no material previously published or written by another person, except where due reference is made in the text of the thesis.

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Abbreviations

AHPRA	Australian Health Practitioners Regulation Agency
ALS	Advanced Life Support
CAA	Council of Ambulance Authorities
CBT	Competency-based training
CFA	Confirmatory factor analysis
CFI	Comparative fit index
CMIN/DF	$\chi 2$ to the degrees of freedom
DCEHPP	Department of Community Emergency Health and Paramedic Practice
ED	Emergency Department
EFA	Exploratory factor analysis
EMS	Emergency Medical Services
EMT	Emergency Medical Technician
HPCSA	Health Professions Council of South Africa
IRCP	International Roundtable on Community Paramedicine
JRCALC	The Joint Royal College of Ambulance Liaison Committee
KMO	Kaiser-Meyer-Olkin
KSAU-HS	King Saud bin Abdulaziz University for Health Sciences
KSU	King Saud University
MOH	Saudi Ministry of Health
NAHA	National Ambulance Health Association
NFI	Normed fit index
NGT	Nominal group technique
NHS	National Health Services
NHTSA	National Highway and Traffic Safety Administration
NNFI	Non-normed fit index
NREMT	National Registry of Emergency Medical Technicians
PA	Paramedics Australasia
PCC	Population, Concept and Context
PNFI	Parsimonious normed fit index
RMSEA	Root mean square error of approximation
RMSR	Root mean square residual
SAEMS	Saudi Association of Emergency Medical Services

SASEM	Saudi Association Society of Emergency Medicine
SCFHS	Saudi Commission for Health Specialities
SEM	Structural equation modelling
SPECS	Saudi ParamEdic Competency Scale
SRCA	Saudi Red Crescent Authority
SRMR	Standardised root mean square residual
TLI	Tucker-Lewis index
VET	Vocational education and training

Definitions

Attitude: “A person’s views (values and beliefs) about a thing, process or person that often lead to positive or negative behaviour” [1 p6].

Certification: “The issuing of a certificate by a private agency based upon competency standards adopted by that agency and met by the individual” [2 p62].

Competence: “Sufficient knowledge, psychomotor, communication and decision-making skills and attitudes to enable the performance of actions and specific tasks to a defined level of proficiency” [1 p6].

Competencies: “the combination of skills, knowledge, attitudes, values and abilities that underpin effective and/or superior performance in a profession/occupational area” [3 p16].

Competent: “The successful demonstration of essential knowledge, skills, attitudes and professional behaviour on a specific task, action or function in the work setting” [1 p6].

Chapter 1: Evolution of Saudi Emergency Medical Services

1.1. Introduction to Saudi Arabia

The Kingdom of Saudi Arabia (KSA) was established in 1932. It is approximately a quarter the size of United States with over 2,150,000 km^2 in size, constituting nearly 80% of the Arabian Peninsula [(4)]. Saudi Arabia is made up of 13 regions, each one of the regions contains a capital city. There are eight countries bordering Saudi Arabia starting from the north clock wise Jordan, Iraq, Kuwait, Bahrain, Qatar, Emirates, Oman and Yemen. The geography of Saudi Arabia is varied, with coastlines on the Arabian Gulf and Red Sea, mountains in the southwest and plains and deserts covering more than half the country. According to the General Authority of Statistics, the estimated population of Saudi Arabia in 2016 was 31,742,580 [(5)].

1.2. Healthcare System

In Saudi Arabia, for every 10,000 people, there are 26.5 physicians and dentists, 53.7 nurses, 7.2 pharmacists, and 30.8 allied health professionals, which include emergency medical service (EMS) providers [(6)]. The Ministry of Health (MOH) budget for 2014 was 59.985 billion Saudi Riyals or 7.01% of the government budget. This does not include the budget for other healthcare sectors of the country; 43.5% of the MOH budget was allocated to staff salaries [(7)]. In total, there are 453 hospitals and 67.997 beds in the country, 59.3% of which are run by the MOH [(7)]. In addition, 29.5% of the population is under the age of 15, and life expectancy is 74.2, four years over the global average and six over the regional average [(8)]. The five leading causes of death are ischaemic heart disease (21.7%), stroke (16%), lower respiratory infections (6.3%), road injury (5.8%), and diabetes mellitus (4.6%) [(6)].

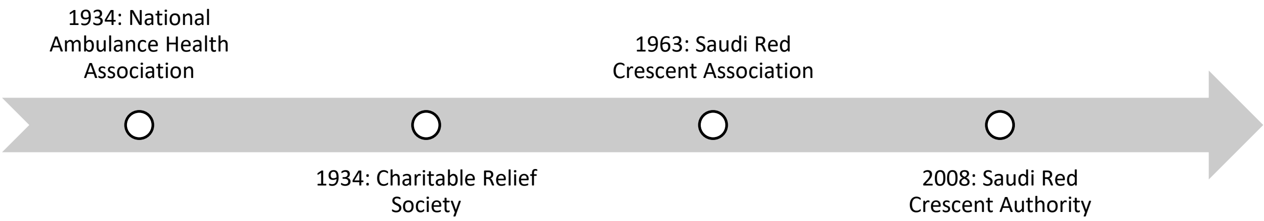
1.3. History of EMS in Saudi Arabia

The history of EMS in Saudi Arabia is directly related to the Saudi Red Crescent Authority (SRCA). The SRCA constitutes the beginning of pre-hospital care provided by the Saudi government for the general public from the early decades of the development of health care in the KSA [9]. According to the SRCA's official website, EMS care was only officially institutionalised by an independent ambulance provider after the formation of the National Ambulance Health Association (NAHA) in 1934 [9]. The role of the ambulance service was initially part of the Public Health and Ambulance Authority, the government provider of health and ambulance care for the general public and especially to pilgrims visiting Mecca and Medina. The development of the NAHA came about in response to the Saudi-Yemeni War of 1934 by providing medical care for the military [9].

Following the Saudi-Yemeni War, pre-hospital care in the KSA was mostly limited to Mecca and Medina and was a private initiative under the Charitable Relief Society [9]. However, following the Second World War, the income of such private institutions was greatly diminished and led to dependence on the government rather than charity. In 1963, a royal decree from King Faisal was issued to convert the Charitable Relief Society into a public institution under the name Saudi Red Crescent Association [9,10], which was later amended in 2008 to the Saudi Red Crescent Authority (see fig. 1.1) [11].

The main objectives of the SRCA encompass providing aid relief, ambulance services, and humanitarian work through international treaties [10]. The SRCA is the 91st member of the International Federation of Red Cross and Red Crescent Societies [10]. Furthermore, the office of the United Nations High Commissioner for Refugees was involved in providing an emergency management training program in collaboration with the SRCA in 2000 [10].

Figure 1.1: History of Saudi EMS Timeline



1.4. Organisation and Service Providers

The EMS is a vital first point of contact for pre-hospital patients and is responsible for providing pre-hospital care and transport for the SRCA throughout the country with some exceptions [12]. Inter-facility patient transfer is generally the responsibility of hospitals and not the SRCA, with these hospitals running their own ambulance transfer service [12,13]. The EMS in Saudi Arabia is based mostly on an Anglo-American model, which aims for rapid patient transport to an emergency department by clinically competent paramedics [14]. Other countries to adopt this model include the United Kingdom, United States, New Zealand, Australia, and Oman [14].

The pre-hospital care system in the KSA is still developing in terms of community awareness, public attitudes, and the knowledge deficiencies of pre-hospital care providers. One of the issues reported by Salleeh [15] is that the majority of cardiac arrest patients in Riyadh are being brought to hospitals in private automobiles by people who are seldom educated in CPR. A recent study by AlHabib [16] compared EMS and non-EMS patient transfer in the Arabian Gulf countries for acute care and the clinical arrival within 24 hours of the onset of ST segment elevation myocardial infarction (STEMI) symptoms. Of the 2,928 patients transferred, only 109 used the Red Crescent EMS service, or 3.7% of the study population, which the study described as a “disturbing finding”. In addition, the study reported a significant lack of basic life support and advanced cardiac life support certification for the paramedics involved. The majority of patient ECGs were also performed in hospitals and not by EMS providers, which may indicate a limitation in the current clinical and theoretical competence of EMS providers.

In the case of motor vehicle accident scenes are regularly congested with friends, family members, and spectators. Such gatherings lead to significant interruption to onsite patient care [13]. Furthermore, a recent Saudi study found the majority of pre-hospital care providers suffered from a deficiency in knowledge regarding important stroke symptoms and recommended addressing educational needs in addition to screening tools [17]. This finding indicates a lack of development in the educational aspect of EMS in the KSA.

The issue of transferring accident patients directly to hospitals in private cars, whether by family or strangers can be linked to many factors, such as socioeconomic status, education, public awareness, and the media [13,16]. A factor that may also have an effect is the Arab cultural concept of *fazaa*, which involves helping those in need and is considered a virtue. This concept could be used by the media to tell people that the best way to perform one's *fazaa* duty is to be educated in CPR or the Heimlich manoeuvre, call the EMS hotline, follow dispatcher instructions, and answer their questions.

Despite the importance of EMS, plans for organisational and educational EMS development in the KSA are unclear. Positive examples of how research can help in planning and improving the EMS can be found in Alsalloum's [18] research, which developed a model for the SRCA to pinpoint the most appropriate locations for EMS stations and reduce mortality in Riyadh by improving response times [18]. Another plan to decrease mortality among trauma patients has been proposed by Al-Naami [19]. It calls for the establishment of a multidisciplinary trauma system with pre-hospital care as an essential component. Such proposals, however, have yet to come into effect such as the establishment of a pre-hospital registry or research agenda [19].

Other organisational issues facing EMS in the KSA and the SRCA is a lack of published data regarding key performance indicators, such as response time for pre-hospital cases. According to Al-Ghamdi [20], the average response time for ambulances was 10.23 minutes. In another observational cross-sectional study with 1,534 participants, 355 of whom had previous experience using SRCA services, 40.3% (*n* = 143) of the time, ambulances arrived after an hour [21]. In addition, only a third of participants knew the actual dispatch number for the SRCA [21]. These results suggest a substantial lack of public awareness of EMS in Saudi Arabia. The SRCA should therefore strive to provide better community outreach programs through universities other institutions to educate the public and support research in Saudi EMS to empirically analyse and empower the profession.

1.5. Statistics

In 2014, the SRCA responded to and transported 260,789 cases throughout the KSA [8]. When comparing this number to other countries in the same year, Ambulance Victoria in Australia responded to 840,188 emergency and non-emergency cases [22]. The population of Saudi Arabia in 2014 was 30,770,375 in contrast to the population of Australia in 2015, which was 23,860,100, and the population of Victoria was 5,596,670 [23,24]. Overall, Saudi Arabia has 5.49 times the population of Victoria but only responds to approximately one third as many calls. Moreover, a resident of Victoria is 17.71 times more likely to use EMS than a resident of Saudi Arabia (see Table 1.1).

Table 1.1: Saudi Ambulance Response Rate Compared to Other Countries and States

EMS Provider	Cases	Country / State Population	Per 1000 Persons a Year
SRCA	260,789	30,770,375	8.47
AV (State of Victoria)	840,188	5,596,670	150.12
Qatar	168,332	2,003,700	84.01
NHS	9,000,000	54,300,000	165.74

Source of data: [7,22-27]

In addition, Ambulance Victoria constitutes only part of the EMS providers in Australia. Another example of this disparity is the National Health Services (NHS) England Ambulance Services, which had 9,000,000 service calls in 2014 [25]. An example closer to Saudi Arabia is Qatar, where Hamad Medical Corporation reported 168,332 ambulance service calls in 2014 [7]. These figures give a strong indication that the EMS environment and variables are very different in the KSA than in other countries. As such, the unique nature of the entire EMS process in Saudi Arabia warrants developing a research-based approach specific to the country. This includes all aspects of EMS to understand and accommodate cultural, ethical, educational, and service-related variables.

1.6. Governance

The quality and development of an EMS system cannot be measured using a specific classification scale to assess if the country is underdeveloped. Therefore, it can be helpful to provide a comparison of certain aspects of the current situation between developed countries such as Australia, the United Kingdom (UK) and the United States of America (USA) compared to Saudi Arabia, as shown in Table 1.2.

Table 1.2: Overview of EMS Governance in Saudi Arabia Compared to Other Countries

Country	Registry and licensing	Primary pre-hospital care provider	Industry based governance	Professional health associations
Australia	Employer based (state based)	State providers	Council of Ambulance Authorities	Paramedics Australasia
Saudi Arabia	Saudi Commission for Health Specialities	Saudi Red Crescent Authority	Employer based	Saudi Association of Emergency Medical Services
United Kingdom	Health and care professions council	Regional trusts	The Joint Royal College of Ambulance Liaison Committee	College of Paramedics
United States	National Registry of Emergency Medical Technicians and state based	State providers	NHTSA and state based	National Association of Emergency Medical Technicians

Source of Data: [9,28-36]

In the KSA, governance of EMS practice is divided between various industry employers (e.g., the SRCA, MOH, military) and the private sector. These institutions do not have an overarching body that regulates the EMS profession [37]. In contrast, the Council of Ambulance Authorities (CAA) in Australia was established in 1962 and is made of EMS employing agencies [38]. The CAA plays a significant role in Australian paramedic education as it offers an accreditation process for paramedic university programs to guarantee that graduates have attained the necessary entry-level competencies for paramedic employment with an Australian ambulance service [38]. The CAA also provides input into the development of public policies regarding EMS and helps exchange information and research [34]. The Joint Royal College of Ambulance Liaison Committee (JRCALC) was established in 1989 in the UK to provide expert consultation to EMS providers and conduct clinical oversight [31]. Furthermore, the first practice guidelines for paramedics in the UK were published in 2000 by the JRCALC and emphasise paramedic discretion and clinical judgment over rigid protocols [31].

The second aspect of governance in Saudi Arabia is undertaken by the Saudi Commission for Health Specialities (SCFHS), which governs the practice of all health professions, including the clinical practice registration and licensing of healthcare workers, approving health courses and certificates, and the establishment of scientific associations for health [30]. In the US, the National Registry of Emergency Medical Technicians (NREMT) provides certifications for Paramedic, EMT Intermediate, EMT Basic, and First Responder level practitioners [35]. The NREMT is generally accepted by many states as a facilitator that provides competent standards through examination of EMS candidates [35].

It should be noted that health industry employers are required to follow the regulations, registration, licensing, and other requirements set by the SCFHS [30]. In the US, the title EMT-Paramedic was officially recognised as an Allied Health Occupation in 1975 [2]. The EMS speciality has also been recognised professionally by the SCFHS and are categorised within three tiers for university and college graduates: Specialist for a Bachelor degree, Senior Specialist for a Master, and Consultant Specialist for a PhD holder (see Table 1.3) with other specific requirements, such as experience and certain courses.

Table 1.3: SCFHS Specialist Tiers and Requirements

University Degree Held	Level of Recognition	Required Experience
Bachelor	Specialist	4 years of study 1 year of internship
Master	Senior Specialist	2 years of postgraduate speciality experience
PhD	Consultant Specialist	3 years of post-PhD speciality experience

Source of Data: [30]

The establishment of scientific associations for health specialities by the SCFHS led to the creation of the Saudi Association Society of Emergency Medicine (SASEM), which initially included all health specialities in emergency medicine, including doctors, nurses, and paramedics [29]. Although paramedics can vote in the SASEM, they cannot be nominated to the board of directors according to Element No. 19 of the SASEM bylaws and regulations [(29)]. The SASEM's main activities include establishing scientific committees, holding symposia and conferences, encouraging research, and promoting public knowledge and awareness.

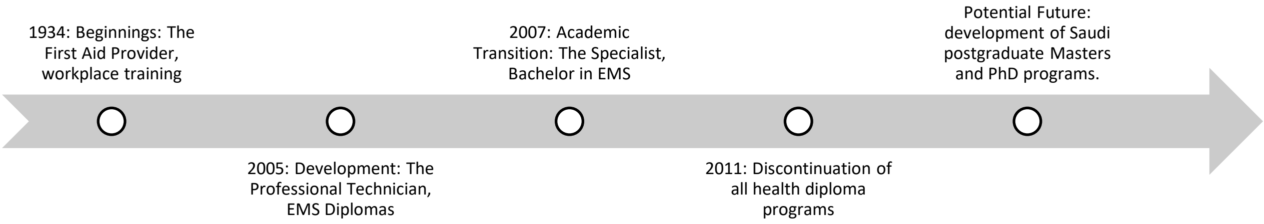
This was followed by the establishment of the Saudi Association of Emergency Medical Services (SAEMS), which has similar objectives but is oriented towards EMS [(30)]. Although these associations have no governance over the profession or practitioners, they may play a future role in developing the profession and workers in pre-hospital care [(30)]. Such a role can be compared to the British Paramedic Association, now called the College of Paramedics, the aim of which is to provide a professional voice for EMS clinicians in legislation, education, and the community [(32)]. These types of associations can also be compared with Paramedics Australasia (PA), a professional association representing pre-hospital practitioners in Australia that helps shape legislation, services, and clinical practice [(33)].

Governance of the EMS system in Saudi Arabia is developed in certain areas, such as the SCFHS, where registration and licensing of the profession is concerned. Yet the system also requires further development in other sectors, as there is a lack of advocacy for the profession by important groups, and there is no overarching body for industry employers to enforce competency standards in academic institutions. In addition, the industry could be improved through associations and authorities that represent the professional interests of EMS practitioners, similar to the UK College of Paramedics or the Australian PA [(39)].

1.7. Educational Transition

The evolution of Saudi EMS education can be divided into three broad stages: the emphasis of EMS practitioners being first aid providers through workplace training, 1934-2005; professional technicians with EMS diplomas, 2005-2012; and specialists with a Bachelor degree in EMS, 2007 to the present (see Figure 1.2).

Figure 1.2: Timeline of key stages in the educational transition of Saudi EMS.



Stage 1: 1934-2005: First Aid Provider with Workplace Training

The first stage of EMS education in Saudi was by far the longest when EMS education was somewhat restricted to certain courses, such as basic life support, first aid, and first responder training [9,12]. These programs were mostly limited to the training provided by the industry, based on the expectation at the time that ambulances would only provide basic first aid and transport to the nearest emergency department [9,12]. A parallel to this can be seen with the history of EMS in Australia, as healthcare professional training was originally industry-based, hospital-based, or through privately operated institutions. These professions were eventually recognised by the Australian Health Practitioners Regulation Agency (AHPRA), including Nursing, Osteopathy, and Chinese Medicine [38]. As such, educational requirements for paramedics in the past were minimal and limited to first aid training [38]. An example from the UK would be the 1966 Millar Report, which specified the post-employment training requirements for ambulance staff under the umbrella of the Institute of Health Care Development, which provided certification for graduates [31].

During this stage, the concept of a paramedic as a separate health profession did not exist in Saudi Arabia; this is made evident by the SRCA founding charter in 1966, which states in Section 2, Article 6 that the Saudi Red Crescent will strive to elevate the nursing profession and will work on training male and female nurses in hospital work and emergency situations [9]. This can be achieved by training courses and the creation of ambulance and nursing schools [9]. In the US, the start of an organised civilian EMS system was initiated in the

1960s; as the operations of the EMS system continued to develop, so did the educational sector [2]. In the early 1970s, physicians and registered nurses trained the majority of EMS educational courses. Very little of the instructor and student material was related to emergency pre-hospital patient care, there was no apparent outline of the pre-hospital scopes of practice, and there were no standards defining EMS practices [2].

Stage 2: 2005-2012: Professional Technician with an EMS Diploma

The second phase in the development of pre-hospital care in Saudi Arabia came with the creation of the first diploma programs in EMS. These programs started to develop in the early 21st century, with a focus on delivering professional, well-trained paramedics [40]. By taking the scope of paramedic education into a new model of Advanced Life Support (ALS) care, these programs had a significant impact on what it meant to be a pre-hospital care provider in the KSA. Ultimately, the level of professional accreditation was recognised as a technician by the SCFHS. With the introduction of the first Red Crescent operated ALS unit in Riyadh by 2005 [40], the stage was set for a new phase in pre-hospital education and provision of care in the KSA. A comparison can be drawn to the adoption of ALS clinicians for ambulance care in other countries, such as the 1969 ALS firefighter paramedic training adopted in six states in the US, the 1971 intensive care paramedics in Victoria, and the 1979 UK adoption of the Medical Commission on accident prevention recommendations for ALS-trained ambulance clinicians to provide pre-hospital care for trauma patients [31].

A process of national media and social dialogue criticised the results of this stage because a large number of health diploma graduates from all specialities faced unemployment [41]. According to the SCFHS, this issue, coupled with a recommendation by the World Health Organization (WHO) to expect a Bachelor degree as the minimum requirement for all healthcare professionals, led the SCFHS to halt all diplomas in the medical sciences in 2012 and make the Bachelor degree the new standard [41].

Stage 3: 2007 to the Present: Specialist with a Bachelor in EMS

The third phase of EMS education in the KSA was the development of a Bachelor degree. These programs were launched at King Saud University (KSU) and King Saud bin Abdulaziz University for Health Sciences (KSAU-HS) after 2007 [(42)]. According to Alanazi [(43)], the reasons for this degree at KSAU-HS were the lack of skilled Saudi paramedics, to establish a model for EMS education, and to support research in the field. One of the first such programs adopted the paramedic Bachelor program from Flinders University in South Australia due to its unique approach in developing a problem-based, student-centred and patient-based curriculum integrated into work practice [(43)].

Academic institutions providing higher-level EMS programs have helped promote EMS as a recognised discipline. These programs also increase the recognition of an EMS degree, expand management skills, and protect the resources devoted to education [(35)]. In general, the lack of research publications in EMS is international, since it is a developing area in medical and health education [(44)]. A potential solution would be to develop research capacity by establishing Saudi Master and PhD programs to empirically study EMS issues and develop plans to address them.

Bachelor degrees are offered by 10 universities in various regions of the KSA (see Table 1.4), some of which are offering programs at different campuses. In comparison, Australia has 17 universities offering paramedic Bachelor degrees [(45)], and the UK Health and Care Professions Council has 65 programs that offer the title of paramedic [(28)].

Table 1.4: Saudi Universities and Colleges with an EMS Bachelor Degree

Name of University/College	Type	Name of Program
Al-Ghad	Private	Emergency Medicine
Al-Marefa	Private	Emergency Medical Services
Dammam University	Public	Emergency Medical Care
Inaya	Private	Emergency Medical Services and Critical Care
Jazan University	Public	Emergency Medical Services
King Khaled University	Public	Emergency Medical Services
King Saud University Prince Sultan bin Abdulaziz College for Emergency Medical Services (PSCEMS)	Public	Emergency Medical Services
King Saud bin Abdulaziz University for Health Sciences (KSAU-HS)	Public	Emergency Medical Services
Prince Sultan Military College	Public	Emergency Medical Technology
Umm Al-Qura University	Public	Emergency Medical Services

Source of data: [42,46-55]

1.8. Disparity in Educational Approaches

With the rapid development of pre-hospital care from first aid employment training to Bachelor programs, universities have developed their own expectations and core competencies, which in the case of KSAU-HS, have been based on scientific research [43]. As a result, disparities have emerged between EMS programs. Furthermore, no official discernible competency standards have been adopted from other developed EMS countries, and there is little apparent development in Saudi competency standards, with the exception of the list developed by Alanazi [43], which has its own limitations, such as 50% of candidates being physicians and the other 50% having a US background. The ability to analyse the current disparity in approaches to competency is limited by the scarcity of research on these competencies in different programs.

Academic institutions offer a certification to graduates based on their adherence to the institution's competency standards [2]. The criteria by which each institution specifies its expectations and competencies for students have been defined by the CAA Paramedic Professional Competency Standard as "the combination of skills, knowledge, attitudes, values and abilities that underpin effective and/or superior performance in a profession/occupational area” (3 p16). The US Department of National Highway and Traffic Safety Administration (NHTSA) National Emergency Medical Services Education Standards defines competency as “Expected behavior or knowledge to be achieved within a defined area of practice” (2 p62). The method by which the EMS program competencies were identified in this study was based on these definitions. The study analysed the official website of each Saudi university or college with an EMS Bachelor program recognised by the MOE. The available competencies under the different headings of values and goals for students in the undergraduate program were extracted and have been included in Table 1.5.

Table 1.5: Saudi Universities and Colleges with EMS Bachelor Degree Competencies

Competency	**Al-Ghad**	**Al-Marefa**	**Dammam University**	**Inaya**	**Jazan University**	**King Khaled University**	**King Saud University**	**King Saud University for Health Sciences**	**Prince Sultan Military College**	**Umm Al-Qura University**
Safety	X					X		X	X	X
Assessment	X							X		
Decision-Making	X	X					X	X	X	X
Communication	X	X	X			X		X		
Understanding Standards	X			X			X			
Medical and Trauma Skills	X						X	X		
Patient Safety	X									
Advanced Cardiac Life Support	X									
Paediatric	X									
Disaster Preparedness	X						X	X		X
Ethics		X	X					X	X	
Leadership		X					X		X	
Teamwork		X	X	X		X				
Technology		X			X					
Research			X	X	X					
Islamic Values			X			X				X
Public/Community Health			X		X				X	
Evidence Based Practice						X		X		
Teaching								X		
Continuous Learning				X			X	X	X	
Physical/ emotional readiness									X	
Umrah/Hajj Preparedness										X
First Aid										X

Source of data: (42,47-54)

As can be seen in table 1.5, 23 competencies were found. The educational concept of competence is split into three classic domains associated with learning are cognitive, affective, and psychomotor, which are associated with knowledge and intellect, attitudes and values, and motor skills, respectively [56]. Some of these program competencies focus on attitudes, values, and intellectual skills, whilst others address the knowledge, practical, and psychomotor aspects of the profession. The only competency with a majority consensus was decision-making. In addition, two more core competencies (safety and communication) were each endorsed by five programs. Otherwise, the list shows a great disparity in the expectations for degree-seeking students. As a result, there is uncertainty about what a paramedic should be in Saudi Arabia. This inconsistency is likely to cause a mismatch between educational institutions and industry needs. For instance, paramedics from different institutions might communicate with and treat their patients in different ways or conduct poor patient handover with limited interdisciplinary knowledge. Medical oversight and paramedical guidelines have an inherently limited capacity to deal with the range of medical ambiguity and diverse pre-hospital contexts and circumstances [57]. Consequently, the degree to which paramedics adequately and safely deliver patient care is dependent on their making accurate decisions about the scene, patient condition, available equipment, safety concerns, and the other factors. Thus, providing the right competencies to students might improve patient care [57].

An example of how another country has dealt with the issue of standardising the core competencies taught by academic institutions is the CAA in Australia. The CAA used a UK model of competence as a foundation to build its own model and grants accreditation to academic institutions based their adherence to this model [3]. This approach can work for Saudi Arabia if it was based on empirical data and with certain adjustments to local cultural needs.

1.9. Research Problem and Objectives

As demonstrated in this chapter there is a lack of cohesion in the use and emphasis of EMS competencies at Saudi colleges and universities. As such, it may be prudent to develop core competency standards that reflect the needs of the Saudi EMS industry. Therefore, the objectives of this study were as follows:

- To describe the current status of Saudi EMS education and the disparity between the educational approaches of different institutions.
- To empirically develop a model of competence based on the needs and concerns of Saudi Arabia.
- To develop that model through a combination of international standards and local Saudi requirements.
- To include input from academic, clinical, and leadership stakeholder groups.
- To understand the perceptions of the different EMS professional groups in relation to paramedic competency.

1.10. Conclusion

The EMS field in Saudi Arabia has seen substantial advancements in many respects, including organisation and education. Nonetheless, there remain considerable challenges facing service providers, such as a lack of published material, current statistics, awareness of EMS services in the community, and the need to improve the education of pre-hospital practitioners. The continued development of EMS university programs is vital, yet there is a lack of cohesion between the expectations of graduates from different institutions. Therefore, empirical research is needed to study and present remedies for these challenges.

Chapter 2: EMS Core Competencies: A Scoping Review

2.1. Introduction

The previous chapter gave an overview of the evolution of emergency medical services (EMS) in Saudi Arabia, including the history, service providers, governance, statistics, and educational development of the field [58]. This chapter provides an international context for what have been deemed important and desirable paramedic core competencies.

The field of EMS in many countries has come a long way from post-employment (or vocational) training models, where the educational requirements for being a paramedic were minimal, such as first aid certificates [59]. The newer model for EMS education is a pre-employment model, where the initial learning process is undertaken at universities and employment offered after education is completed [60]. However, new EMS university graduates have been reported to hold less than desirable competencies, including a lack of maturity, empathy, clinical skills, and overall work readiness [61-63]. Below, an overview is given of competency in educational institutions from the history of the concept to its application and current issues.

The concept of competency has a long history dating back to the 1950s and the behavioural objective movement in the US [64]. The history of competency-based training (CBT) started in 1967 in the US, 1988 in the UK, and 1989 in Australia [65,66]. The aim of CBT was to improve the skills of the workforce and was initially focused on vocational education and training (VET) programs [65,66]. By 1993 70% of Australian professions had developed a statement of competence, referred to as competency standards in Australia [64,65]. In the US, with support from the Bill and Melinda Gates Foundation, research was conducted, vetted, and validated by the Association of American Colleges and Universities, American Council of Education, and four other educational organisations [67]. The research was aimed at successful competency-based educational programs and found they shared 10 design elements, described as pillars of competency-based education [67]:

1. Clear, cross-cutting and specialised competencies.
2. Coherent, competency-driven program and curriculum design.
3. Embedded process for continuous improvement.
4. Enable and align business processes and systems.
5. Engage faculty and external partners.
6. Flexible staffing roles and structures.
7. Learner centred.
8. Measurable and meaningful assessments.
9. New or adjusted financial models.
10. Proficient and prepared graduates.

Given the long history of CBT there is variation in terms used to describe competency, which can hinder the understanding of what constitutes a core competency. A guide for the development of competency standards for professions stated, “While there are obvious contextual differences between professions, there are significant differences between the contexts in which professionals work within a profession as well (e.g. Pharmacists work in hospitals, industry and the retail sector)” [68 p27]. This may explain the difference within the profession and its subsectors, such as the competencies expected from paramedics working in pre-hospital settings who respond to emergency calls with limited crew members, whilst a hospital-based paramedic is involved in inter-facility patient transfers, which usually comprises a multi-disciplinary team of health professionals. Heywood [68 p27] explained that “Some aspects of professional competence will be shared by all members of a profession (so-called ‘core competence’)”. Characteristics which represent competence in certain industry professions are considered “industry competence”, while specialists within an industry are regarded as having “occupational competence” (68).

When applied to EMS it can be understood that paramedics work in different industries, including the military, hospitals, ambulance providers, helicopter medics, industrial and petroleum sectors, and international fixed-wing patient transport services. However, paramedics should still share a set of core competencies that represent the values, personal attributes, and best practices that are desirable and important for the entire profession. This study looks at these competencies in the context of Saudi Bachelor degree programs.

It is not only important to identify the industry-based competency requirements, but also its association with practice. Therefore, the link between core competency and observable practice can best be explained by a model developed by Bowden (64) presented in Figure 2.1, in which the term “underlying capacity” was used to replace different competency terms. The aim was to develop a useful conceptual model for the complex relationship between underlying capacities and observable practice, which makes competent professional practice possible. The model defines competency in three levels:

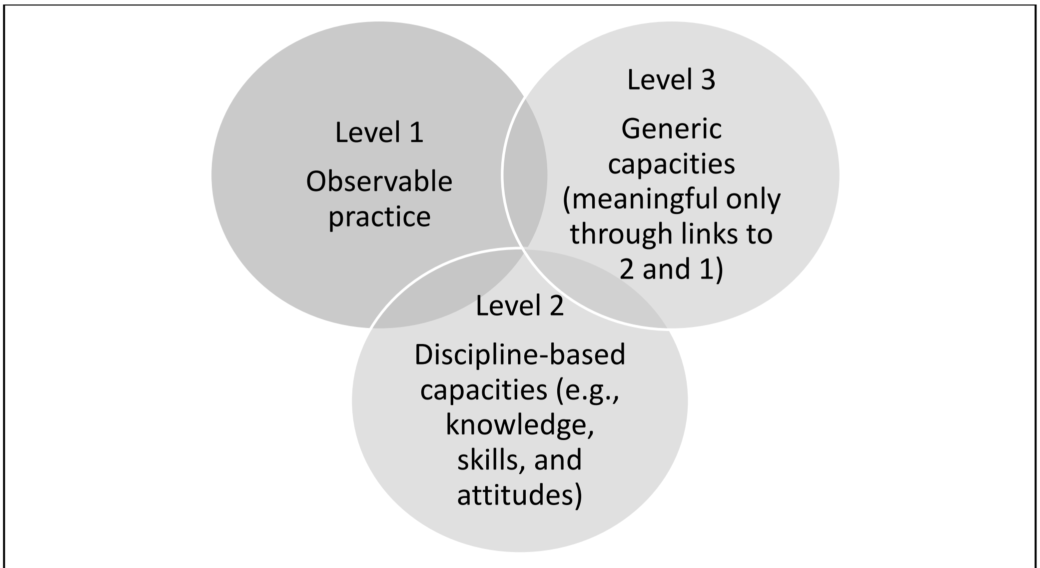
1. Observable practice: professionally this can be represented as an account of what people in the profession essentially perform or are expected to be able to do on an everyday basis which focuses on observable behaviour. This is typically identified by the main areas of occupational practice and the types of tasks and roles involved in each area of the profession. Observable practice can be assessed by observing whether specific tasks are being conducted up to an adequate level. Therefore, tasks are the object of this level of assessment (64).
2. Discipline-based capacities: the second level of attributes consists of the capacity to draw on what is regarded as the essential knowledgebase of the discipline; it includes

knowing the what, how, and when. Discipline-based capacities represent a deep conceptual comprehension of phenomena and principles. Moreover, the level includes a wide range of skills needed in the discipline, including psychomotor skills. This level can be developed through discipline-specific experience, continuing educational courses, formal education, and training. Essentially, the second level is the ability to conceptualise the underlying skills, attitudes, and discipline-based knowledge essential for competent professional practice (64). An example of assessing these capacities would be conducting interviews or knowledge tests to evaluate the patterns of thinking and conceptual understanding of candidates (64).

3. Generic capacities: the third level is linked with employability of graduates and consists of problem solving, communication, critical reasoning, planning, and organisation skills. Capacities in this level can be considered desirable outcomes independent of program or discipline. However, Bowden (64) found it doubtful that generic capacities would be transferable between disciplines. An example would be that a good problem solver might not be a good problem solver in any discipline or context. Generic capacities for the most part are highly context dependent. However, Bowden (64) maintains the usefulness of upholding generic capacities across different academic and training programs. Assessment approaches for this level include the ability of a candidate to draw upon, integrate, and apply knowledge and skills to deal with workplace simulations and real professional tasks. Therefore, these capacities are understood during interaction with real-world practice (64).

According to Bowden (64), the concern in the VET sector is that education is narrowly restricted to the first observable practice Level capacities and does not include the two underlying levels. Also, traditional university programs are believed to focus on the second and third discipline-based and generic capacity levels. The model is supposed to be completely effective only when all levels of competence are embraced. Therefore, the ideal outcome, according to Bowden [64], is for universities and other professional stakeholders to work together to develop higher-order capacities. This model was adopted because of its relation to the present study's aim of developing core competencies for Saudi Arabia. As the Saudi EMS profession has developed out of a VET like technical diploma and post-employment setting, the inclusion of all industry and academic stakeholders can contribute to a better integration of the observable practice and underlying capacities, as identified by Bowden [64].

Figure 2.1: The Underlying Capacity Model Adopted from Bowden [63]



Note: Levels 2 and 3 represent underlying capacities.

The EMS Bachelor program in the KSA was a major move towards better education and qualification by offering a greater breadth and depth of knowledge and skills [65]. Limitations, however, include new EMS graduates reportedly having a deficit in communication, maturity, teamwork, and emotional control [61,62,69]. Such deficiencies can provide an insight into the lack of direction in the expanding field of EMS, which is evolving and becoming part of a holistic healthcare model [70]. Empirically identifying the core competencies for the Saudi context can help in reforming the priorities and curricula of EMS educational programs.

A comprehensive list of core competencies should be based on a review of the current paramedic literature [71]. This approach determines what international and national EMS research regards as core competencies, similar to the international roundtable on community paramedicine's (IRCP) goal of creating and sharing an international curriculum, with each country or state adopting and optimising the curriculum based on the local system's requirements and being delivered in a multi-modal international standardised approach [72].

For the purposes of this review the WHO definition for core competencies was used. According to it, a core competency "Identifies units of competency that an industry (health, education etc.) has agreed are essential to be achieved by a person to provide quality services" [1 p6]. For EMS education in Saudi Arabia it is vital to develop a set of EMS core competencies tailored to meet basic globally agreed-upon standards that are important in the Saudi context. Bachelor programs can then be developed around these competencies.

A preliminary search for studies on the topic in Saudi Arabia was conducted using PubMed, Campbell Collaboration, and JBI Database of Systematic Reviews. One study by Alanazi [43] was identified and included in the research. Alanazi [43] used a modified Delphi method made up of two rounds with the study having two objectives. The first was the modification of the EMS Bachelor program from Flinders University in Australia to the needs of King Saud University for Health Sciences. The second was to provide a modern, student-centred EMS education program. The first Delphi round generated competency statements by 20 participants. The second round was used to rate the items on a 5-point Likert scale, where competencies above three points were included with no iteration (third round). Alanazi [43] stated there was a need to consider the local cultural norms, practices, and health priorities when adopting or localising foreign curricula. This conclusion supports the aim of the present study to develop core EMS competencies specific to the needs of Saudi Arabia. No other study was found in the preliminary search, indicating a gap in the literature.

The objective of this scoping review is to identify the EMS student core competencies in the literature to provide a starting point for the identification of core competencies for Saudi Bachelor degree programs. The WHO definitions of competent, competence, and attitude were used. Competent means “The successful demonstration of essential knowledge, skills, attitudes and professional behaviour on a specific task, action or function in the work setting” [1 p6]. Competence is “Sufficient knowledge, psychomotor, communication and decision-making skills and attitudes to enable the performance of actions and specific tasks to a defined level of proficiency” [1 p6]. Attitude is “A person’s views (values and beliefs) about a thing, process or person that often lead to positive or negative behaviour” [1 p6].

2.2. Methods

The UK Centre for Reviews and Dissemination at the University of York published an important paper in 2005 establishing a methodological framework for conducting scoping reviews [74]. The Arksey and O'Malley methodology suggests five stages for such a review:

1. Identification of the research question.
2. Identification of the relevant studies.
3. Study selection.
4. Charting of data within the studies.
5. Collating, summarising and reporting results of the scoping review.

An optional sixth stage involves consultation with experts to ensure comprehensive inclusion of all relevant material. This framework, including all six stages, was used as a template to guide the present review of desirable core competencies for paramedic students, as outlined in the following sections.

2.3. Identifying the Research Question

This scoping review was conducted to answer the following question: “What are the desirable core competencies of paramedic students?” The review employed a broad approach, based on the recommendations of Arksey and O'Malley [74], to produce a breadth of coverage while maintaining the review parameters.

2.4. Identify Relevant Studies

The scoping review considered journal articles and grey literature (peer-reviewed and non-peer reviewed). The following databases were utilised: CINAHL, MEDLINE, EMBASE, Scopus, and ERIC. Grey literature was searched through greylit.org, Google Scholar, Trove, expert consultation, and EMS professional associations. The key search terms were based on the research question and applied to the concept of Population, Concept, and Context (PCC) [75]. Population in this case meant Paramedic, Emergency Medical Services, and Emergency Medical Technician. Concept meant Competence and Attributes. Context meant Student. Based on the research question PCC, the resulting Boolean search string was Paramedic OR Emergency Medical Technician* OR Emergency Medical Service* AND Competence* OR Attribute* AND Student*. Taking into consideration that this scoping review is an integral component of a larger program to develop core competencies for EMS Bachelor degree graduates in Saudi Arabia. In addition to finding from the research literature, as an expansion to the grey literature element of the scoping review, core competencies from five professional associations of EMS guidelines were also incorporated. This was done to provide an expanded view of the international stage, so as to deliver better feedback on the desirable core competencies.

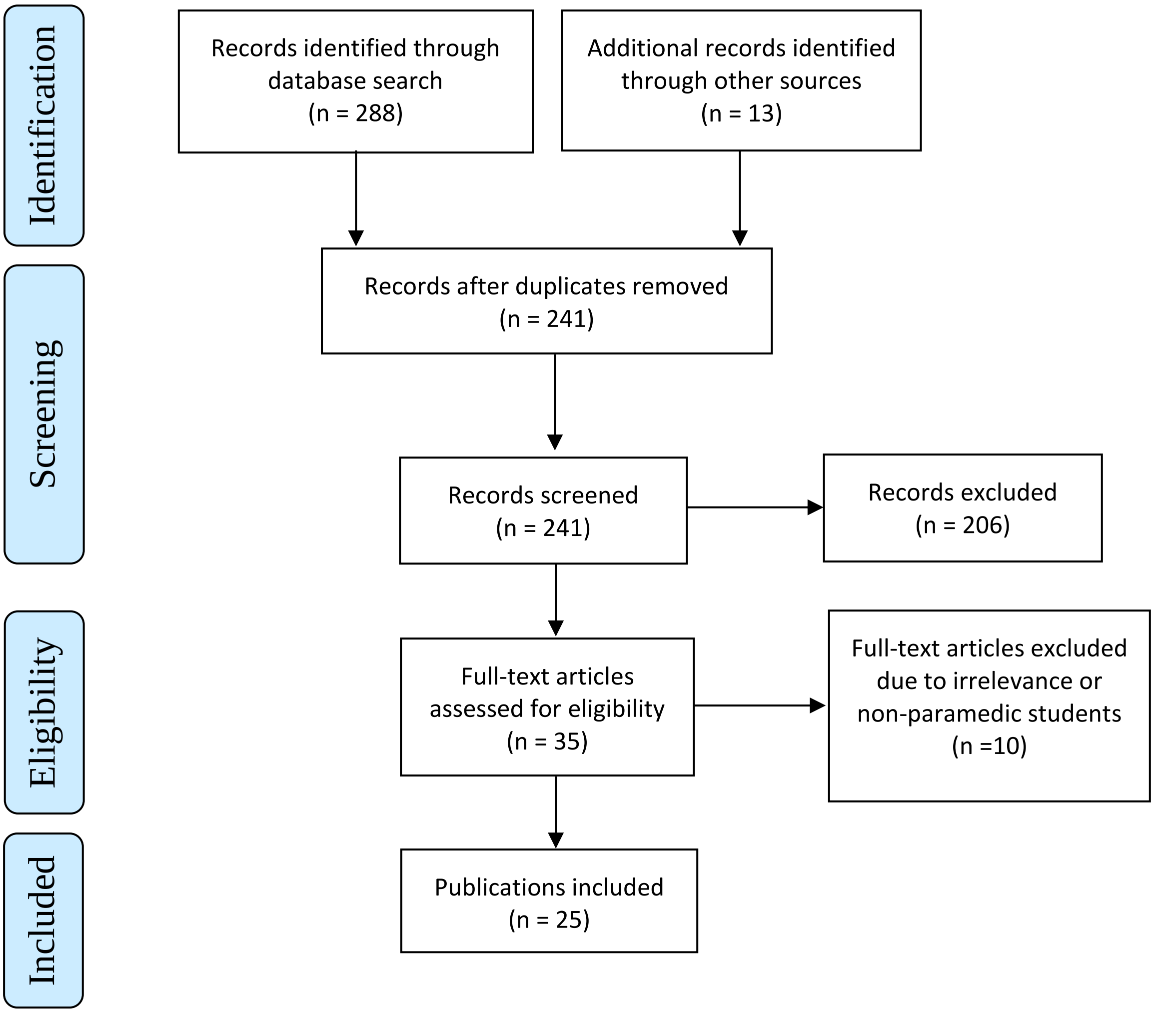
2.5. Study Selection

The first step in study selection was to search the titles and abstracts of the identified sources, which produced 301 publications (53 from CINAHL, 103 from MEDLINE, 84 from EMBASE, six from Scopus, 42 from ERIC, and 13 from other grey literature). After removing duplicates, 241 remained. Their abstracts and titles were reviewed by two reviewers (TA and BW), yielding 35 publications. Inclusion criteria were as follows:

1. Article involves EMS student core competencies.
2. Article is in English and/or Arabic and was published between 2000 and 2016.
3. Population consists of paramedic students.

Studies that did not address students or paramedics or did not provide a statement related to the core competency of paramedic students were excluded. The full-text publications were independently revised by two reviewers (TA and BW), who agreed on the inclusion of 23 publications for review, as shown in Figure 2.2. The reference lists of all included full-text studies were also searched for relevant articles. The search yielded another two publications, bringing the total number of included studies to 25.

Figure 2.2: Flow Diagram of Scoping Review Results



Source of flow diagram template: [76]

2.6. Charting the Data

These 25 publications were tabulated using six categories: author, year of publication, study location, study type, population and cohorts, and findings (see Tables 2.1 and 2.2). This approach of charting all data according to a common descriptive analytical framework with general study information is part of the narrative tradition recommended by Arksey and O'Malley [74]. Furthermore, all statements in these publications related to the core competencies of paramedic students were collected under the study findings section.

Table 2.1: Research-Based Journal Articles

Author	Year	Location	Study Type	Population and Cohorts	Findings: Core Competencies
Alanazi [43]	2012	Saudi Arabia	Modified Delphi	Participants (n = 20), paramedics (n = 10), emergency consultants (n = 10)	1. Safety 2. Communication 3. Critical thinking 4. Assessment 5. Scene management 6. Clinical skills 7. Professionalism 8. Team approach 9. Teaching skills 10. Research
Boyle [77]	2011	Australia	Cross-sectional survey	Paramedic students (n = 114)	1. Listening and communication
Ford [62]	2014	Australia	Qualitative	Paramedic students (n = 29)	1. Interpersonal relating 2. Maturity, respect, and tolerance 3. Self-awareness in the team environment 4. Belonging and professional identity
Hamilton [78]	2008	Australia	Review	N/A	1. Information literacy.
Johnston [79]	2014	Australia	Quantitative	Paramedic and nursing students (n = 200), academics (n = 6), paramedic tutors (n = 4), technical support staff (n = 5)	1. Interprofessional communication
Kilner [56]	2004	United Kingdom	Delphi	First round (n = 34), second round (n = 42)	1. Clinical skills 2. Professionalism 3. Personal qualities 4. Knowledgebase 5. Clinical decision-making 6. Mentoring and clinical supervision 7. Intellectual skills 8. Communication skills 9. Management 10. Learning and professional development 11. Assessment and history taking 12. Driving 13. Self-awareness 14. Educational background 15. Policy/guidelines 16. Manual handling/health and safety 17. Fit for role 18. Equipment 19. Evidence base/research 20. Knowledge of common emergencies 21. Professional Issues 22. Teaching/education skills 23. Course-based knowledge and skills 24. Range of experience 25. Mental health skills
Mantha [80]	2016	India	Quantitative, Pre- and post-training	Paramedic students (n = 40)	1. Leadership 2. Communication 3. Teamwork
O’Brien [59]	2013	Australia	Qualitative	Paramedic employers (n = 11)	1. Theoretical knowledge 2. Clinical skills 3. Critical thinking 4. Problem solving
O'Brien [81]	2013	Australia	Mixed methods	Paramedic students (n = 23)	1. Theoretical knowledge 2. Clinical skills 3. Practical skills 4. Interpersonal skills 5. Communication with colleagues and other professionals 6. Coping skills 7. Lifelong learning

					8. Ethics and legal responsibilities
Riesen [82]	2012	Canada	Mixed methods, Pre- and post-training	Participant students (n = 60), paramedics (n = 14), other (n = 46)	1. Interprofessional competence
Ross [83]	2014	Australia	Quantitative	Paramedic students (n = 56)	1. Interpersonal communication
Shields [84]	2012	United Kingdom	Review	N/A	1. Situation awareness 2. Decision-making 3. Communication 4. Teamwork 5. Leadership
Spencer [85]	2015	Australia	Review	N/A	1. Cultural diversity
Spencer [86]	2008	Australia	Review	N/A	1. Cultural competency
Tavares [87]	2016	Canada	Mixed Methods (Review and Qualitative Interview)	Participants (n = 20)	1. Clinician (effective clinical care) 2. Team member (team-based care in broad interprofessional settings) 3. Health and social advocate 4. Educator 5. Reflective practitioner (self-awareness, self-monitoring, and self-reflection) 6. Professional (behaving ethically with integrity and respect for the individual while avoiding further harm)
Twinley [88]	2012	United Kingdom	Quantitative	Participant students (n = 80), Paramedics (n = 28), Occupational therapy (n = 52)	1. Communication
Williams [89]	2013	United Kingdom	Qualitative	Paramedic students (n = 8)	1. Emotion work
Williams [90]	2010	Australia	Delphi Pilot	Paramedic experts (n = 63)	1. Personal characteristics 2. Clinical reasoning skills 3. Interpersonal and team skills 4. Professionalism 5. Continuing professional development 6. Social awareness 7. Flexible learning 8. Accountability 9. Evidence-based practice 10. Self-directed practice
Williams [91]	2011	Australia	Quantitative	Paramedic experts (n = 872)	1. Personal behaviour attitudes 2. Patient interaction and welfare 3. Scientific approach to patient care 4. Paramedic and society 5. Commitment to professional and healthcare outcomes 6. Professional behaviour 7. Interaction skills
Wloszczak-Szubzda [92]	2013	Poland	Mixed Methods	Participants (n = 105), paramedic (31), paramedic students (n = 74)	1. Communication

Table 2.2: EMS Professional Association Guidelines

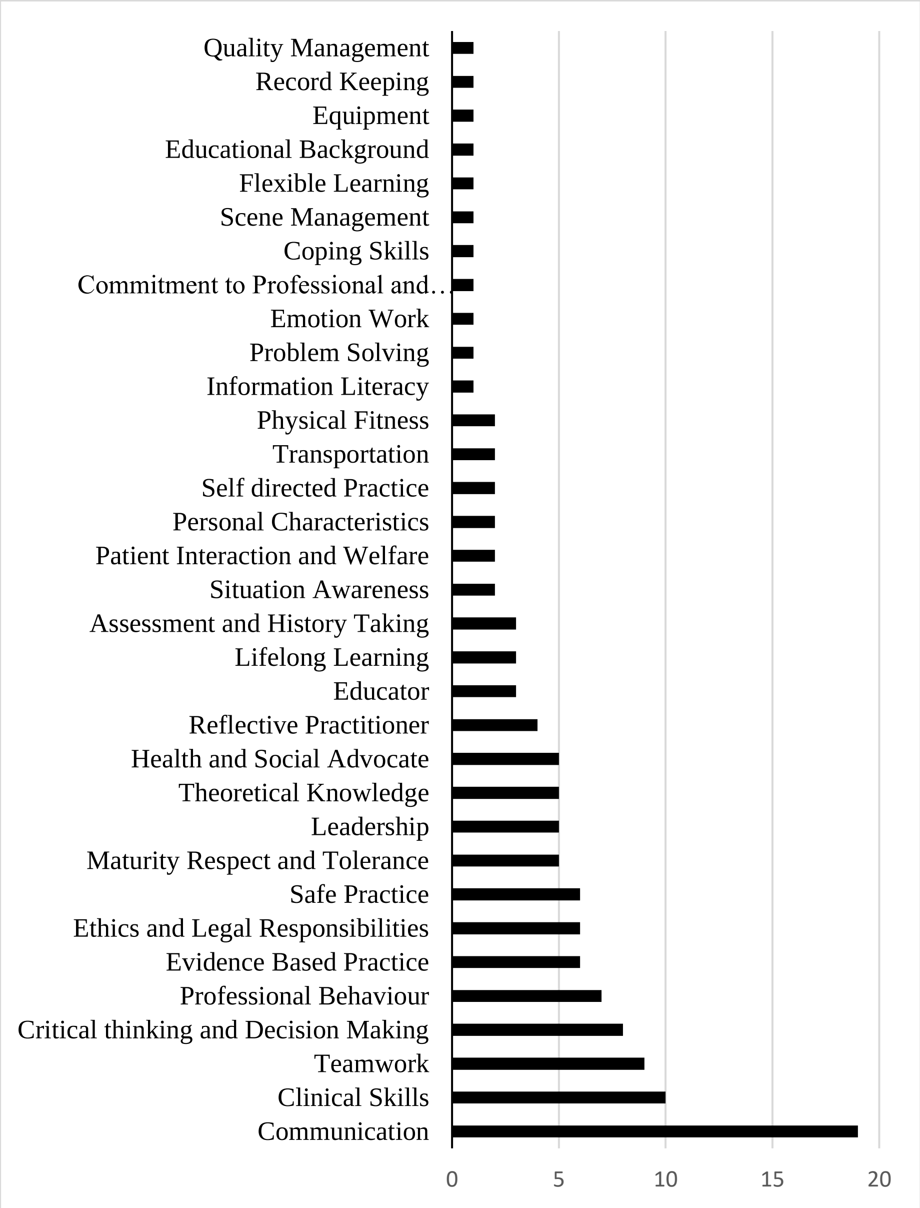
Association	Country	Year	Domains (Core Competencies)
Health and Care Professions Council [93]	United Kingdom	2014	1. Be able to practise safely and effectively within their scope of practice 2. Be able to practise within the legal and ethical boundaries of their profession 3. Be able to maintain fitness to practise 4. Be able to practise as an autonomous professional, exercising their own professional judgement 5. Be aware of the impact of culture, equality, and diversity on practice 6. Be able to practise in a non-discriminatory manner 7. Understand the importance of and be able to maintain confidentiality 8. Be able to communicate effectively 9. Be able to work appropriately with others 10. Be able to maintain records appropriately 11. Be able to reflect on and review practice 12. Be able to assure the quality of their practice 13. Understand the key concepts of the knowledgebase relevant to their profession 14. Be able to draw on appropriate knowledge and skills to inform practice 15. Understand the need to establish and maintain a safe practice environment
Health Professions Council of South Africa [94]	South Africa	2014	1. Healthcare practitioner (clinical skills and professional attributes) 2. Communicator (patient-carer relationship) 3. Collaborator (work effectively within a team) 4. Leader and manager 5. Health advocate (advance the health and well-being of individuals and communities) 6. Scholar (commitment to reflective learning as well as the creation, dissemination, application, and translation of knowledge)
Paramedic Association of Canada [95]	Canada	2011	1. Professional responsibilities 2. Communication 3. Health and safety 4. Assessment and diagnostics 5. Therapeutics 6. Integration (differential diagnosis skills, decision-making skills, and psychomotor skills) 7. Transportation 8. Health promotion and public safety
Paramedics Australasia [96]	Australia	2011	1. Professional autonomy and accountability 2. Professional relationships (communication) 3. Evidence-based practice 4. Identification and assessment of health and social care needs 5. Teamwork 6. Safe practice 7. Critical evaluation of paramedic practice 8. Theoretical knowledge
The Council of Ambulance Authorities [3]	Australia	2010	1. Acts in accordance with accepted standards of conduct and performance 2. Makes informed and reasonable decisions 3. Demonstrates professional autonomy and accountability 4. Develops and maintains professional relationships 5. Demonstrates the knowledge and understanding required for practice as a paramedic 6. Operates within a safe practice environment 7. Identifies and assesses health and social care needs in the context 8. Formulates and delivers clinical practice to meet health and social care needs within the context of the environment 9. Critically evaluates the impact of or response to the paramedic’s actions

2.7. Collating, Summarising, and Reporting Results

The studies included in the review were made up of five quantitative, three qualitative, four review, four mixed-methods, and four Delphi studies. The distribution of studies and EMS professional association guidelines according to country were as follows: Australia (13), UK

(5), Canada (3), India (1), Poland (1), Saudi Arabia (1), and South Africa (1). A total of n = 20 research-based journal articles were considered relevant to core competencies of paramedic students, yielding a total of 85 core competency statements. In addition, EMS professional association guidelines provided 42 core competency statements. Pooling these sets of statements together resulted in 127 statements, which were narrowed down to a final list of 33 core competencies (see Figure 2.4).

Figure 2.3: Frequency of Core Competencies in the Publications



The process of extracting and categorising the core competencies from journal articles was similar to a scoping review by Galipeau [97]. First, one reviewer (TA) studied all of the included publications and extracted core competency statements involving paramedic students, excluding non-paramedic students included in mixed-population studies. Second, the statements were collated to remove duplicate or overlapping statements. The resulting list was reviewed by the second reviewer (BW) to confirm the final list of 33 core competencies.

According to Levac [98], a scoping review should involve a thematic analysis of a topic, where the product is associated with the purpose of the review. This thematic approach found five prevalent core competencies:

1. Communication
2. Clinical skills
3. Teamwork
4. Critical thinking and decision-making
5. Professional behaviour

2.8. Expert Consultation

Two key expert authors in the field of EMS core competency were contacted for consultation on the current research and were provided with a full list of included articles. The contributions by Professor Björn-Ove Suserud included three articles that addressed ambulance nursing, though these did not meet the inclusion criteria. Dr. Walter Tavares was also contacted and provided two articles, one of which was included in the review, while the other had already been found through the initial search process.

2.9. Discussion

This review found 25 relevant publications involving seven countries and spanning a period of more than 14 years. Three were published from 2000 to 2009 and 17 between 2010 and

2016, roughly corresponding to the EMS professional association guidelines, which were dated from 2010 to 2014. This rising trend may indicate a move towards professionalism, competency standards, and general educational research within the EMS field. By systematically searching and extracting current international core competencies, this review can give EMS organisations and researchers a basic roadmap of what core competencies are needed among paramedic students. The five most prevalent themes of communication, clinical skills, teamwork, critical thinking and decision-making, and professional behaviour are discussed below.

2.10. Communication

Communication was by far the most researched core competency for paramedic students. Not only was communication featured in 19 out of 25 publications, but five articles were specifically focused on communication. Communication was mentioned in different forms and expressed through different constructs, such as interpersonal communication, professional communication, interprofessional communication, and communication skills, and was divided into hearing and communication styles. The importance of communication for the field of EMS has been stressed by numerous researchers (77,79,83,88,92), such as in the form of being effective listeners (77), being able to conduct interprofessional communication during patient handover (79) and having interpersonal skills in communication (83). Communication was suggested to provide high-quality care and to gain the respect and trust of patients (83). Even if paramedics are working under pressure with limited time, they should communicate appropriately with their patients and not convey an impression of being in a hurry or avoid communication (92).

A Polish study of paramedic professional communication competence by Wloszczak-Szubzda (92) analysed the standards of 20 Polish paramedic educational programs by comparing each institution's official website. Next, diagnostic surveys of professional communication and interpersonal communication skills were conducted. There were 105 participants surveyed divided into three sub-groups: 31 professional paramedics not trained in communication, 54 paramedic students of EMS educational programs, and 20 paramedic students who had attended professional communication courses. The study found that the first two groups had certain shortcomings, such as knowledge of communication, feedback, and patient acceptance for the first group and knowledge of assertiveness, empathy, active listening, and psychological self-defence for the second group. The third group, whose members had taken communication courses, were found to be the most competent. Wloszczak-Szubzda (92) argued paramedic educational programs in Poland suffered from a lack of curriculum content regarding communication specific to paramedic needs.

Hearing and communication were studied by Boyle (77), who reported that paramedic students listening style tended to focus on the feelings and concerns of other people. Additionally, students were friendly and attentive in their communication style, which has the potential for them to be less prone to hostility in conversation. Boyle (77) argued these styles were appropriate for paramedic students. In addition, people inclined toward these styles might be drawn to become paramedics, as the field of EMS is characterised by concern for others and interest in their well-being (77).

The issue of communication in general and interprofessional communication specifically was addressed by Johnston (79) through a week-long exercise involving 130 paramedic students and 70 nursing students. Students from both disciplines were involved in the handover and management of different scenarios involving trauma and different age groups (79). This approach was reported to have a positive effect and provided more confidence in clinical handover and communication. The importance of embedding communication as a core competency in EMS education has been stressed and recommended on numerous occasions

[88,92], although there is a need for more research standardisation of interdisciplinary handover communication procedures in EMS.

2.11. Clinical Skills

Clinical skills were featured in 10 publications. The definition of clinical skills differed between publications, but they were generally considered to be skills used to manage a range of common emergency conditions, such as defibrillation, drug administration, and airway management [56]. This core competency was generally considered essential for a paramedic student to excel [43,56,59,81,87]. Kilner [56] was the earliest study found by this review, which was published in 2004. Its aim was to identify the desirable paramedic attributes through the Delphi expert technique. The highest count for collected competency statements was for clinical skills. Moreover, clinical skills received a high mean score, comparable to other core competencies with similar or higher means, such as self-awareness, evidence-based practice, mentoring, and supervision [56].

Clinical skills were thought to be presented in curricula prominently, yet the other core competencies were not present [56]. This can be linked to the lack of underlying capacities model by Bowden [64], where Level 2 and 3 capacities are not featured in vocational training. In contrast, the new generation of university paramedic students are reported to have a limited capacity in clinical practice [81]. However, when students enter an internship to link theory with practice, this issue has been argued to improve [59,81]. In addition, the strength of university-educated paramedics is the flexibility of new graduates who are considered to have appropriate clinical skills, excellent theoretical knowledge, and employability competencies, which include problem solving and critical thinking [59]. Therefore, embedding clinical skills with other important core competencies in university programs can produce a well-rounded paramedic who can improve patient care.

2.12. Teamwork

Teamwork was featured in nine publications and was regarded as an important core competency for paramedics, especially in aspects associated with practice in an interdisciplinary team. Teamwork is associated with handing over patients to physicians and nurses in an emergency department or working with firefighters, police, and other paramedics on scene [62,79,84,87]. Mantha [80] developed the first non-technical skills training course in India to address crowd control and safety risks for patients and EMS professionals. The concerns reported were due to differences in culture, religion, language, and public awareness of the EMS profession, which led to resistance when dealing with paramedics on the scene [80]. The course was found to have an improvement ranging from 58% to 80% in non-technical skills of the 37 participants and stressed the inclusion of non-technical skills, including teamwork training in EMS curricula.

Ford [62] stressed the lack of relational competence of fresh EMS graduates when applied to their work roles. To address the issue, a simulated wilderness exercise was conducted with 29 senior paramedic students. The exercise was conducted for three days, and students kept field diaries and were invited to focus groups afterward. Results showed greater understanding about communication strategies and team cohesion, which could ease the transition of graduates into the workforce.

The literature has displayed a move to elevate the teamwork core competency through exercise simulations [62,79] or short courses [80]. There is a concern about the lack of research on the theoretical university curricula about teamwork. Simulated exercises and training courses are important [62,79,80] but can be viewed as a stop-gap measure of remedying the issue before or after graduation. In addition, these solutions are not part of university or college programs which should encourage pre-hospital EMS research on teamwork.

2.13. Critical Thinking and Decision-Making

Critical thinking and decision-making as a core competency were featured in eight publications [59]. One study interviewed 11 senior educational and operational EMS personnel who worked for ambulance services that employed Bachelor degree graduates in Australia [59]. These individuals stressed the importance of critical thinking as part of the everyday duties of paramedics, who routinely face cases they have not dealt with before.

Decision-making in clinical care is vital as evident during emergency calls where paramedics are expected to make many on-scene decisions, such as whether to provide patient care on route to hospital (scoop and run) or offer on-scene patient care (stay and play) [84]. This may be why in certain studies such as Kilner [56], the term is called "clinical decision making" and defined as the mental and cognitive skills associated with the ability to understand clinical data, apply clinical judgement and decision-making, and formulate a diagnosis.

The definition by Kilner [56] is specific to the clinical aspects of the EMS profession, whereas Shields [84] adopted a broader definition namely the ability to make judgments and act specific to any situation. Decision-making as a core competency can be understood through Bowden's [64] model, as Kilner [56] focused on the first level of observable practice, similar to the outlook of the vocational training sector. In contrast, Shields [84] adopted a broader approach influenced by other more established professions, while including the underlying levels of the Bowden [64] model which stresses the importance of the link between the different levels and not just the representation of one.

2.14. Professional Behaviour

Professional behaviour was featured in seven publications and encompasses various concepts [56,62,87]. Tavares [87] mentioned many aspects that may be associated with professional behaviour, such as empathy, compassion, ethics, morality, care, honesty, and a commitment to excellence. Honesty was the highest ranked attribute by all groups in Kilner [(56)] and was recommended as one of the qualities to consider when recruiting EMS professionals. In Ford's [(62)] study which involved a simulated wilderness exercise, the participants looked very kindly toward their professional teams. This was due to the benefits gained from a diverse set of skills from individuals in the group; the sense of belonging to the team, which contributed to the learning experience; and the satisfaction of being recognised for the contributions made to the team [(62)]. These positive effects offered a sense of pride from belonging to a professional group. In addition, professional identity was associated with personal accountability for practice and being responsible for the well-being of other colleagues in the profession [(62)]. Therefore, when taking all these concepts together, it appears professional behaviour is imperative for EMS students to perform appropriately within the profession as part of a team.

Finally, it can be observed from this review that many core competencies overlap, such as the importance of communication in teamwork. Moreover, when paramedics are on scene, these core competencies are simultaneously practiced, as demonstrated by a quote from one of the paramedic student participants in Ford [(62 p582)]:

> I think I learnt more about communication, team work and leadership than I did about my clinical skills. It became obvious… that leadership is very important and communication/team work is vital to good care. I felt that… you don't understand how important it is until you are in that situation.

2.15. Limitations

This review identified a large number of core competencies for paramedics. Therefore, the author amended the list to avoid overlapping and redundant items. This process may have removed some subtle nuances between the overlapping competencies. While considerable care was taken when amending the list, ultimately this process is open to criticism. In addition, any studies that were written in other languages such as French, German, or Swedish were not included which may have limited the number of studies and excluded information that could have been relevant.

2.16. Future Directions

This scoping review discovered a modest amount of research concerning EMS student core competencies, especially concerning Saudi Arabia as the country was limited to only one study. Thus, there is a need for more EMS core competency research in Saudi Arabia. As mentioned in the previous chapter, the approach to developing a core competencies model should adjust international standards to local Saudi requirements. This objective has been achieved with the extraction of 33 international core competency statements from the scoping review and seven core competency statements from the review of all Saudi universities and colleges. The next step would be to combine these core competencies and conduct a Delphi study. This process would ask a broad spectrum of EMS professionals in Saudi Arabia to rate the importance of each core competency in relation to the desirable core competencies of Bachelor degree EMS students in Saudi Arabia.

2.17. Conclusion

This appears to be the first scoping review to systematically identify the potential core competencies of paramedic students. As such, this review offers insight into the scope of knowledge, abilities, skills, and education important for paramedic students. In addition, the review is part of a greater project to develop a set of core competencies designed for EMS Bachelor degree programs in Saudi Arabia. This review and project will thus lay the evidence-based groundwork for the field of EMS competency in Saudi Arabia and other countries.

Chapter 3: Methodology

3.1. Introduction

The previous chapter systematically identified the publications associated with Emergency Medical Services (EMS) student core competencies [99]. The approach in developing the core competencies model was based on a combination of international standards and local Saudi requirements. The extracted core competencies were utilised in forming the next part of the study. This chapter addresses the methodology employed, including the research objective, design, instrument, pre-Delphi instrument validation, Delphi method, Delphi design, expert selection, sample size, data collection procedures, data analysis, and ethical considerations. The chapter discusses the national study conducted as a follow up to the Delphi study to validate and generalise the outcomes.

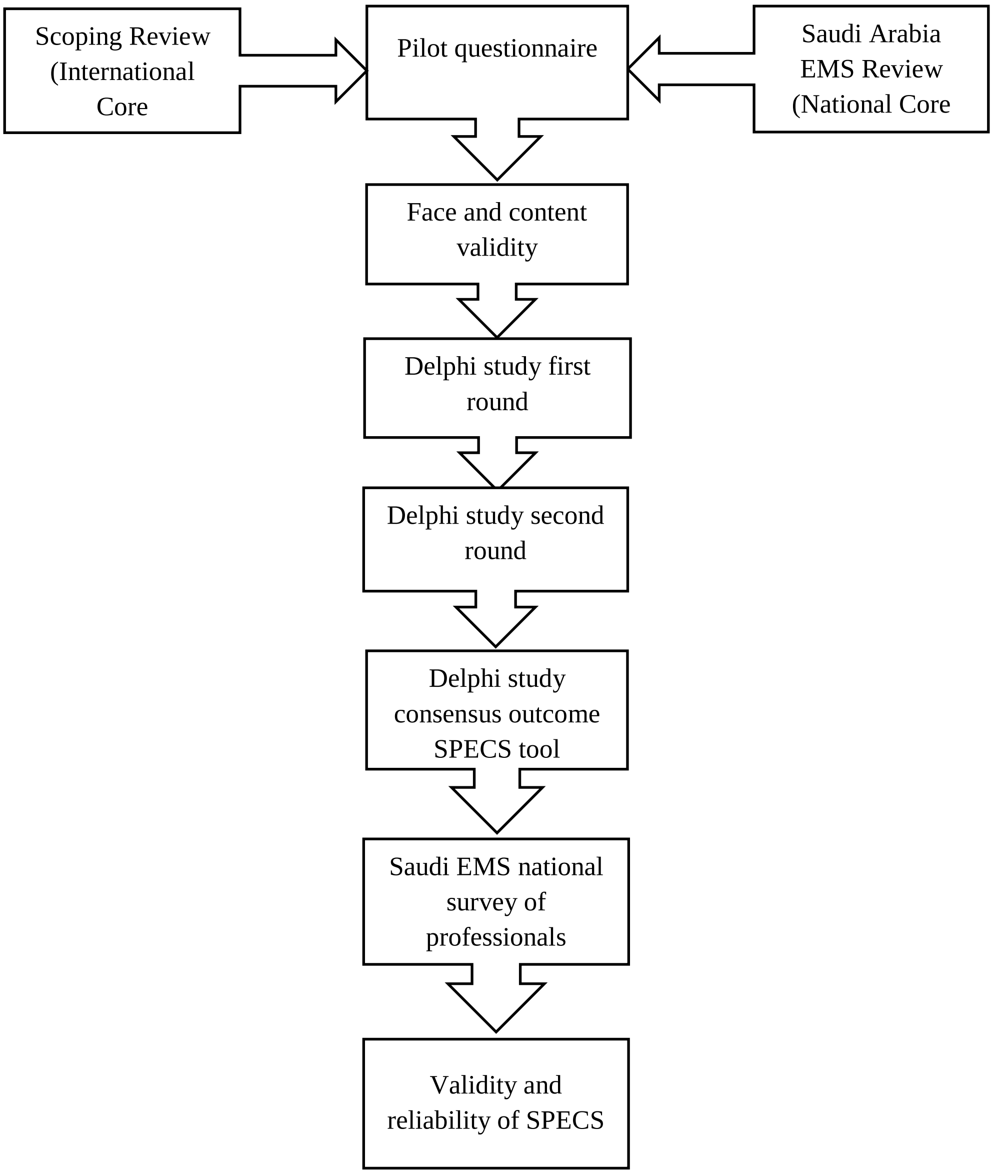
3.2. Research Objective

The objective of this study was to examine EMS Bachelor degree core competencies in Saudi Arabia by identifying the core competencies regarded as desirable qualities of a Saudi EMS graduate.

3.3. Research Design

The study is divided into two parts: the Delphi study and the follow-up national study of EMS professionals in the Saudi Red Crescent Authority (SRCA). The first part of this chapter will discuss the Delphi study which includes the method design, expert selection, sample size, instrument, setting and communication, data analysis and ethical considerations. The second part of the chapter will expand further by discussing the national study which was conducted as a follow up to the Delphi study, to validate and generalise the outcomes. The general plan for the study is shown in Figure 3.1.

Figure 3.1: Research design plan.



3.4. Group Techniques

According to Delbecq [(100)] the Delphi method is classified under the nominal group technique (NGT). These special purpose techniques are effective for when the judgement of individual experts must be acquired and aggregated, and such judgements are not expected to be elucidated by a single person [(100)]. Nevertheless, these processes which are divided between the NGT and the Delphi process are different in three major respects [(100)]:

1. Delphi respondents are typically anonymous to each other, whilst the NGT members meet and become familiar with each other.
2. Delphi respondents are geographically distant and never meet in person, whilst NGT members meet face to face.
3. Members of an NGT group have direct communication between them and the facilitator, whilst Delphi respondents are limited to written communication with the research facilitator or monitoring team.

When comparing the Delphi method to other methods involving face-to-face discussion, Dalkey [(101)] asserted discussions do not help the statistical aggregation used in the Delphi method. Moreover, Dalkey [(101)] hypothesised that group discussions usually lead to the degradation of group estimates for three main reasons: 1) the influence of dominant personalities, as there is limited correlation between rhetorical skill and actual knowledge; 2) semantic noise, where most communication may appear to address problem solving but has to do more with individual and group interests; and 3) group pressure to conform, which can distort individual expert judgment.

Campbell [(102)] found similar results suggesting the advantage of using the Delphi method over other face-to-face discussion methods. Furthermore, Van de Ven [(103)] found the NGT and Delphi method were both superior to a conventional interaction group method but concluded that participants were less satisfied with the Delphi data collection process. This disadvantage should thus be anticipated when performing Delphi-based research.

3.5. The Delphi Method

Project Delphi was the title of the first study performed using the Delphi method. This study was conducted in 1959 by Dalkey [(104)] at the RAND Corporation but was only made public 10 years after the experiment. The aim of the Delphi study was “to obtain the most reliable consensus of opinion of a group of experts. It attempts to achieve this by a series of intensive questionnaires interspersed with controlled opinion feedback" [104 p458]. The Delphi method is primarily a consensus-building method, which utilises questionnaires to obtain data on certain subjects [73,104-109]. The Delphi method is also a mature and adaptable research methodology that has been used in numerous arenas around the world [73]. The Delphi method is defined by four main features: anonymity, iteration, controlled feedback, and the statistical aggregation of group responses [109]. These four features are intertwined and can be understood as follows:

1. Anonymity is achieved by using a questionnaire giving each participant the ability to express their opinions privately without being influenced by other team members. The aim is for ideas to be judged based on merit rather than social pressure.
2. Iteration is the concept of giving participants the chance to change their opinions and judgments made in the previous round. This is done in combination with anonymity to maintain the dignity of each participant in relation to other group members.
3. Controlled feedback is the statistical data and information provided by all group members. This data is extracted from the Delphi round and then cycled back to the group anonymously. This type of feedback is usually in the form of simple statistics, such as median with interquartile ranges or mean with standard deviation.
4. Statistical aggregation of group responses provides the ability to perform statistical analyses and data interpretation while giving equal value to all participants.

In contrast to the aforementioned key features of the Delphi study, there are variations among researchers in the administration of the Delphi method, which are summarised in four key aspects [100]:

1. Whether open-ended or structured questions are used to obtain data from participants.
2. The level of participant anonymity.
3. The number of rounds (iterations) and feedback reports that are needed.

4. The decision rules that are utilised in aggregating participants' judgments.

Therefore, Delphi studies require a degree of quasi-anonymity, at least a single round or iteration, statistical feedback to participants between rounds, and a statistical aggregation of all responses. These guidelines were used in formulating the framework of this Delphi study.

3.6. Delphi Design

This study used the Delphi method through a quantitative survey of selected experts in the field of Saudi EMS in order to obtain group consensus on the desirable core competencies for EMS Bachelor degree graduates. According to Crutzen (110), when there is a scarcity of scientific knowledge on a topic, the Delphi method is particularly appropriate. Furthermore, meeting experts face to face in Saudi Arabia was impractical, since the country is vast, and the field of EMS is limited with no anticipated major conferences or scientific gatherings. Also, the anonymity of a Delphi study was conducive to a merit-based response by experts and limited potential for peer pressure (109). A Delphi study was also conducted to give experts a chance to amend their decisions between rounds. According to de Meyrick (111), this method is useful in health research, since knowledge is held by a group of recognised field experts.

3.7. Expert Selection

Purposeful sampling was used to obtain rich information from specific individuals. Since there are generally no detailed guidelines for choosing experts in the Delphi method, "It is a matter of judgment and discretion of a control group or a Delphi experimenter to select a person for a participant" (112 p27). However, there are three general criteria for participants to be eligible: they must hold a certain degree of experience in the field, they must be able to positively contribute to the study, and they must be willing to review their initial judgments with the aim of attaining a consensus (105,112). Finally, the expert selection method may be subjective and can limit the generalisability of the data.

The 20 expert participants in this Delphi study panel comprised two main groups. The first contained 10 academic department heads of each of the 10 EMS programs in Saudi Arabia. This group of experts was targeted for two main reasons. First, the leadership role they carried gave them a point of view that might not be available to other experts regarding academic practice, student concerns, research, scholarship, and the core competencies they believed would best serve the Saudi EMS system. Second, once these leaders are involved in the empirical development of Saudi core competencies, they will be able to analyse the benefits of the instrument as a potential standard for EMS curriculum development. The second group of 10 experts represented industry stakeholders from different hospital and EMS providers who were in clinical and administrative leadership positions and included one of the few female paramedic leaders in Saudi Arabia. The experts represented the different fields involved in Saudi EMS, including disaster management, emergency medicine, quality management, EMS training, accreditation, and medical and operational supervision.

3.8. Sample Size

According to Okoli (113 p19), "The Delphi group size does not depend on statistical power, but rather on group dynamics for arriving at consensus among experts. Thus, the literature recommends 10-18 experts on a Delphi panel". Therefore, 20 participants were invited with the expectation that not all 20 would accept the invitation to participate. This number also left room for participants to discontinue the Delphi rounds or not agree to participate later. As stated previously, one of the disadvantages of a Delphi study is the lower level of satisfaction from participants (103). This coupled with an intrinsic repetitive iteration process to the same expert group may lead to a significant drop in response rate following the first round.

Basically, a Delphi process is perceived to be less satisfying due to the lack of social face-to-face interaction [103]. Also, the Delphi study requires a continued commitment from participants through a strong research relationship and interest.

To mitigate dissatisfaction and increase participant involvement, each participant should be contacted in writing (by email), in person, or over the phone to clearly describe the objectives of the study, the nature of the participant panel, why they were chosen, the obligations of the participants, the length of time needed for the Delphi process, the iteration process, and the information that would be reported back to participants following the initial round [100,106,107,114]. Also, an online or email-based Delphi research project may consider the technology literacy of participants and their ability to conduct an online survey [106]. Finally, clear phone and written communication by the researcher is useful in a Delphi study, but the final response rate is ultimately in the hands of the participants [107].

3.9. Instrument

The international scoping review and review of Saudi Bachelor degree programs resulted in a Saudi-specific EMS instrument. The first part of the instrument is made up of seven demographic questions regarding gender, age, qualifications, experience, medical discipline, professional role, and nationality. The second part is made up of 40 core competency statements rated from 1 to 10, with 1 being “not important at all” and 10 being “extremely important”. Finally, an open-ended question was added: “If there is another Core Competency statement that you think is missing, please write it here”. The survey was amended following each round as this is generally considered an advantage of the Delphi technique due to the sequential nature of the questionnaire rounds, which permits modification of the instrument between each round [115]. These modifications are essential to the formatting of the instrument and to include additional items that have been suggested by experts in the previous round [115]. Furthermore, an important premise of a Delphi study is that experts are better equipped to respond to the questions if they are offered feedback on the responses of the other experts to the same questions [115].

3.10. Pre-Delphi Instrument Validation

Prior to developing the instrument through the Delphi process, face and content validity instrument validation were undertaken. Validity refers to the scientific utility of a measuring instrument and can be understood as how well an instrument measures what it purports to measure [116]. Validity is measured in terms of degree rather than being a binary measurement [116]. The instrument validation involved the nomination and invitation of eight Australia-based academics from varying health disciplines involved in EMS education and research. Although the instrument was in English, two native Arabic speakers fluent in English were also invited.

The study instruments with an accompanying envelope were left at the Department of Community Emergency Health and Paramedic Practice (DCEHPP) management office for distribution and collection. An email was sent on 9 March 2017 to each nominated participant requesting their involvement in the study. Clear instructions on what was required to conduct the face and content validity were provided, with the following four objectives:

1. Check if the spelling and grammar are correct.
2. Assess the layout, look, and structure of the survey.
3. Assess how much time it would take to fully conduct the survey.
4. Assess if the items on the survey make sense.

The instrument validation was concluded in a week by 16 March 2017. The responses included seven of the eight invited reviewers, including one native Arabic speaker. The instrument, including the explanatory statement, went through several alterations. The changes involved revising the grammar, structure, spelling, and wording in four core competency items (see appendix A). Also, the following statement was proposed: "Understand and avoid risks to their own health and safety whilst working", but it was disqualified as it was included under Item 23 ("Be able to maintain appropriate and effective safety procedures"). After amendments were taken into consideration, the instrument was prepared for the Delphi phase.

3.11. Setting and Communication

The surveys were sent and received using an online Qualtrics questionnaire via email [117]. Anonymity was important to the method to give experts the freedom to express their professional judgments on the topic. The survey was sent to every expert individually so that their identities would remain anonymous during data collection. The responses were received via Qualtrics, thus limiting the ability of the research team to recognise the identity of individual participant responses, adding another layer of anonymity [111]. Following the first round, responses were analysed and a feedback report was included with the second round. The feedback was limited to collective responses, not individual participant responses.

3.12. Data Collection Procedures

First Round

The 20 prospective participants were invited to the study through emails containing an anonymous Qualtrics link on 11 April 2017. The emails were personalised to address each participant's title and name. In addition, prospective participants were contacted via phone and email with a clear description of the study objectives, the nature of the participant panel, why they were chosen, their obligations, the time needed for the study, the iteration process, and information that would be reported back to participants following the initial round. The consent of prospective participants was implied following access to the Qualtrics email link and completion of the study. A follow-up reminder email was sent on 23 April 2017, and the first round of the study was concluded on 30 April 2017.

Feedback Report

The statistical feedback report was made up of seven categories: minimum, maximum, central tendency (mean), level of dispersion (standard deviation), variance, count (frequency), and the number and percentage of responses to each of the items. The demographic information was omitted from the report, which was also limited to collective responses so as not to expose the anonymity of participants during the collection process. The comments were also removed from the report and were only presented as part of the core competency items.

The adopted consensus level was 75%, as recommended by Keeney [118], and this was decided a priori. Since Saudi EMS education lacks cohesion in the standardisation of core competencies it was expected that all items would be thought of as important for the Saudi EMS education system and rated highly. All core competency statements reached consensus above 75% but were all included in the second Delphi round to give participants a chance to change their opinion based on the feedback report and personal judgment. Moreover, since there was only one new generated statement and one amendment, the best approach was to carry all statements through the entire Delphi process [106].

Second Round

The feedback report from the first round was emailed on 2 May 2017 to participants with an invitation to conduct the second round. A follow-up email was sent on 7 May 2017, and the second round of the Delphi study was concluded on 14 May 2017.

Delphi Study Consensus

The Delphi consensus method varies from study to study statistically and in terminology. Some include post hoc figures, while others assign specific ranges that vary from 51-80% or use other techniques (105,106,108,109, 118-122). For this study, a systematic procedure for Delphi termination was adopted from Dajani (120). The basic definitions of the procedure are as follows:

- Consensus: complete and unanimous agreement between participants.
- Majority: more than 50% agreement between participants.
- Bipolarity: when there is an equal divide between participants.
- Plurality: the agreement of the largest subgroup of participants.
- Disagreement: when each participant has differing views from all other participants.

Another approach at testing consensus and stability was proposed by Scheibe (121). Its basic aim is achieving a state of equilibrium between each iteration by having a marginal change of less than 15% for each Delphi item.

3.13. National Study

The Delphi methodology has been practised for more than 50 years (104). During this time, criticisms have included the limited ability to generalise the results given the typically small sample size (73,123). Geographic representation is another possible limitation (124). When there is a specific small profile for the sample of experts, the results could be influenced by participant agendas or limited points of view (125). This can be seen in the study by Niederman (126), where executive participants were concerned about the big picture rather than the micro process of problem resolution. Most researchers recommend further studies to refine and validate the Delphi findings (73,106,125,127-132). Therefore, further inquiry of Delphi results is both practically and theoretically important and can considerably improve the quality of the instrument [132].

After conducting the Delphi study, a follow-up national quantitative cross-sectional survey of SRCA healthcare workers was conducted. This population was chosen because feedback from professionals working in EMS clinical, academic, and administrative positions is central to build an understanding of the most desirable core competencies for Saudi EMS graduates.

3.14. Study Design

Survey research designs provide a plan for a quantitative explanation of attitudes, opinions, or trends of a population by researching a sample of the population [71]. This observational cross-sectional quantitative survey collected data at a single point in time [133]. The study used a non-probability sampling technique. Unlike probability sampling, nonprobability sampling does not rely on randomisation in selecting the sample. Rather, certain subjective methods are used to decide the elements involved in the sample. For example, Etikan [134 p1] defines non-probability sampling as "a sampling technique where the samples are gathered in a process that does not give all the participants or units in the population equal chances of being included". Furthermore, unlike the Delphi study where purposive sampling was used the second study utilised a convenience sample due to the following advantages [134]:

1. Flexibility with easier accessibility.
2. Geographical proximity of the data collection points.
3. Availability of the participants at a given time.
4. Targeted population density sites.
5. Relatively inexpensive.
6. The ability to acquire the inclusion criteria for the participants.

3.15. Population Selection

A purposive sampling technique was used with a population containing all healthcare professionals working for the SRCA. The inclusion criteria were as follows:

1. The capacity to read and write in English.
2. A minimum age of 18.
3. A minimum qualification of a healthcare certificate.
4. Currently working for the SRCA as a healthcare provider in any capacity, including management, training, or clinical practice.

3.16. Sample Population

Opinions among researchers vary regarding the sample size required for factor analysis (135). There are generally two accepted rules of thumb when deciding the adequacy of the sample size. The first is the Comrey (136) guideline: 50 is very poor, 100 is poor, 200 is fair, 300 is good, 500 is very good, and 1000 or more is excellent. The second rule of thumb by Pett (135) suggests recruiting 10-15 participants for each item in the study instrument. However, the general preference is to have a sample size of very good to excellent, in accordance with Comrey (135). Overall, having a sufficient sample size increases the suitability of factor analysis (137), as the larger the sample, the higher the reliability and stability of the obtainable correlations are likely to be (136). The sample population sought after was large to achieve a reliable factor analysis. In addition, a representative sample was taken into consideration by electronically disseminating the study to all 13 regions of Saudi Arabia.

3.17. Setting and Communication

The SRCA is the Saudi pre-hospital care provider for the entire country with previously mentioned exceptions. Therefore, the pre-hospital care system is centralised including EMS health policies, policy development, and other organisational governance in the SRCA (58).

However, the number of medical staff members, type of healthcare providers, and types of crews utilised are different in each SRCA station, which vary in location from rural areas to metropolitan areas and industrial zones.

3.18. Data Collection Procedures

Prior to data collection, a meeting was held on 9 July 2017 with the head of the SRCA department of research to agree upon and facilitate the data collection procedures. An email script was sent to the department head, with an explanatory statement and Qualtrics link to the study. The survey was sent on 10 July 2017 to all SRCA email accounts with the title "EMS Research Participants Invitation", requesting the voluntary participation of all healthcare providers in the SRCA. The email included the title, explanatory statement, expected time required, and an assurance of anonymity. A reminder email was sent after a week and another after two weeks. The study was concluded within a month. Although electronic data collection has a major advantage of flexibility and speed, there is a disadvantage of low response rates (138). Therefore, paper-based data collection was planned concurrently with the electronic form. In total, data were collected from 42 SRCA EMS stations in the Central and Eastern regions of Saudi Arabia, which represent two of the most populous regions of the country.

3.19. Ethical Considerations (Data Management, Confidentiality)

There were no expected risks to participating in this research. The questions were not intended to make participants uncomfortable, as all participation was voluntary. The survey took approximately 10-15 minutes to complete, was anonymous, and participants were not asked to give any personal information that could identify them. Final approval from the Saudi government official provider of EMS care, the SRCA, was granted with approval number 81211 on 15 April 2017. The approval of the Monash University Human Research Ethics Committee was granted with project number 8072 on 28 February 2017.

There was no consent form as consent was implied when the paper survey was filled out or when the Qualtrics email link was opened and the survey completed electronically. The paper-based survey was distributed to EMS stations. The participants were asked to return the completed questionnaire in an envelope provided with the survey. The researcher visited the EMS stations on a regular basis to collect the surveys and to be available to respond to any questions in relation to the study.

The primary contact was performed between the researcher and station managers. For example, the data collection in the Eastern region was performed through a coordinator, who provided the contact details of the local EMS station managers. The managers were then contacted to explain the research purpose, schedule a visit, and determine station location, as they are mostly unidentified on digital maps. The researcher visited the station manager and presented a letter of facilitation specific to the data collection in the Eastern region. The researcher explained the purpose, procedures, and ethical aspects of the study and answered all queries. A box with a brief explanation of the study in Arabic was left at the station manager's office or a centralised location to offer access to day and night shift workers. The stations were visited again to collect the data from the station manager.

Only the researchers will have access to the study information. Also, no incentives were offered to participants. All electronic data were password protected. All paper-based surveys will be securely stored for five years in a locked filing cabinet at the Monash University Department of Community Emergency Health and Paramedic Practice. Following that period, the paper forms will be shredded, and electronic versions will be permanently deleted.

The research process started with a meeting held on 9 July 2017 with the SRCA department of research, where the electronic and paper procedures were agreed upon. A letter to facilitate the paper data collection in the Central region was given to the researcher, number 143297, which was signed and dated 15-10-1438 Hijra, equivalent to 9 July 2017. A similar letter was issued for the Eastern region with the number 143306 and the same date.

3.20. Data Analysis

Data should be analysed with care and consideration by people who have an inherent knowledge of the nature of the data and their interpretation [139]. The initial step in data analysis is data management and entry. Therefore, prior to data collection, an SPSS codebook was developed. This included clear instructions for converting the data into a format compatible with SPSS [140]. The codebook was reviewed by the author and main supervisor prior to data collection. As the Qualtrics email survey was concluded before the paper survey, the electronic data were exported from Qualtrics into Excel first. After receiving the completed paper surveys, participant responses were coded. The raw data were entered into the Excel spreadsheet. Visual checking was used to verify data entered as a time-efficient and adequate approach [141,142]. This involved the author entering the data into the spreadsheet and visually comparing the data entered to the original paper form [143]. The data were then analysed using SPSS (Version 23). The data were randomly divided in half through SPSS, and each half was used to conduct a separate factor analysis.

3.21. Factor Analysis

Factor analysis is one of the many branches of multivariate statistics and often mistakenly recognised as a psychological theory. This belief has come about due to its development and widespread use in psychology [144]. The origin of factor analysis is attributed to the 1904 seminal work by Spearman [145] in response to the need to explain the psychological theories of human behaviour and ability via a statistical model.

According to Hair [146 p90], factor analysis is “a generic name given to a class of multivariate statistical methods whose primary purpose is to define the underlying structure in a data matrix”. Factor analysis is not used to test different groups against each other, as in ANOVA or *t*-tests, and is not a single statistical test either. The term factor analysis represents a set of different procedures utilising complex structure analyses to detect the interrelations between numerous observed variables; this is accomplished by reducing the data into a smaller number of variables clustered into factors with common attributes [116,135]. When there is a need to understand the underlying structure, factor analysis is the method of choice [147]. Factor analysis is closely related to validation, as the factorial configuration of measures is partly involved in the three aspects of validity [116]:

1. Predictive validity: factor analysis can suggest predictors that will work well in their intended practice.
2. Content validity: factor analysis can provide appropriate suggestions on how to revise an instrument.
3. Construct validity: factor analysis can provide some tools required to define cross structures and internal structures for sets of variables.

The definitive value of a scale or other measures is explained by the relationship to other variables. The ultimate utility in all categories of factor analysis is to determine the relation structure among measures and can also include the following uses [116]:

1. To determine where each variable belongs to which group and the strength of the relationship.
2. To determine the number of dimensions required to explain the relationship between variables.

3. To determine the clustering or grouping of variables.
4. To determine a frame of reference in coordinate axes to explain the relationship between variables with more convenience.
5. To determine the scores of individuals in the groupings.

3.22. Exploratory Factor Analysis

Factor analysis is divided into exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). The aim of EFA is to develop a theoretical understanding of a structure from a set of variables or as a data reduction process. In this regard, there are no prior expectations or constraints on the number of extracted components and the estimation of components. The basic analytical technique is that whatever the data produces is accepted (146). The EFA is mostly used in the early stages of research to consolidate variables and generate a hypothesis regarding the underlying processes (147). The simplified five-step EFA protocol by Williams (137) was followed as a general linear pathway in conducting the analysis for the SPECS instrument (see Figure 3.3, adopted from Williams (137)).

Figure 3.2: Simplified Five-Step EFA Protocol

Step 1: Is the data suitable for factor analysis?

↓

Step 2: How will the factors be extracted?

↓

Step 3: What criteria will assist in determining factor extraction?

↓

Step 4: Selection of the rotational method

↓

Step 5: Interpretation

Regarding Step 1, the two main issues in the suitability of the data for factor analysis are the sample size and the power of the relationship between the different variables or items. The sampling numbers and ratios have been previously presented. But when considering the factorability of the correlation matrix, MacCallum [(148)] proposed the following formulas:

- A minimum sample of 100-200 participants with well-determined factors that are loading their variables at more than .80 and communalities in the range of .5.
- A minimum sample of 300 with a small number of factors, low communalities, and three or four items for each factor.
- A sample size of 500 is required in the worst-case scenario when there is a considerably large number of weakly determined factors and low communality.
- Finally, if no correlation supersedes the .30 mark, the use of factor analysis is not advised as there is nothing to factor analyse [(146,147)].

To assess the factorability of the data, two statistical measures were used: the Bartlett test of sphericity and the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy. The Bartlett test of sphericity is used to statistically test for the existence of correlations between the different variables by providing a statistical probability that there are significant correlations in the correlation matrix [(146)]. In this test, a significance level of $p < 0.05$ is considered suitable for factor analysis [(140)]. The dataset in the EFA analysis scored a significance of $p \leq 0.000$ and was therefore suitable for factor analysis. The KMO was also used to measure the strength of intercorrelations between variables and the suitability of factor analysis. The KMO index ranges from 0 to 1, with 1 indicating every variable is perfectly projected by the other measured variables with no error [(146)]. A KMO score of [(149)]:

- .90 and above is considered marvellous.
- .80 and above is meritorious.
- .70 and above is middling.
- .60 and above is mediocre.
- .50 and above is miserable.

- below .50 is unacceptable.

Generally, a value of .6 and above is essential for a good factor analysis [147].

Regarding Step 2, there are several factor analysis extraction techniques, including principal components analysis, principal axis factoring, maximum likelihood, unweighted least squares, generalised least squares, alpha factoring, and image factoring [137]. In EFA, the main extraction techniques are principal components analysis and common factor analysis [150]. The key difference between these two approaches is the assumed communalities in the tested variables. The communality found in a variable is defined as the variance that different variables share with the underlying latent variable found in a scale or instrument [150]. Principal components analysis measures all the variance in the data, while common factor analysis only measures the common variance that is shared between variables and does not include the unique variable variance in the procedure [151].

The preferred method of extraction recommended by Meyers [151] is principal components analysis. However, a different method for data extraction, namely alpha factoring, is grounded on the psychometric concept of generalisability [152]. When alpha factoring was compared with maximum likelihood in amount of scaling and computational contrasts, alpha factoring was found to be more appropriate for psychometric testing and is a more sensible measure of the number of factors in a model [153]. Moreover, alpha factoring regards the variables in the data analysis as a sample from the universe of possible variables, thus maximising the alpha reliability of each extracted factor [154].

Regarding Step 3, determining the number of factors to retain in EFA relies on several techniques until a satisfactory solution is found. The first technique goes by different names, including the Kaiser-Guttman rule [116], the Latent Root Criterion [146], and the Kaiser criterion [137]. The Kaiser criterion is the most widely used rule for factor retention [116,140].

The rule retains all factors with an eigenvalue of 1.0 or above [116]. Although the Kaiser criterion was criticised by Nunnally [116] for retaining too many factors, Hair [146] recommended it for its reliability when the number of variables is 20-50, as having less than 20 variables leads to an abnormally low factor count and more than 50 leads to an excessive number of factors. Furthermore, the number of variables in the study was 41 and therefore fit within the recommended reliability for the Kaiser criterion [146].

The scree test for number of factors, developed by Cattell [155] involves the plotting of each factor based on the eigenvalues. The plot would then be inspected for an elbow shape or horizontal levelling; any factors above the elbow are retained and values below are discarded. The scree test was criticised by Nunnally [116] and Tabachnick [147] for being too subjective and is only recommended in conjunction with other factor retention criteria. The cumulative percentage of variance criterion is another approach which recommends factor retention based on a specific cumulative percentage of variance. However, the percentage can vary widely from 60% to 95% based on the field of study [146]. Therefore, this approach alone is regarded as unsuitable to determine the number of factors [116].

The parallel analysis proposed by Horn [156] is a less commonly utilised method, which may be due to it being unavailable in SPSS [137]. Parallel analysis is considered to be generally accurate but usually generates fewer factors than the Kaiser criterion or scree plot [140]. The method suggests factoring a random set of generated data with the same number of variables and subjects as the original dataset. The sizes of eigenvalues for each factor are compared, and only the factors with a higher eigenvalue than the random results are retained [116]. Finally, any result from the combined factor retention techniques should be based on theoretical sense [116].

Regarding Step 4, factor rotation simplifies the structure of factors, as unrotated factors may be meaningless [146]. The aim of factor rotation is to restructure the variance from earlier factors to later ones in order to achieve a simpler, more meaningful theoretical factor pattern [146]. Since orthogonal (uncorrelated) is the method of choice in achieving simplicity [147], the orthogonal varimax rotation is the most popular default method among researchers [151,157-159]. The varimax method has also been considered a very successful analytic approach [146] and the definitive orthogonal solution for factor rotation [116]. However, this method has been argued as seldom providing satisfactory results when constructing an ideal solution [159]. Although an orthogonal rotation may generate an easy, simple solution, the underlying assumption is that the subscales of interest and dimensions are uncorrelated with each other, which is seldom found in health research [135].

Oblique rotation, on the other hand, diminishes the constraint of orthogonality, increasing the simplicity of data interpretation [158]. Moreover, as grouped variables in EFA are generally not independent on each other, unlike orthogonal rotation, the oblique rotation method allows factors to be situated closer to grouped variables [116]. As an end result, oblique factors provide salient variables better than orthogonal factors [116].

The promax method is regarded as the fastest and simplest method to conceptualise in oblique rotation [154,158]. In addition, when promax and varimax rotations were compared, varimax was found to fail in certain analytical datasets, while promax could solve similar datasets and other common real-world dataset problems [157]. When referring to the debate regarding the value of using the orthogonal versus oblique rotation methods, Nunnally [116 p501] stated that "Orthogonal rotations offer the advantage of simplicity at the expense of poorer factor definition; oblique rotations offer the converse". Therefore, the oblique promax rotation method was utilised for the EFA in this study.

Unlike the orthogonal rotation method, oblique rotation assumes that some correlation is present between at least two rotated factors (116,135). Therefore, since the factors are not independent of each other, the angle or rotation is not fixed between the axes at 90 degrees and each factor is rotated independently at differing degrees (116,135). A regression-like beta weight is utilised to identify the contribution of each rotated factor to the explained variance for a given item; in an orthogonal solution, this is equal to the simple correlations between the factors and the items (135,160). However, in an oblique rotation, the regression-like beta weights are not equal to the simple correlations, since there is a correlation between the resulting factors (135). Therefore, three factor matrices are generated in an oblique solution: the factor pattern matrix, factor structure matrix and factor correlation matrix.

First, the factor pattern matrix loadings are in some respect equivalent to the partial standardised regression coefficients when utilised in a multiple regression analysis (135). These pattern loadings estimate the effect of each factor on each variable while controlling other factors (135). Second, the factor structure matrix provides a zero-order correlation of the variables with the factors (135). Basically, this is simply the mathematical multiplication of the pattern matrix by the factor correlation matrix (160). Finally, the factor correlation matrix provides the intercorrelation between different factors (135). The factor correlation matrix is simply an identity matrix in orthogonal rotation and not an identity matrix in oblique rotation (160). In oblique rotation, the recommended practice is to report both the factor pattern matrix and the factor structure matrix (160), which was adhered to in this study.

The next issue to address in oblique rotation is which factor coefficient should be utilised in assessing the EFA results. The question of whether to use the factor pattern matrix or factor structure matrix is somewhat ambiguous in EFA research, especially when researchers refer to both matrices as "loadings" and do not specify which of the two is being used to interpret the EFA result (160).

The issue of which factor matrix to focus on in EFA interpretation is a contentious subject in statistical research. The argument for the use of the factor structure matrix is supported by Pett [135], where the factor structure matrix is the principal focus for identification and interpretation in EFA with an oblique rotation. In contrast, the factor pattern matrix should be utilised in the reproduction of the correlation matrix and in obtaining factor scores according to Pett [135], Schumacker [161], and Harman [144]. Moreover, Harman [144] suggested the added benefit of using the pattern matrix to compare the different systems of factors for a given set of variables. Furthermore, Nunnally [116] argued it is a major error to confuse the pattern matrix with the structure matrix by neglecting the role that the correlation matrix provides in data interpretation. A mixed method for EFA interpretation was also suggested by Nunnally [116], where none of the different matrices are used separately to interpret the data.

However strong the argument for the primary use of the structure matrix might be, most factor analysts prefer interpreting the pattern matrix [147,162]. According to Hair [162], with the increase in the correlation between factors, distinguishing which of the variables loads uniquely onto what factors can become vague. In addition, Tabachnick [147] stressed that the structure matrix inflates the correlation between variables and factors when there is an overlap between factors. In contrast, the pattern matrix comprises the specific contribution of each factor to the variance in the EFA variables [147]. Therefore, based on the previously mentioned statistical arguments, the oblique method pattern matrix was utilised for the interpretation of this EFA with the structure matrix only being reported.

Regarding Step 5, the interpretation process is conducted through the examination of the variables and attributing them to a factor [137]. Therefore, interpreting the factors is dependent on understanding the underlying dimensions uniting each group of variables [147]. As a rule of thumb, only variables with a loading higher than .32 may be considered for interpretation [147]. The higher the loading, the more the variable is a pure measure for the factor [147]. A loading of .5 may also be considered as a cut-off point for factor interpretation [146]. The process followed for interpretation was based on the following steps [146]:

1. Examining the factor matrix loadings.
2. Identifying the highest loadings for each factor.
3. Assessing the communalities of the variables.
4. Labelling the factors.

3.23. Confirmatory Factor Analysis

After allowing the EFA statistical procedure to observe the correlations between variables and generates a factor structure based on those relations [151]. CFA, by contrast, requires the use of a deductive strategy, whereby the researcher is given full control over the specification of indicators for each factor [146]. In this strategy, the factors and the variables that represent them are set at the beginning of the procedure rather than being the final product of the analysis [151]. The aim of CFA is to view how well the proposed factors and variables explain the data [116]. Therefore, the procedure is performed to determine if the hypothesised theoretical structure fits the available empirical data [151]. The approach by Jöreskog [163] was followed in this study. The hypothesised model was developed via exploratory methods, which was then statistically confirmed with a different dataset.

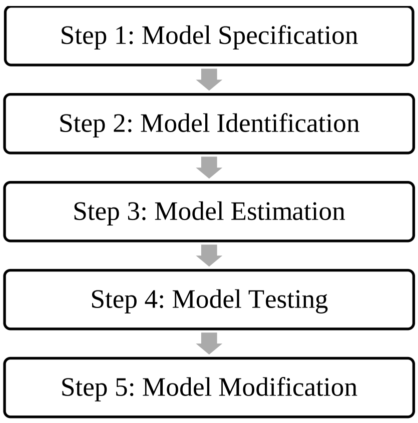
The CFA was conducted through structural equation modelling (SEM), which is defined as showing “relations among observed and latent variables in various types of theoretical models, which provide a quantitative test of hypothesis by the researcher” [161 p1]. According to Schumacker [161], the SEM is important for four primary reasons:

1. SEM allows for multiple relations among multiple variables to be modelled to confirm or disconfirm, unlike other statistical methods, which provide a limited utilisation of dependant and independent variables, such as bivariate correlation.

2. Unlike other methods, which ignore measurement error, SEM explicitly accounts for measurement error when analysing data.
3. SEM software is sophisticated and mature to a point where multi-level and multi-group SEM models can be calculated, and the models are not limited to linear relations.
4. With time, the SEM software has developed into a more user-friendly tool. Before 1993, all program syntax had to be entered using Greek alphabetic and matrix rotation.

The data were initially randomly divided in half through SPSS. One half was used to conduct the EFA, and the other was used to perform the CFA through SEM with a five-step process as identified in Figure. 3.4, adopted from Schumacker (161). The five steps were specification, identification, estimation, testing, and modification of the model.

Figure 3.3: Five-Step CFA Protocol Through Simulated Structural Modelling



Model specification is the first step in CFA; this also applies for pathway and regression models (161). The specification of a model should be based on preceding research and theory (161). The step is essential as many different relations between variables can be postulated using numerous estimates and parameters (161). Therefore, the factor model outcome may differ based on the different hypothesised relationships between the factors and observed variables [161].

Model identification is the second step in CFA; a model is considered to be identified if the degrees of freedom are one or more [161]. Degrees of freedom equalling zero result in a saturated model, where all the parameters are estimated [161]. When there are negative degrees of freedom, there are more estimated parameters in a covariance matrix than distinct values [161]. The aim in this step is to calculate an over-identified model, where the number of parameters being estimated is less than or equal to the number of distinct values in the matrix [161].

Model estimation is the third step in CFA. When using parameter estimates in a hypothesised theoretical model, there are different estimation methods to utilise [161]. These methods include generalised least squares, maximum likelihood, weighted least squares, and unweighted least squares [164]. When utilising the unweighted least squares, certain assumptions of the Pearson correlation coefficient should be met, including normal distribution and other parametric assumptions [161]. The maximum likelihood is considered superior to other estimation methods in medium-to-large samples of less than 2,500 [147]. Moreover, this method is considered a robust estimate of parameters and does not have to meet parametric assumptions [161]. It was therefore the method used for this study.

Model testing is the fourth step in CFA and is performed using Chi-square and other statistical indices [161]. The $\chi 2$ (Chi-square) aims to be non-significant, which indicates the original matrix of variance-covariance and model-implied matrix of variance-covariance to be similar, indicating the model to be a good illustration of the relations between the observed variables, namely their variance and covariance [161]. However, the $\chi 2$ test is sensitive to a large sample size and tends to indicate significance probability level with an increase in sample numbers [147,164,165]. Generally, any sample above 200 would cause the $\chi 2$ test to indicate significance [161]. Because of this problem, a rule of thumb has been developed to measure the $\chi 2$ of a model. It involves dividing the Chi-square by the degrees of freedom [147]. The recommended value for this adjusted $\chi 2$ test is any value equal to or less than three [164,165].

Model modification is the fifth and final step in CFA, which takes place when hypothesis testing a model that might not fit [161]. The modification involves altering the model using the residual matrix, theory, or modification indices [161]. The recommendation is to perform the changes and create pathways which can be justified by the theory [161]. In general, the model requires adding error covariance between observed variables, which may be sufficient to improve the data to fit the model [161]. Finally, the model might not fit the data even with modifications, in which case the theory is not supported by the data and may require disqualification of the model or testing a different sample [161].

3.1. CFA Model Fit Indices

The fit of a CFA model is determined by the degree to which the data sample variance and covariance fit the SEM model [161]. There are dozens of criteria commonly utilised in SEM and generally are split into three major categories: absolute fit measures, incremental fit measures, and parsimonious fit measures, also called model fit, model comparison, and model parsimony, respectively [161,162,166]. The absolute fit measures are only designed to assess the overall fit of the model in terms of the measurement and structural models collectively. However, absolute fit measures do not adjust for overfitting that may affect the model [162]. The incremental fit measures compare the proposed model to a different model or to a null model [161,162]. Finally, the parsimonious fit measures work by correcting the fit measures to offer a comparison amongst models with dissimilar values of estimated coefficients with the aim of evaluating the extent of fit attained by each of the estimated coefficients [162].

For each of the three categories, there are different fit indices, and for each of these indices, there are certain rules of thumb regarding an acceptable minimum level value to achieve a good fit. In most cases, a good fitting SEM model generates consistent results across different model fit categories [147]. The choice of which measure to apply for the SEM model is highly contentious between researchers, as no single measure has been universally recognised to produce SEM model fit [162]. However, a recommended approach by Hair [162] is to consider at least one measure for each of the three model fit categories. It should be noted that assessing SEM model fit is more of a relative method rather than an absolute statistical criterion [162].

A good-fitting SEM model is comparable to other statistical analyses, such as logistic regression and multiway frequency analysis, where a good fit is sometimes represented by a nonsignificant $\chi 2$ test result [147]. However, as previously mentioned, the $\chi 2$ test is sensitive to large sample sizes. Therefore, the $\chi 2$ has been presented with the ratio of $\chi 2$ to the degrees of freedom (CMIN/DF); a model with a value of CMIN/DF below 2.0 is recommended [147], any value for CMIN/DF below 3.0 is generally good fitting, and a value below 5.0 is sometimes regarded as acceptable for model fit [162,164,166]. Furthermore, the goodness-of-fit index (GFI) is a non-statistical measurement index which represents the degree of model fit via squared residuals from the prediction against the actual data, without adjusting for the degrees of freedom in the data [162]. In addition, this measure can be adjusted in relation to the number of estimated parameters in the SEM model, with an adjusted goodness-of-fit index (AGFI) [147]. Simply put, the fewer estimated parameters in the model, the closer the values between the GFI and AGFI are likely to be [147]. The index measure ranges from a perfect fit with a value of one to a poor fit with a value of zero; a good fit is represented with a value of .90 to .95 and higher [161,162].

Absolute fit measures also include other common indices, such as the root mean square residual (RMSR) and the expected cross-validation index (ECVI). However, since the sample size in the study was large even when split in half, the root mean square error of approximation (RMSEA) was the preferred method [162]. The RMSEA works in similar fashion to the RMSR measure. The difference is that the RMSEA measures the discrepancy in relation to the data population, not just the data sample utilised in the estimation [162,167]. The value produced by the RMSEA provides a goodness-of-fit that would be anticipated if the SEM model was estimated in the researched population, not with only the sample extracted for the purposes of the estimation [162]. As a SEM measurement index, the RMSEA indication of a model fit is usually any value ranging from .05 to .08 [162]. In addition, the standardised root mean square residual (SRMR) can be utilised via an AMOS software plugin, with a good fitting model value of .08 or less [168].

The measurement index by Bentler [169], generally named the Bentler-Bonett normed fit index (NFI), works by assessing the estimated SEM model by comparing the $\chi 2$ value produced by the model to the $\chi 2$ value of an independent null model [147,166]. A common independence null model is where the observed variables are typically regarded to be uncorrelated [166]. As an example, if the NFI value for the estimated model is .80, the overall fit of the estimated model is 80% better than a null independence model using the same sample values [166]. The NFI is regarded as an incremental fit index and has other similarly scaled indices, such as the Bentler [170] comparative fit index (CFI) and the Bentler-Bonett non-normed fit index (NNFI), also called the Tucker-Lewis Index (TLI) [147,162,166]. All of the aforementioned incremental measurement indices are recommended to have a value of .90 to .95 or greater to represent a good fitting model [147,161,162].

The third and final category for establishing SEM model fit is model parsimony. There are several measures used to analyse the degree of parsimony in a SEM model, such as the

Akaike information criterion (AIC) [171], the consistent Akaike information criterion (CAIC) [172], and the parsimonious goodness-of-fit index (PGFI); the normed $\chi 2$ is also considered a measure of model parsimony with a cut-off minimum value of 1.0 and upper limit of 5.0 [162]. A common measure for reporting the degree of model parsimony is the parsimonious normed fit index (PNFI), which is a variation of the NFI measure [162]. The PNFI considers the number of degrees of freedom utilised in attaining a level of model fit, considering that the definition of parsimony is achieving better degree of model fit for each degree of freedom used in the model [162]. Therefore, increased parsimony is preferable in a SEM model, with a value of zero representing a no fit and a value of one indicating a perfect fit [161].

3.2. Conclusion

This chapter has given a comprehensive explanation of the methods used in this study to identify the desirable core competencies of an EMS Bachelor degree graduate in Saudi Arabia. The SPECS instrument was developed based on a thorough review of the literature. Face and content validity validation were undertaken, followed by an explanation of the methods utilised in an expert consensus Delphi study. Finally, the methodology of a national observational cross-sectional quantitative study of EMS professionals in the SRCA was explained.

Chapter 4: Results

4.1. Introduction

In the previous chapter, the methodology of the thesis was explained, consisting of the research question and objective, research design, sample population, research instrument, setting and communication, data collection, ethical consideration and data analysis of the Delphi and national study. This chapter presents the descriptive and inferential results of the Delphi and national study. The descriptive statistics include the measure of frequency, central tendency (mean, median, and mode), and standard deviation or interquartile ranges. The inferential statistics are analysed through the Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) tests, followed by a Mann-Whitney U and Kruskal-Wallis H tests. The Saudi ParamEdic Competency Scale (SPECS) was the tool used in the study, and the data were analysed using SPSS (Version 23) and AMOS.

4.2. Delphi Study Results

As presented in Table 4.1, a diverse range of qualifications, expertise, and disciplines was found among expert participants. Of the 20 prospective participants, 17 participated in the first round of the Delphi study. All 17 completed the survey, and five responded to the optional open-ended question "If there are other Core Competency statements that you think are missing, please write them below". Following a review of the comments by the author and supervisor, another core competency item was added ("Be able to demonstrate English proficiency to an adequate level for professional communication") since English is the medical language used in Saudi Arabia. Another item regarding disaster preparation and management was amended to include the phrase "and terrorist attacks". The changes were based on the input of three of the participants. The other two responses were disqualified for the following reasons:

1. Statement: “Health advocacy for the community” was already included under Item 13 (“Be able to provide health and social advocacy responsibly”).
2. Statement: “Be able to maintain personal well-being and fitness” was already included under Item 32 (“Understand the need to maintain an appropriate level of physical and mental fitness”).

Table 4.1: Delphi Demographic Information

	Category	**First Round**	**Second Round**
Gender	Male	16	13
	Female	1	1
	Total	17	14
Age Group	18-28	1	1
	29-39	10	9
	40-49	6	4
	50 or above	0	0
	Total	17	14
Highest Qualification	Certificate	0	0
	Diploma	0	0
	Bachelor degree	6	5
	Master degree	8	7
	PhD	3	2
	Total	17	14
Years of EMS Experience	1-4	3	3
	5-9	4	3
	10 or more	10	8
	Total	17	14
Primary Medical Discipline	Paramedic	9	8
	Nurse	2	2
	Physician	5	4
	Respiratory Care	1	0
	Total	17	14
Main Professional Role	Administrative/Leadership	11	9
	Education/Academic	5	4
	Clinical/Patient care	1	1
	Total	17	14
Nationality	Saudi	15	13
	Egyptian	1	1
	Jordanian	1	0
	Total	17	14

In the second round, the response rate decreased to 14, with only one response to the open-ended question to generate new or missing core competency statements. The generated statement (“Be familiar and friendly to a multi-cultural society in hospitals, companies, and the Hajj") was disqualified because it was already included under Item 2 ("Be able to practise respectfully and in a non-discriminatory manner").

In accordance with established Delphi stability and agreement criteria [120], all core competency statements achieved a majority in each round (see Table 4.2).

Table 4.2: List of Core Competencies for Both Delphi Rounds

Item	Round 1		Round 2	
	M	SD	M	SD
Be able to practice within the legal and ethical boundaries of the profession (Item 22)	9.59	.69	9.64	.61
Be able to maintain appropriate and effective safety procedures (Item 23)	9.59	1.19	9.64	.48
Be able to practice with respect and non-discriminatory manner (Item 2)	9.41	1.09	9.64	.48
Be able to conduct appropriate decision-making and critical thinking (Item 9)	9.41	1.46	9.43	.49
Be able to provide appropriate and effective clinical care (Item 8)	9.35	1.23	9.79	.56
Be able to work as part of a team in a collaborative and professional approach (Item 3)	9.18	1.38	9.64	.61
Have the ability to take patient history and conduct examination and assessment of both adults and children (Item 24)	9.18	.86	9.50	.63
Be able to conduct appropriate scene management (Item 25)	9.18	.98	9.57	.49
Be able to effectively communicate information verbally and non-verbally to patients, colleagues and others (Item 1)	9.12	1.18	9.43	.82
Be able to demonstrate English Language proficiency to an adequate level for appropriate professional communication (Item 41)	-	-	9.07	.96
Be able to maintain good coping skills to deal with stressful situations (Item 20)	8.94	.87	9.21	.56
Be able to demonstrate a high level of understanding for practice standards and protocols (Item 35)	8.94	1.00	9.21	.67
Be able to conduct themselves to a high professional behavioural standard (Item 19)	8.88	1.41	9.43	.61
Have the theoretical knowledge of key concepts in the EMS profession (Item 7)	8.82	1.82	9.14	.99
Be responsible for the quality of patient care (Item 18)	8.82	1.46	9.57	.73
Be able to maintain the appropriate personal characteristics of being trustworthy and accountable (Item 26)	8.82	1.10	9.50	.50
Be able to problem-solve, by assessing professional issues and calling upon the required experience and knowledge to resolve them (Item 10)	8.76	1.35	9.29	.59
Be able to maintain situational awareness at all times, whilst working in unpredictable situations (Item 11)	8.76	1.39	9.21	.77
Be able to maintain appropriate patient interaction and welfare of patients (Item 16)	8.76	1.11	9.29	.88
Be able to work as autonomous professionals with high levels of personal professional judgement (Item 28)	8.76	1.11	9.29	.70
Be able to work with different equipment and technology within the scope of practice (Item 32)	8.76	1.63	9.43	.62
Be able to maintain accurate and comprehensible record keeping within the scope of practice (Item 33)	8.76	1.52	9.14	.74
Be committed to a process of continuous lifelong learning and professional development (Item 21)	8.65	2.08	8.86	.83
Be able to reflect on their own experience and practice as professionals (Item 15)	8.59	1.19	9.29	.59
Be able to maintain an appropriate level of training through different professional courses (Item 30)	8.59	1.14	8.93	.88
Understand the need to maintain an appropriate level of physical and mental fitness (Item 31)	8.59	1.42	9.14	.64
Be able to manage personal emotions and those of patients and relatives (Item 12)	8.53	1.29	9.00	.76
Be able to provide mentoring and education when training others (Item 14)	8.53	1.88	8.64	1.11
Be able to provide care according to evidence-based practice (Item 17)	8.53	1.68	9.36	.72
Be able to work in different transportation modes (Item 29)	8.53	1.04	8.64	1.23
Be able to practice with appropriate Islamic values (Item 38)	8.53	2.23	9.29	1.33
Be able to maintain involvement with public and community health (Item 39)	8.41	1.42	8.64	.89
Be able to effectively practice in Umrah and Hajj (Item 40)	8.41	2.40	8.50	1.76
Be able to conduct an appropriate level of professional quality management (Item 34)	8.35	1.78	8.93	.80
Be able to demonstrate leadership skills (Item 5)	8.29	1.67	8.64	.89
Be able to provide health and social advocacy responsibly (Item 13)	8.24	1.31	8.86	.74
Be able to demonstrate an understanding of new technologies for clinical practice (Item 37)	8.24	1.93	8.86	.64
Be able to effectively supervise students and colleagues (Item 6)	8.18	1.76	8.21	1.21
Be information literate, by having the capacity to search and apply information (Item 4)	8.12	1.97	8.79	.56
Be flexible in learning from different sources including guidance from other colleagues (Item 27)	7.94	1.89	8.79	.77
Be able to prepare for and manage disasters and terrorist incidents (Item 36)	7.88	2.35	8.79	1.21

Moreover, all core competency items—whether original, new, or modified—surpassed the 75% consensus requirement [118]. All items in this study achieved the Scheibe [121] criteria, with the highest marginal difference in Item 36 with a 9.1% change between the two rounds. All items demonstrated an increase in the level of consensus between rounds, with a minimum increase of 0.2% for Item 9, indicating the highest level of consensus possible [106]. The initial round generated five statements, resulting in a new core competency and an amendment to another, whilst the second round only generated one disqualified statement, which indicated stability [122]. To maintain rigor, a 70% response rate is considered the minimum recommended rate [106]. In the current study, the response rates in the first and second rounds were 85% (17 out of 20) and 70% (14 out of 20), respectively. It was therefore anticipated that the response rate would fall below 70% if another round was introduced [73,131]. The Delphi study achieved the required recommendations for majority, consensus, stability, and response rate. Therefore, the final Delphi product was ready for the next phase, the national study, which is presented later.

4.3. Response Rate and Demographic Results

Of the 1,260 surveys distributed to 42 Saudi Red Crescent Authority (SRCA) stations, 909 were returned, with a response rate of 72.14%. In addition, the online survey provided 104 responses, yielding a grand total of 1,013 responses. Of these 1,013 responses, 86 had one or more missing values. Of the completed surveys, the number of missing values was small. Therefore, a listwise deletion process was conducted, also known as complete case analysis. This process entailed deleting the data for any participant with one or more missing values and is recommended when there is only a small amount of missing data [151,173]. Moreover, almost all multivariate statistical analysis procedures require a complete dataset with no missing values [151]. Consequently, 927 surveys had a complete dataset and were included in the analysis.

The survey had seven demographic questions regarding gender, age, qualifications, experience, medical discipline, main professional role, and nationality. Each question is presented in turn, and all are shown in Table 4.3.

Table 4.3: National Study Demographic Data

	Category	**Frequency**	**Percent**
Gender	Male	866	93.4
	Female	61	6.6
	Total	927	100.0
Age Group	18-28	230	24.8
	29-39	552	59.5
	40-49	122	13.2
	50 or above	23	2.5
	Total	927	100.0
Highest Qualification	Certificate	68	7.3
	Diploma	707	76.3
	Bachelor degree	114	12.3
	Master degree	24	2.6
	PhD	14	1.5
	Total	927	100.0
Years of EMS Experience	1-4	315	34.0
	5-9	508	54.8
	10 or more	104	11.2
	Total	927	100.0
Primary Medical Discipline	Paramedic	585	63.1
	Nurse	257	27.7
	Physician	83	9.0
	Public health	1	.1
	Pharmacist	1	.1
	Total	927	100.0
Main Professional Role	Administrative/Leadership	150	16.2
	Education/Academic	328	35.4
	Clinical/Patient care	449	48.4
	Total	927	100.0
Nationality	Saudi	792	85.4
	Egyptian	53	5.7
	Jordanian	41	4.4
	Syrian	21	2.3
	Indian	11	1.2
	Pakistani	3	.3
	Sudanese	5	.5
	Filipino	1	.1
	Total	927	100.0

Finally, univariate normality was assessed for each variable and each half of the dataset. Since the sample size was large, significance tests were disregarded, as even a slight departure from normality can indicate significance with larger samples sizes in these tests [(166)]. Therefore, the alternative of analysing absolute values for univariate skewness and kurtosis was undertaken. Kline [166] suggested that for data non-normality to be problematic, a skewness value greater than +/-3.0 and kurtosis of more than +/-10.0 can indicate a problem in data normality. All variables in both datasets achieved absolute values in skewness and kurtosis of less than +/-3.0 and +/-10.0, respectively, indicating no multivariate normality problems for factor analysis.

As EMS is a male-dominated sector in Saudi Arabia, most of the national study participants were male (*n* = 866, 93.4%) with the remaining 61 (6.6%) being female. Most participants were between the ages of 29 and 39 (*n* = 552, 59.5%), whilst the smallest age group was 50 or above (*n* = 23, 2.5%). The age groups 18-28 and 40-49 represented 24.8% and 13.2% of the sample, respectively. Participants over the age of 40 represented less than one sixth of the overall population (*n* = 145, 15.7%), indicating a younger EMS workforce with a lack of senior and mature EMS providers.

More than three quarters of participants had a diploma as their highest qualification (*n* = 707, 76.3%). This could be related to the second phase in the development of pre-hospital care in Saudi Arabia, which came with the creation of the first diploma programs in EMS between 2005 and 2012. The next most common qualification was Bachelor degree (*n* = 114, 12.3%), followed by certificate (*n* = 68, 7.3%), Master (*n* = 24, 2.6%), and PhD (*n* = 14, 1.5%).

Participants' EMS experience varied, with 5-9 years representing more than half (*n* = 508, 54.8%), 1-4 years more than a third (*n* = 315, 34%), and 10 or more years being the least common (*n* = 104, 11.2%). Experience level was somewhat comparable to the age groups, i.e., where people aged 40 and above represented 15.7% and 10 or more represented 11.2%.

When the data were initially collected, the four primary medical disciplines were paramedic, nurse, physician, and other. After data collection, only two participants identified as "other": one as "public health" and the other as "pharmacist". Therefore, the "other" category was replaced with these two disciplines. The majority of participants identified as a paramedic (*n* = 585, 63.1%), as expected in a pre-hospital EMS system, followed by nurse (*n* = 257, 27.7%), physician (*n* = 83, 9%), public health (*n* =1, .1%), and pharmacist (*n* =1, .1%). Nearly half identified their main professional role as clinical/patient care (*n* = 449, 48.4%), followed by education/academic (*n* = 328, 35.4%) and administrative/leadership (*n* = 150, 16.2%).

The Saudi economy depends on Saudi national workers as well as a large expatriate workforce. As such, a multi-cultural work environment in the SRCA was expected. The dominant nationality of participants was unsurprisingly from Saudi Arabia (*n* = 792, 85.4%), followed by Egyptians (*n* = 53, 5.7%), Jordanians (*n* = 41, 4.4%), Syrians (*n* = 21, 2.3%), Indians (*n* = 11, 1.2%), and Pakistanis (*n* = 3, .3%). The "other" category provided two additional nationalities, namely Sudanese (*n* = 5, .5%) and Filipino (*n* = 1, 1%).

4.4. Exploratory Factor Analysis

The EFA was chosen as the initial step for data analysis. However, the overall aim was to utilise the exploratory nature of the test to provide data reduction and to generate a theoretical model regarding the underlying processes. As the research was developed under the assumption that there were no prior expectations or constraints on the number of extracted components and the estimation of components, the data were randomly split roughly in half through select cases command in SPSS. The result was 450 cases to be utilised for the EFA analysis. This was regarded as a good sample size according to the Comrey [136] guideline. Furthermore, the Pett [135] recommendation was also satisfied for the 10-15 participants for each initial item, as there are 10.97 participants for each initial 41 factors.

The EFA was initiated by generating a correlation matrix to determine the available relationship between the different variables and the strength of the relationship. If no correlation is above a .32 loading value, the factor analysis may be reconsidered, as this is regarded as the minimum accepted level of correlation valid for interpretation [147]. If no correlation supersedes the .30 mark, the use of factor analysis is not advised as there is nothing to factor analyse [146,147]. The correlation matrix produced a considerably large number of strong correlations, the Kaiser-Meyer-Olkin (KMO) measurement for the dataset was .964, and the Bartlett test of sphericity significance measure was $p \leq 0.000$, as presented in Table 4.6, indicating the suitability of the data for the EFA statistical method.

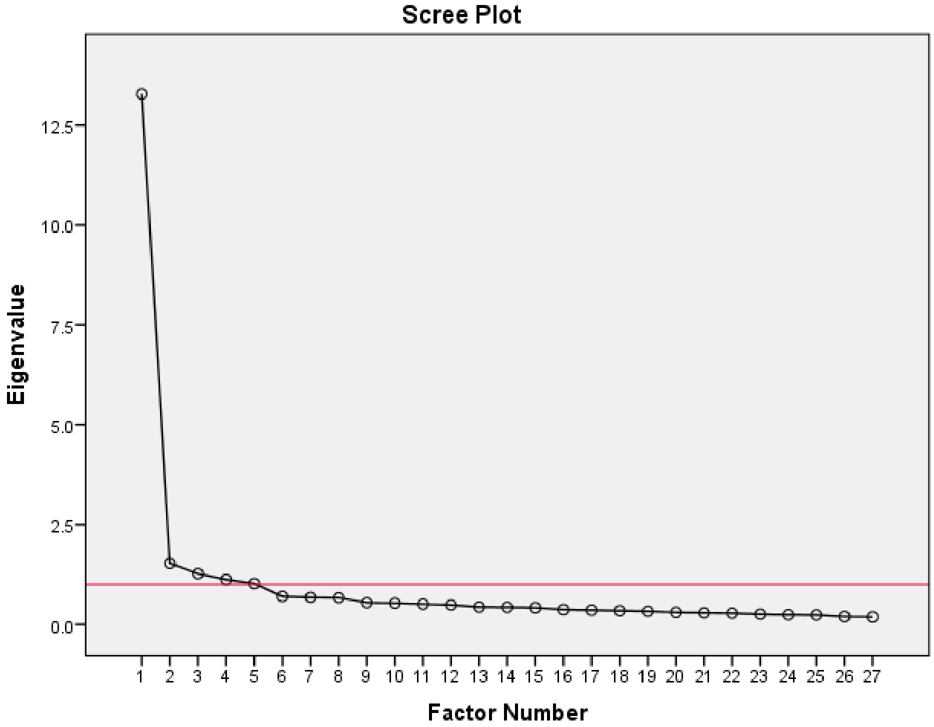
Table 4.4: Kaiser-Meyer-Olkin Measure and Bartlett's Test of Sphericity

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		**.964**
Bartlett's Test of Sphericity	Approx. Chi-Square	13210.850
	df	820
	Sig.	.000

4.5. Number of Factors in EFA

Deciding on how many of the extracted factors to keep is an important decision in EFA. Four factor retention techniques were utilised. First, the Kaiser criterion is based on the value of each extracted factor equal to or higher than one eigenvalue. Five factors were retained based on the Kaiser criterion (see Table 4.6). Second, the cumulative percentage of variance criterion explained by the five factors was 65.5%. In a review of 60 EFA studies, 52.03% total variance explained was identified as the mean of all the studies included in the review [160]. Moreover, the expectation in EFA studies was that the percentage of total variance explained would decline as the total number of factored variables increased [160]. Although no specific percentage is recommended, a range from 60% to 95% is generally accepted in different fields of study [146]. Third, a scree plot was used to identify the horizontal levelling point for the factors; any factors above that point were retained, and the rest were rejected. As per Figure 4.1, the elbow shape was identified from factor 5 and above, while the horizontal levelling was at factor 6 and below.

Figure 4.1: Scree Plot



The final technique used in deciding on the number of factors to retain was the Monte Carlo PCA for Parallel analysis. The tabulation process and software used was based on the recommendations of Pallant [140]. The software by Watkins [174] was used to generate 100 random datasets with an equal number of cases and variables to the EFA data. The process produced the average eigenvalues of the random data, which were compared to the EFA factor eigenvalues. If each of the EFA factors had a higher eigenvalue than the random data, that factor was accepted; if not, the factor was rejected. According to the parallel analysis, two of the five factors were recommended for retention, as shown in Table 4.7.

Table 4.5: Parallel Analysis Results

Factors	Eigenvalues	% of Variance	Cumulative %	Parallel analysis Random results	Decision
1	13.280	49.184	49.184	1.479	Accept
2	1.528	5.661	54.845	1.404	Accept
3	1.269	4.700	59.545	1.356	Reject
4	1.123	4.158	63.703	1.310	Reject
5	1.022	3.785	67.489	1.269	Reject

The scree plot confirmed the five factors identified by the Kaiser criterion and the percentage of variance criterion explained. Parallel analysis disagreed with the model based on five factors and recommended a model of only two factors. Nevertheless, the results of the random parallel analysis model only gave a 54.8 percentage of variance criterion explained, as shown in Table 4.7. A minimum 60% was not achieved by parallel analysis. In addition, any outcome from the combined factor retention techniques must be based on theoretical sense [(116)]. The model based on five factors was preferred, as this would theoretically allow for core competency dimensions to be better constructed and justified for the research. Thus, a model based on five factors was used for the EFA model.

4.6. EFA Rotation Results

In health research, the development of instruments does not involve a single phenomenon but rather involves different aspects of a construct [(135)]. As a result, several latent variables are likely to be generated as a potential explanation for the variables. The ideal expectation is that each variable will provide a strong loading on a specific factor after implementing the factor rotation. However, when dealing with real-life data, the variables are expected to generate weak loadings with factors, cross loading both strong and weak. As such, all variables that had a loading value of .40 or less [(135)], cross loading variables, and weak loading variables inconsistent with a given factor were deleted. In total, 14 variables were deleted during three rotation EFA iterations, the reasons for each deletion are presented in Table 4.8. As expected, the first rotation presented the largest number of variables for removal, with 11 in total.

During the second rotation, only one variable was removed. Finally, the third rotation presented two variables for removal. The resulting EFA model was cleaner with less complex variable loadings, therefore presenting a simpler EFA model.

Table 4.6: Reasons for Variable Deletion

Number	Iteration	Deleted Variable	Reason for Variable Deletion
1	First	11: Be able to maintain situational awareness at all times whilst working in unpredictable situations.	Cross loading between factors
2	First	13: Be able to provide health and social advocacy responsibly.	Weak factor loading.
3	First	14: Be able to provide mentoring and education when training others.	Cross loading between factors.
4	First	15: Be able to reflect on their own experience and practice as professionals.	Single factor variable with weak loading.
5	First	16: Be able to maintain appropriate patient interaction and welfare of patients.	Not loading on any factor.
6	First	19: Be able to conduct themselves in a high professional behavioural standard.	Cross loading between factors.
7	First	25: Be able to conduct appropriate scene management.	Cross loading between factors.
8	First	32: Be able to work with different equipment and technology within the scope of practice.	Not loading on any factor.
9	First	33: Be able to maintain accurate and comprehensible record keeping within the scope of practice.	Not loading on any factor.
10	First	34: Be able to conduct an appropriate level of professional quality management.	Cross loading between factors.
11	First	35: Be able to demonstrate a high level of understanding for practice standards and protocols.	Cross loading between factors.
12	Second	6: Be able to effectively supervise students and colleagues.	Cross loading between factors.
13	Third	18: Be responsible for the quality of patient care.	Weakest loading variable and theoretically inconsistent with the factor.
14	Third	24: Have the ability to take patient history and conduct examination and assessment of both adults and children.	Second weakest loading variable and theoretically inconsistent with the factor.

4.7. Naming the Factors

After reducing the variables in the model into a more parsimonious and clearly defined factor structure, the next step was to label the factors with appropriate conceptual titles. According to Pett [135 p4], “Naming factors is a poetic, theoretical, and inductive leap”. In other words, there are no specific guidelines for the process. According to Tabachnick [147], researchers in EFA use different extraction and rotation procedures, but the overall aim is to provide and interpret a solution with the greatest scientific meaning, utility, and consistency. Generally, factor labelling is dependent on the field of study, the representation of the highest loading variables in a factor, and the partially subjective inductive analysis of the researcher. As such, the highest loading item and following items with a loading value of equal to or more than .7 are presented in full text, and any items with a lesser value are briefly explained under each factor to provide context to the naming of each factor. The five factors of the EFA model are presented in Table 4.9 and discussed below.

Table 4.7: Final EFA Factors with Retained Items and Explained Variance

Number	**Factor Name**	**Retained Items**	**% of Variance for Each Factor**
1	Professionalism	27, 28, 26, 23, 29, 21, 17, 22, 20	49.1%
2	Preparedness	37, 38, 39, 40, 36, 41	5.6%
3	Communication	2, 4, 3, 1, 5	4.7%
4	Clinical	8, 9, 7, 10	4.1%
5	Personal	30, 31, 12	3.7%

Factor 1 was given the name "professionalism" and contained nine items that loaded between a high of 0.79 and a low of 0.48. The factor retained an explained variance of 49.1% and the highest loading item was "Be flexible in learning from different sources including guidance from other colleagues" at a loading value of .79. The second highest was "Be able to work as autonomous professionals with high levels of personal professional judgment" at a loading value of .75. The third highest was "Be able to maintain the appropriate personal characteristics of being trustworthy and accountable" at a loading value of .73. The fourth highest was "Be able to maintain appropriate and effective safety procedures" at a loading value of .71. The other five items represented the ability to work in different transportation modes, a commitment to lifelong learning and professional development, providing care based on evidence-based practice, practising within legal and ethical boundaries, and maintaining good coping skills with stressful situations. The items loading on Factor 1 best represented the "professionalism" domain of a Saudi EMS Bachelor degree graduate.

Factor 2 was given the name “preparedness” and consisted of six items that loaded between 0.77 and 0.45. The factor retained an explained variance of 5.6% and the highest loading item was “Be able to demonstrate an understanding of new technologies for clinical practice” at a loading value of .77. The second highest was “Be able to practise with appropriate Islamic values” at a loading value of .74. The third highest was “Be able to maintain involvement with public and community health” at a loading value of .72. The fourth highest was “Be able to effectively practise in Umrah and the Hajj” at a loading value of .71. The other two items represented the ability to manage disasters and terrorist incidents and to demonstrate proficiency in English. The items loading on Factor 2 best represented the “preparedness” domain of a Saudi EMS graduate.

Factor 3 was given the name “communication” and was made up of five items that loaded between 0.83 and 0.58. The factor retained an explained variance of 4.7% and the highest loading item was “Be able to practice with respect and non-discriminatory manner” at a loading value of .83. The second highest was “Be information literate by having the capacity to search and apply information” at a loading value of .77. The third highest was “Be able to work as part of a team in a collaborative and professional approach” at a loading value of .77. The other two items represented the ability to communicate verbally and non-verbally and to demonstrate leadership skills. The items loading on Factor 3 best represented the communication domain of a Saudi EMS graduate.

Factor 4 was given the name “clinical” and contained four items that loaded between 0.88 and 0.46. The factor retained an explained variance of 4.1% and the highest loading item was “Be able to provide appropriate and effective clinical care” at a loading value of .88. The second highest was “Be able to conduct appropriate decision-making and critical thinking” at a loading value of .70. The other two items represented the ability to retain theoretical knowledge and the ability to solve problems. The items loading on Factor 4 best represented the clinical domain of a Saudi EMS graduate.

Factor 5 was given the name “personal” and included three items that loaded between 0.69 and 0.43. The factor retained an explained variance of 3.7% and the highest loading item was “Be able to maintain an appropriate level of training through different professional courses” at a loading value of .69. The other two items represented the understanding of physical and mental fitness and the ability to manage personal emotions. The items loading on Factor 5 best represented the personal domain of a Saudi EMS graduate.

A final five-factor solution for the EFA was assigned with appropriate conceptual titles. The solution is presented with the factor pattern matrix, structure matrix, and communality coefficients in Table 4.10. Since the communality coefficients indicated a relation between the variables that were less than .3 and did not equal or exceed the value of 1, the final EFA showed no problems with the solution, such as the wrong number of factors or insufficient data [147].

Note: The factor pattern matrix coefficients were the loadings used to interpret the EFA results. The table is based on post rotation for the alpha factoring extraction method and promax with Kaiser normalisation rotation; rotation converged in seven iterations. h^2 = communality coefficient.

Table 4.8: Factor Pattern and Structure Matrix for the Final EFA Five Factor Solution

	Factor Pattern Matrix Coefficients					**Factor Structure Matrix Coefficients**					
Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	h2
Be flexible in learning from different sources including guidance from other colleagues (Item 27)	**.791**	-.184	.050	.037	.056	.749	.475	.548	.544	.400	.575
Be able to work as autonomous professionals with high levels of personal professional judgment (Item 28)	**.753**	.106	-.102	-.033	.127	.798	.634	.549	.555	.508	.658
Be able to maintain the appropriate personal characteristics of being trustworthy and accountable (Item 26)	**.735**	-.027	.107	-.150	.122	.749	.554	.578	.481	.465	.582
Be able to maintain appropriate and effective safety procedures (Item 23)	**.717**	.071	-.013	.075	-.094	.764	.573	.552	.571	.343	.592
Be able to work in different transportation modes (Item 29)	**.664**	.055	-.008	-.048	.044	.687	.525	.495	.469	.389	.475
Be committed to a process of continuous lifelong learning and professional development (Item 21)	**.606**	.193	-.125	.139	.057	.782	.663	.557	.627	.481	.647
Be able to provide care according to evidence based practice (Item 17)	**.583**	-.110	.253	.091	-.060	.718	.499	.629	.574	.344	.554
Be able to practise within the legal and ethical boundaries of the profession (Item 22)	**.576**	.010	-.090	.199	.102	.712	.544	.511	.601	.453	.535
Be able to maintain good coping skills to deal with stressful situations (Item 20)	**.482**	.087	.043	.122	.132	.730	.612	.592	.606	.508	.572
Be able to demonstrate an understanding of new technologies for clinical practice (Item 37)	-.194	**.776**	-.084	.152	.173	.503	.770	.476	.509	.544	.632
Be able to practice with appropriate Islamic values (Item 38)	-.042	**.742**	-.067	.124	.042	.555	.766	.496	.517	.466	.596
Be able to maintain involvement with public and community health (Item 39)	.217	**.727**	-.007	-.105	-.086	.618	.767	.518	.440	.384	.608
Be able to effectively practice in Umrah and Hajj (Item 40)	.173	**.718**	.117	-.110	-.106	.644	.794	.592	.471	.395	.657
Be able to prepare for and manage disasters and terrorist incidents (Item 36)	-.137	**.612**	.080	-.053	.320	.490	.716	.510	.424	.611	.586
Be able to demonstrate English Language proficiency to an adequate level for appropriate professional communication (Item 41)	.195	**.457**	.280	-.056	-.120	.625	.681	.626	.484	.350	.539
Be able to practice with respect and non-discriminatory manner (Item 2)	-.102	-.036	**.838**	.115	.043	.577	.538	.838	.593	.436	.710
Be information literate, by having the capacity to search and apply information (Item 4)	.145	.008	**.776**	-.037	-.038	.662	.582	.842	.563	.405	.718
Be able to work as part of a team in a collaborative and professional approach (Item 3)	.015	-.077	**.775**	.040	.113	.602	.535	.817	.567	.477	.677
Be able to effectively communicate information verbally and non-verbally to patients, colleagues and others (Item 1)	-.085	.067	**.596**	.157	.094	.550	.548	.729	.574	.456	.558
Be able to demonstrate leadership skills (Item 5)	.104	.234	**.581**	-.108	-.007	.610	.624	.736	.485	.413	.581
Be able to provide appropriate and effective clinical care (Item 8)	-.045	-.048	.052	**.884**	.019	.592	.497	.580	.867	.413	.755
Be able to conduct appropriate decision-making and critical thinking (Item 9)	.118	.135	-.008	**.702**	-.088	.660	.588	.585	.820	.378	.695
Have the theoretical knowledge of key concepts in the EMS profession (Item 7)	.110	-.105	.094	**.591**	.140	.590	.471	.560	.733	.462	.565
Be able to problem-solve, by assessing professional issues and calling upon the required experience and knowledge to resolve them (Item 10)	.270	.129	.148	**.468**	-.273	.659	.549	.600	.704	.233	.603
Be able to maintain an appropriate level of training through different professional courses. (Item 30)	.097	-.041	.059	-.083	**.694**	.407	.411	.388	.327	.710	.511
Understand the need to maintain an appropriate level of physical and mental fitness (Item 31)	.162	.117	.015	.048	**.562**	.580	.591	.516	.509	.741	.612
Be able to manage personal emotions and those of patients and relatives (Item 12)	.084	.160	.097	.062	**.433**	.534	.566	.516	.485	.643	.493

4.8. Internal Consistency Reliability of the Identified Factors

All empirical research grounded in measurement should be thoughtful of the dependability and accuracy—i.e., the reliability—of results [175]. According to Hair [162 p641], the concept of "Reliability is a measure of the internal consistency of the construct indicators, depicting the degree to which they 'indicate' the common latent (unobserved) construct". In research, a reliable variable will enhance an analysis, whilst an unreliable variable will degrade an analysis [147]. A substantial number of unreliable variables offers a less meaningful solution when compared to a small number of reliable variables [147]. Therefore, greater confidence that all individual indicators are consistent in their measurement can be associated with increased reliability [162]. An acceptably reliable coefficient value determines whether the statistical test was correct in expecting a clustering of variables to yield interpretable statements regarding individual differences [175].

The reliability test was performed using Cronbach's alpha as this is the preferred method in assessing internal consistency reliability [135]. Cronbach alpha is a common measure of reliability for the assessment of two or more construct indicators [162]. Values for Cronbach's alpha range from 0 to 1.0; the closer the values are to 1.0, the higher the reliability of the indicators is [162]. The study followed Hair's [162] recommendation, where the minimum threshold to establish acceptable factor reliability is a value equal to or greater than .70. All five EFA factors were measured using Cronbach's alpha and all had a value greater than .80 except Factor 5, which achieved a value of .76 (see Table 4.11). In addition to the EFA factors achieving the required threshold of .70, the factors also indicated a strong internal consistency especially the first four factors.

Table 4.9: Reliability measure for the EFA factors

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Cronbach's alpha	.919	.883	.893	.869	.766
Number of items	9	6	5	4	3

4.9. Inter-Factor Correlation

To validate test interpretation, justify a novel measure, or establish construct validity, convergent validity and discriminant validity should be verified [(176)]. Convergent and discriminant validity are valuable, as both are used to assess extracted factors against each other [(177)]. According to Campbell [(176 p84)], the presumption is that a newly developed construct is distinct from other constructs; therefore, "One cannot define without implying distinctions, and the verification of these distinctions is an important part of the validation process". Furthermore, according to Kline [(166)], when a set of variables are assumed to be measuring different constructs, discriminant validity is established if:

1. Item coefficients are loading relatively highly on a specific factor, which was achieved.
2. The estimated correlation coefficients between the different factors are not excessively high, with a value greater than .85. In other cases, .90 or greater is relatively problematic [(162)].

On the other hand, when a set of variables are assumed to be measuring the same construct, convergent validity is established if the correlation coefficients reach at least a moderate magnitude [(162)].

The Pearson correlation coefficient was used to measure the inter-factor correlation between the five factors in the EFA study. The sample size for the EFA data, level of significance, and Pearson correlation coefficients are presented in Table 4.12. The correlation coefficients ranged from r = .53 to r = .73 for the five factors. Factor 1 demonstrated a relatively higher level of correlation with other factors. The highest correlation coefficient was identified for Factor 1 "professionalism" and Factor 4 "clinical" at r = .73, while the weakest correlation coefficients were with Factor 5 "personal". The only correlation coefficients which had a value less than $r = .60$ were Factor 3 “communication” ($r = .59$) and Factor 4 “clinical” ($r = .53$), in both cases when correlated with Factor 5 “personal”. All correlation coefficients were positive and all EFA factors were significantly correlated with each other, suggesting strong convergent validity.

Table 4.10: Pearson Correlation Coefficients for the EFA Factors

		Factor 1	**Factor 2**	**Factor 3**	**Factor 4**	**Factor 5**
Factor 1	Pearson Correlation	1	.724**	.716**	.734**	.633**
	Sig. (2-tailed)		.000	.000	.000	.000
	N	450	450	450	450	450
Factor 2	Pearson Correlation	.724**	1	.684**	.618**	.636**
	Sig. (2-tailed)	.000		.000	.000	.000
	N	450	450	450	450	450
Factor 3	Pearson Correlation	.716**	.684**	1	.680**	.590**
	Sig. (2-tailed)	.000	.000		.000	.000
	N	450	450	450	450	450
Factor 4	Pearson Correlation	.734**	.618**	.680**	1	.530**
	Sig. (2-tailed)	.000	.000	.000		.000
	N	450	450	450	450	450
Factor 5	Pearson Correlation	.633**	.636**	.590**	.530**	1
	Sig. (2-tailed)	.000	.000	.000	.000	
	N	450	450	450	450	450

**. Correlation is significant at the 0.01 level (2-tailed).

The Pearson correlation can be used as a simple measurement to compare factors [178]. However, since variables usually do not load perfectly on a factor, a factor with many small loadings that have some correlations to other factors can cause an increase in the correlation between factors, even if the more important variables are highly loading on one factor [178]. This is evident when looking at the correlations for Factor 1, as the only correlation coefficients above $r = .7$ were in this factor, which had the largest number of variables. Nevertheless, all five factors in the EFA study achieved discriminant validity by attaining a correlation of less than $r = .85$, and convergent validity was identified, as all factors were at least moderately correlated with each other at $r = .5$ or more, supporting the model in both convergent and discriminant validity.

4.10. Conclusion

At this stage a theoretical EFA model has been identified; the model consists of the most influential factors associated with EMS core competencies for Bachelor degree graduates in Saudi Arabia. The EFA model could not be considerably validated unless the model fit was tested through CFA, but it did show the most important variables correlated with the model.

4.11. Confirmatory Factor Analysis

Jöreskog (163) suggested a hypothesised model should be established through exploratory methods, which must then be statistically confirmed with a different dataset. According to Hair (162), the direct method of validating results is to split the data in half and confirm the results with CFA. Both approaches were followed in this study. The aim of CFA is to view how well the proposed factors and variables explain the data (116). Consequently, the CFA method was performed to determine if the hypothesised theoretical structure fit the available empirical data indices (see Table 4.13) (151). Principally, the CFA was used to examine the EFA with the assumption that each observed variable only loaded on the projected factor, otherwise known as a latent variable. The analysis involved testing the theorised EFA model with a congeneric approach, where each factor and associated observed variables were tested separately before combining the entire model for analysis. Observed variables were accounted for due to the correlation associated with an underlying latent factor. By the same rationale, since all EFA factors or latent variables in structural equation modelling (SEM) were strongly correlated with each other, there was a strong indication that a higher-order underlying construct was the cause of this correlation (161). A hierarchical higher order analysis can be a more accurate presentation of reality than first order factor analyses alone (179). Therefore, the CFA was used to test the final model fit with a higher order factor categorised as “paramedic competency”.

Table 4.11: Acceptable model fit indices for CFA

Fit indices	Model fit value
CMIN/DF	< 5.0
RMSEA, SRMR	$\leq$.08
NFI, CFI, TLI	$\geq$.90

Note: CMIN/DF = ratio of $\chi 2$ to the degrees of freedom, RMSEA = root mean square error of approximation, SRMR = standardised root mean square residual, NFI = Bentler-Bonett normed fit index, CFI = comparative fit index, and TLI = Tucker-Lewis Index.

4.12. Higher Order Factor

A second order factor, sometimes called a higher order factor, was first proposed by Schmid (180) in 1957 based on the mathematical rationale developed by Tucker (181) in 1940. The development of the higher order factor provides a hierarchical factor solution that is a natural evolution of the bi-factor solution, which includes a designation of sub-groups for the group factors. In contrast to the bi-factor solution or the group factor method by Burt (182), which provides a successive clustering of the variables according to an identified sign pattern via a centroid solution, the hierarchical factor solution is dependent on a successively acquired higher order factor solution (144,180). According to Schmid (180), the concept of psychological behaviour is assumed to be conducted in different levels of complexity. A less complex behavioural activity is one part of an assembly of progressively more complex behaviours which can have practical, psychological, or semantic meanings (180). In this regard, the concept of EMS core competency can be viewed as part of a hierarchical continuum. That is, the observed core competency variables can be viewed as less complex practical or psychological behaviours, which may be directly measurable, such as English proficiency, theoretical knowledge, or clinical skills. Moreover, the five extracted factors from the EFA analysis, such as professionalism and preparedness, can be viewed as the more complex psychological behaviours that may not be directly measurable but might be indirectly assessed through their respective observed variables. Finally, the higher order factor, which represents an abstract concept of paramedic competency, provides a highly complex construct that can be regarded as holding a semantic meaning.

As an example of the hierarchical pattern identified in factor analysis, Schmid (180) cited the work by Vernon (183), where the mental structure of British navy and army recruits was assessed with a range of cognitive tests. As an output of the centroid factor loading sign pattern, one factor was identified in all the administered tests. The factor was named “g”; when “g” was eliminated, two main test groups were identified, namely “practical” and “academic”. The “practical” test group could be further broken down into spatial, mechanical, and physical factors. The academic factor could be broken down into numerical, verbal, and educational factors [(180,183)]. According to Schmid [(180)], structuring the cognitive tests in such a hierarchical set of factors has many positive attributes. A hierarchical structure provides information about the classification of cognitive tests and the behaviours they measure in a variable order of dependence and concurrence [(180)]. Moreover, higher order analysis provides additional viewpoints on the dataset and an opportunity for improved generalisation [(179)]. Therefore, as there was no identifiable CFA model proposed for EMS core competency, and with a strong correlation between all extracted factors in the EFA model, the researcher has proposed a hierarchical structure with a higher order factor representing an abstract concept to be further tested using a full CFA model.

4.13. Factor 1: Professionalism

The first CFA SEM model was for the factor “professionalism”, which was measured using nine observed variables, one latent variable, and nine error estimates. The loading of the observed variable Q2.27 (“Be flexible in learning from different sources including guidance from other colleagues”) was fixed with a value of 1 for model identification, as this was the highest loading observed variable in the “professionalism” model with a standardised regression weight value of .86. The maximum likelihood SEM estimation was used, and the results of the first CFA model presented an adequate SEM model fit within the acceptable fit index ranges. The model fit results were presented as $\chi 2$ value of 127.80 (df = 27, p = .00), CMIN/DF 4.73, RMSEA .08, NFI .96, TLI .95, CFI .96, and a SRMR of .02. The "professionalism" model achieved satisfactory fit without alteration and was further tested as part of the entire model.

4.14. Factor 2: Preparedness

The second CFA SEM model was for the factor "preparedness", which was measured using six observed variables, one latent variable, and six error estimates. The loading of the observed variable Q2.40 ("Be able to effectively practice in Umrah and Hajj") was fixed with a value of 1 for model identification, as this was the highest loading observed variable in the "preparedness" model with a standardised regression weight value of .83. The maximum likelihood SEM estimation was used, and the results of the second CFA model presented an inadequate SEM model fit outside acceptable fit index ranges. The modification indices were inspected, and one potential covariance in the model was found between e14 and e10, indicating a link between e14 ("Be able to prepare for and manage disasters and terrorist incidents'") and e10 ("Be able to demonstrate an understanding of new technologies for clinical practice"). After accounting for the single covariance in the model, the results of the second CFA model presented an adequate SEM model fit within the acceptable fit index ranges. The model fit results were presented as $\chi 2$ value of 15.97 (df = 8, p = .04), CMIN/DF 1.99, RMSEA .04, NFI .99, TLI .99, CFI .99, and a SRMR of .01. The "preparedness" model achieved satisfactory fit and was tested as part of the entire model.

4.15. Factor 3: Communication

The third CFA SEM model was for the factor "communication", which was measured using five observed variables, one latent variable, and five error estimates. The loading of the observed variable Q2.4 ("Be information literate, by having the capacity to search and apply information") was fixed with a value of 1 for model identification, as this was the highest loading observed variable in the "communication" model with a standardised regression weight value of .86. The maximum likelihood SEM estimation was used, and the results of the third CFA model presented an inadequate SEM model fit outside acceptable fit index ranges. The modification indices were inspected, and two potential covariances in the model were found between e19 and e18 and between e19 and e16, indicating a link between e19 ("Be able to effectively communicate information verbally and non-verbally to patients, colleagues and others") and both e16 ("Be able to practice with respect and non-discriminatory manner") and e18 ("Be able to work as part of a team in a collaborative and professional approach"). After accounting for the two covariances in the model, the results of the third CFA model presented an adequate SEM model fit within the acceptable fit index ranges. The model fit results were presented as $\chi 2$ value of 9.26 (df = 3, p = .02), CMIN/DF 3.08, RMSEA .06, NFI .99, TLI .98, CFI .99, and a SRMR of .01. The "preparedness" model achieved satisfactory fit and was tested as part of the entire model.

4.16. Factor 4: Clinical

The fourth CFA SEM model was for the factor "clinical", which was measured using four observed variables, one latent variable, and four error estimates. The loading of the observed variable Q2.9 ("Be able to conduct appropriate decision-making and critical thinking") was fixed with a value of 1 for model identification, as this was the highest loading observed variable in the "clinical" model with a standardised regression weight value of .84. The maximum likelihood SEM estimation was used, and the results of the fourth CFA model presented an inadequate SEM model fit outside acceptable fit index ranges. The modification indices were inspected, and one potential covariance in the model was found between e21 and e23, indicating a link between e21 ("Be able to provide appropriate and effective clinical care") and e23 ("Be able to maintain appropriate and effective safety procedures"). After accounting for the single covariance in the model, the results of the fourth CFA model presented an adequate SEM model fit within the acceptable fit index ranges. The model fit results were presented as $\chi 2$ value of 2.85 (df = 1, p = .09), CMIN/DF 2.85, RMSEA .62, NFI .99, TLI .98, CFI .99, and a SRMR of .00. The "clinical" model achieved satisfactory fit and was tested as part of the entire model.

4.17. Factor 5: Personal

The fifth CFA SEM model was for the factor "personal", which was measured using three observed variables, one latent variable, and three error estimates. The loading of the observed variable Q2.31 ("Understand the need to maintain an appropriate level of physical and mental fitness") was fixed with a value of 1 for model identification, as this was the highest loading observed variable in the "clinical" model with a standardised regression weight value of .87. As this model was made up of only three observed variables, another loading was fixed with a value of 1. The observed variable was Q2.30 and had a standardised regression weight value of .85. The maximum likelihood SEM estimation was used, and the results of the fifth CFA model presented an adequate SEM model fit within acceptable fit index ranges. The model fit results were presented as $\chi 2$ value of 2.34 (df = 1, p = .12), CMIN/DF 2.34, RMSEA .53, NFI .99, TLI .99, CFI .99, and a SRMR of .00. The "personal" model achieved satisfactory fit without alteration and was tested as part of the entire model.

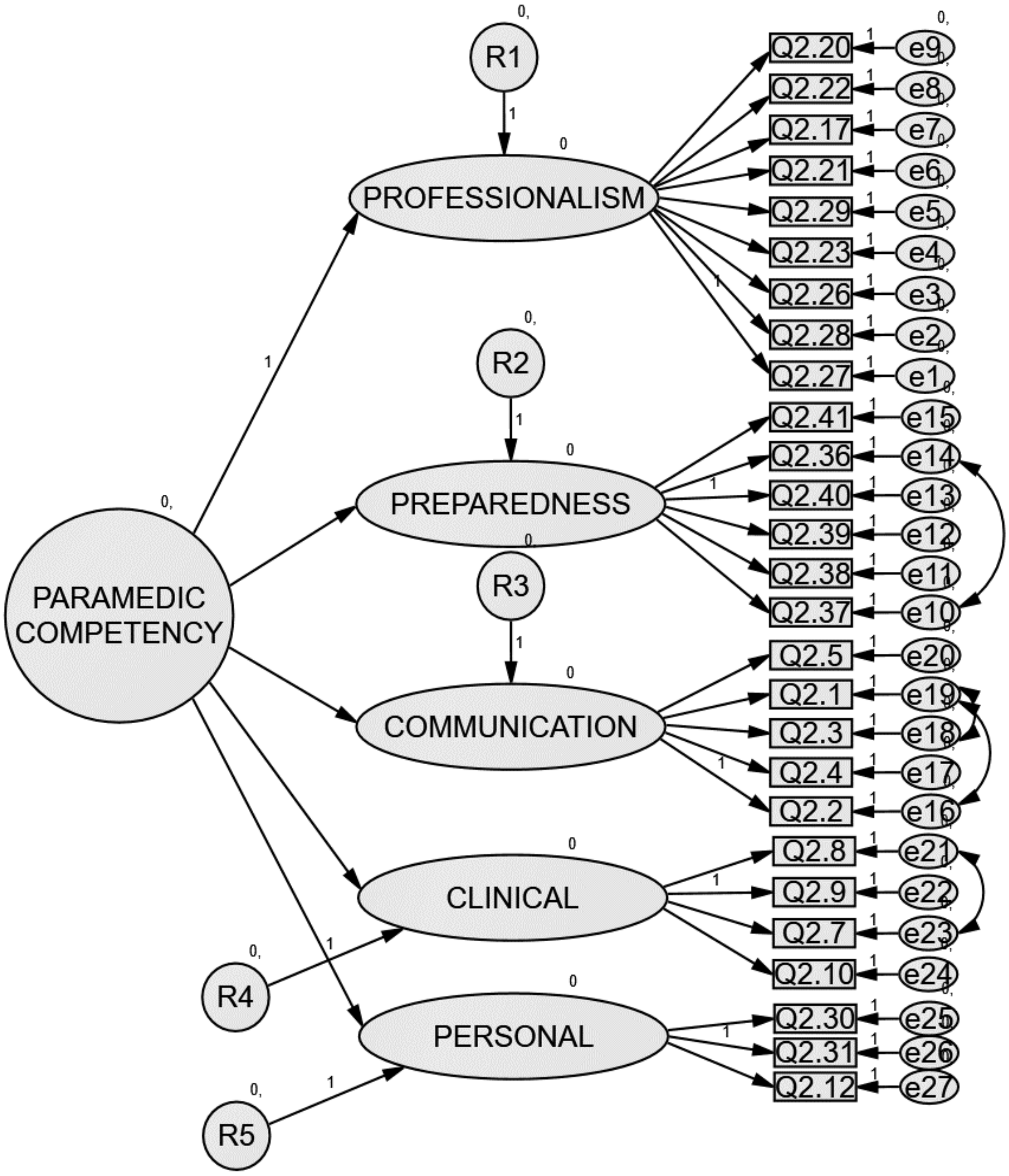
4.18. Complete SPECS Model Fit

The final SEM model, “paramedic competency”, presents an abstract second order factor, sometimes called a higher order factor (see Figure 4.2). The model is represented by the overarching inclusive higher order factor “paramedic competency” with five latent variables: professionalism, preparedness, communication, clinical, and personal. The first order latent variables are represented with 27 observed variables split into nine, six, five, four, and three observed variables, respectively. The final model contains 32 error estimates divided by five for each of the first order latent variables and 27 for the observed variables. The loading of the first order latent variable “professionalism” and the observed variables Q2.31, Q2.40, Q2.4, Q2.9, and Q2.31 were all fixed with a value of 1 for model identification, as these were the highest loading variables for each measured latent variable of the first and second order in the model. As per the modification indices from the previous congeneric model, four covariances were accounted for between e14 and e10, e19 and e18, e19 and e16, and e21 and e23. The maximum likelihood SEM estimation was used, and the results of the final CFA model presented an adequate SEM model fit within acceptable fit index ranges. The model fit results were presented as $\chi 2$ value of 959.88 (df = 315, p = .00), CMIN/DF 3.04, RMSEA .06, NFI .91, TLI .93, CFI .94, and a SRMR of .03. The model achieved satisfactory fit without alteration.

The reliability and validity of the scale were supported. In addition to Cronbach’s alpha, the item reliability was tested using the squared multiple correlation. The conventional cut-off point for the squared multiple correlation is any value below .5 [184]. All observed variables in the scale achieved a value of .5 or more, with the lowest scoring item being Q2.1 with a value of .5. These results indicated the underlying factors roughly explained at least 50% of the variance in each observed variable. In addition, unidimensionality of the scale was achieved, as all factor loading were above the loading value of .5 and were positively loading [185-187].

Convergent validity was supported, as the minimum standardised regression weight for each observed variable achieved a value of .7 or more, with the lowest value being .7 for item Q2.1 [184]. Finally, construct validity was established, as an adequately fitting model in CFA represents a confirmation of construct validity [184]. Overall, the CFA results for the complete SPECS model represented a good fitting model. Since all fit indices met the commonly acceptable fit values, these results verified an acceptable fit for the SPECS model with regards to the national study dataset.

Figure 4.2: The Saudi ParamEdic Competency Scale (SPECS) Complete Model



4.19. Descriptive Analysis of the Factors

The overall outcome of the national study data via EFA and CFA identified and confirmed five latent constructs (factors) under the "paramedic competency" higher order construct: professionalism, preparedness, communication, clinical, and personal. To develop an understanding of the SPECS model following the output of the EFA and CFA, the five factors are presented with the measure of frequency, central tendency (mean, median, and mode), and standard deviation or interquartile ranges. These descriptive statistics are an extension of the demographic descriptive statistics presented earlier in the chapter. The demographics and five SPECS model factors are then analysed using inferential statistics.

4.20. Factor 1: Professionalism

The nine core competencies of the professionalism factor are described in terms of mean, standard deviation, and sample size in Table 4.14. The core competency statements were based on a 10-point Likert scale with 1 being "not important at all" and 10 being "extremely important". The combined nine items representing the first factor achieved a mean of 8.61 (*SD* = 1.39), indicating a high favourability among EMS professionals for the nine statements and by extension the professionalism factor. Moreover, all items had a mean above 8.0, further indicating their desirability. The statement with the highest mean in the professionalism factor was Q2.26 ("Be able to maintain the appropriate personal characteristics of being trustworthy and accountable") (*M* = 8.68, *SD* = 1.62).

The other eight items represented the ability to work in different transportation modes, practise within legal and ethical boundaries, engage in evidence-based practice, maintain coping skills under stress, work as an autonomous professional with good judgment, learn from a variety of sources, maintain proper safety procedures, and have a commitment to lifelong learning and professional development. The items in Factor 1 best represented the professionalism domain for a Saudi EMS graduate, as confirmed by EFA and CFA.

Table 4.12: Descriptive Statistics for Professionalism Factor 1

	M	*SD*	*N*
Be able to maintain the appropriate personal characteristics of being trustworthy and accountable. (Item 26)	8.68	1.62	927
Be able to work in different transportation modes (Item 29)	8.67	1.71	927
Be able to practise within the legal and ethical boundaries of the profession (Item 22)	8.63	1.70	927
Be able to provide care according to evidence based practice (Item 17)	8.63	1.77	927
Be able to maintain good coping skills to deal with stressful situations (Item 20)	8.62	1.73	927
Be able to work as autonomous professionals with high levels of personal professional judgment (Item 28)	8.60	1.74	927
Be flexible in learning from different sources including guidance from other colleagues (Item 27)	8.60	1.68	927
Be able to maintain appropriate and effective safety procedures (Item 23)	8.57	1.82	927
Be committed to a process of continuous lifelong learning and professional development (Item 21)	8.54	1.78	927

4.21. Factor 2: Preparedness

The six core competencies of the preparedness factor are described statistically in Table 4.15. The core competency statements were based on a 10-point Likert scale. The combined six items representing the third factor achieved a mean of 8.71 (*SD* = 1.39), indicating a high favourability among EMS professionals for the statements and by extension the preparedness factor. Moreover, all items had a mean above 8.0, further indicating their desirability. The statement with the highest mean in the preparedness factor was Q2.36 ("Be able to prepare for and manage disasters and terrorist incidents") (*M* = 8.98, *SD* =1.64).

The other five items represented the ability to understand new technology, recognise appropriate Islamic values, practise during Umrah and the Hajj, maintain public and community health, and demonstrate English proficiency. The items in Factor 2 best represented the preparedness domain for Saudi EMS graduates, as confirmed by EFA and CFA.

Table 4.13: Descriptive Statistics for Preparedness Factor 2

	M	*SD*	*N*
Be able to prepare for and manage disasters and terrorist incidents (Item 36)	8.98	1.64	927
Be able to demonstrate an understanding of new technologies for clinical practice (Item 37)	8.73	1.65	927
Be able to practice with appropriate Islamic values (Item 38)	8.70	1.72	927
Be able to effectively practice in Umrah and Hajj (Item 40)	8.65	1.75	927
Be able to maintain involvement with public and community health (Item 39)	8.62	1.70	927
Be able to demonstrate English Language proficiency to an adequate level for appropriate professional communication (Item 41)	8.61	1.78	927

4.22. Factor 3: Communication

The five core competencies of the communication factor are described statistically in Table 4.16. The core competency statements were based on a 10-point Likert scale. The combined five items representing the third factor achieved a mean of 8.54 (*SD* = 1.53), indicating a high favourability among EMS professionals for the five statements and by extension the communication factor. Moreover, all items had a mean above 8.0, further indicating their desirability. The statement with the highest mean in the communication factor was Q2.3 (“Be able to work as part of a team in a collaborative and professional approach”) (*M* = 8.59, *SD* = 2.0).

The other four items represented the ability to communicate verbally and non-verbally, demonstrate information literacy by searching and applying information, provide care respectfully without discrimination, and demonstrate leadership skills. The items in Factor 3 best represented the communication domain for a Saudi EMS graduate, as confirmed by EFA and CFA.

Table 4.14: Descriptive Statistics for Communication Factor 3

	M	*SD*	*N*
Be able to effectively communicate information verbally and non-verbally to patients, colleagues and others (Item 1)	8.57	2.02	927
Be able to practice with respect and non-discriminatory manner (Item 2)	8.51	1.81	927
Be able to work as part of a team in a collaborative and professional approach (Item 3)	8.59	1.78	927
Be information literate, by having the capacity to search and apply information (Item 4)	8.55	1.77	927
Be able to demonstrate leadership skills (Item 5)	8.50	1.75	927

4.23. Factor 4: Clinical

The four core competencies of the clinical factor are described statistically in Table 4.17. The core competency statements were based on a 10-point Likert scale. The combined four items representing the fourth factor achieved a mean of 8.51 (*SD* = 1.52), indicating a high favourability among EMS professionals for the four statements and by extension the clinical factor. Moreover, all items had a mean above 8.0, further indicating their desirability. The statement with the highest mean in the clinical factor was Q2.8 (“Be able to provide appropriate and effective clinical care”) (*M* = 8.55, *SD* = 1.81).

The other three items represented the ability to solve problems, retain appropriate theoretical knowledge, and perform decision-making and critical thinking. The items in Factor 4 best represented the clinical domain for a Saudi EMS graduate, as confirmed by EFA and CFA.

Table 4.15: Descriptive Statistics for Clinical Factor 4

	M	*SD*	*N*
Have the theoretical knowledge of key concepts in the EMS profession (Item 7)	8.49	1.81	927
Be able to provide appropriate and effective clinical care (Item 8)	8.55	1.72	927
Be able to conduct appropriate decision-making and critical thinking (Item 9)	8.48	1.78	927
Be able to problem-solve, by assessing professional issues and calling upon the required experience and knowledge to resolve them (Item 10)	8.54	1.74	927

4.24. Factor 5: Personal

The three core competencies of the personal factor are described statistically in Table 4.18. The core competency statements were based on a 10-point Likert scale. The combined three items representing the fifth factor achieved a mean of 8.82 (*SD* = 1.42), indicating a high favourability among EMS professionals for the three statements and by extension the personal factor. Moreover, all items had a mean above 8.0, further indicating their desirability. The statement with the highest mean in the personal factor was Q2.30 (“Be able to maintain an appropriate level of training through different professional courses”) (*M* = 8.91, SD = 1.76).

The other two items represented the ability to manage personal emotions and understand the need for physical and mental fitness. The items in Factor 5 best represented the personal domain for a Saudi EMS graduate, as confirmed by EFA and CFA.

Table 4.16: Descriptive Statistics for Personal Factor 5

	M	*SD*	*N*
Be able to manage personal emotions and those of patients and relatives (Item 12)	8.81	1.76	927
Be able to maintain an appropriate level of training through different professional courses (Item 30)	8.91	1.60	927
Understand the need to maintain an appropriate level of physical and mental fitness (Item 31)	8.74	1.61	927

4.25. Inferential Analysis of the Factors

This section presents the inferential results pertaining to the confirmed SPECS model factors. The five factors of professionalism, preparedness, communication, clinical, and personal were compared in terms of central tendency to the demographic groups of gender, age, qualifications, experience, medical discipline, main professional role, and nationality. A non-parametric analysis was used. The assumptions for a parametric analysis were not met, as the sample sizes for some of the groups were smaller than 20. According to the recommendations of Simmons (188) and Pallant (140), a minimum of 20 participants are required to provide sufficient power for the data analysis. Moreover, the data were not normally distributed for a parametric data analysis technique.

The inferential statistics were analysed through the Mann-Whitney U test and Kruskal-Wallis H test. The significance of relationships among variables was set at $p \leq .05$. Although the Kruskal-Wallis H test can provide a significant result for demographic data in relation to the SPECS factors, the Kruskal-Wallis H test cannot detect which groups are significantly different from each other (140). Therefore, a post hoc Dunn pairwise analysis with a Bonferroni adjustment to the alpha level was conducted for each significant factor, where each pair of groups was tested to identify the significance level for each pairwise relation.

The Bonferroni adjustment involved setting a more stringent level for the alpha in every comparison, where the alpha level .05 was divided by the number of comparisons [140,189,190]. According to Pallant [140], the Mann-Whitney U test can be used after the Kruskal-Wallis H test to further analyse each significant relationship and identify the effect size of each comparison.

Most groupings of independent demographic variables had enough participants for a non-parametric significance test. The two exceptions were primary medical discipline and nationality. For primary medical discipline, most participants identified as paramedic (585), nurse (257), or physician (83), with only one participant for public health and one for pharmacist. Since these fields were not related to paramedic, nurse, or physician and thus could not be joined to them, these two participants were removed from the Kruskal-Wallis H test. The nationalities of adequate size were Saudi (792), Egyptian (53), Jordanian (41), and Syrian (21), while Indian (11), Sudanese (5), Pakistani (3), and Filipino (1) were too small for the test. The solution was to merge the nationalities into three groups: Arab (Egyptians, Jordanians, Syrians, Sudanese), non-Arab (Indians, Pakistanis, Filipino), and Saudi.

4.26. Gender and the SPECS Model Factors

The first inferential analysis of the SPECS model factors was conducted for gender. This independent variable was split between male and female participants. As there were only two groups, the association between gender and confirmed factors was examined via the Mann-Whitney U test, which revealed a significant difference in four of the five factors, $p < 0.05$, as shown in Table 4.19. The effect size for the Mann-Whitney U test was measured using the Cohen [191] criteria by dividing the population by the square root of the standardised test statistic [140].

The Mann-Whitney U test revealed a significant difference in terms of professionalism between male (n = 866) and female (n = 61) participants, p = .005. A significant difference was likewise found in terms of preparedness (p = .000), communication (p = .000), and clinical factors (p = .000). However, no significant difference was found for the personal factor (p = .805).

Table 4.17: Mann-Whitney U Tests for SPECS Model Factors According to Gender

Construct	**Factor 1**		**Factor 2**		**Factor 3**		**Factor 4**		**Factor 5**	
Group	M	F	M	F	M	F	M	F	M	F
N	866	61	866	61	866	61	866	61	866	61
U	20783.50		18113.00		15451.50		18277.50		25920.00	
z	-2.791		-4.12		-5.44		-4.04		-.24	
p	.005		.000		.000		.000		.805	
r	.09		.13		.17		.13		Non-significant	
MR	470.50	371.71	473.58	327.93	476.66	284.30	473.39	330.63	464.57	455.92
Md	8.88	8.44	9.00	8.33	9.00	8.00	8.75	8.00	9.00	9.33

4.27. Age and the SPECS Model Factors

The second inferential analysis of the SPECS model factors was based on participant age. This independent variable was divided into four groups: 18-28, 29-39, 40-49, and 50 or above. As there were more than two groups, the association between age and confirmed factors was examined via the Kruskal-Wallis H test, which revealed a significant difference between age and the first four factors at < 0.05, as shown in Table 4.20.

Kruskal-Wallis H tests showed a significant difference in professionalism with a $\chi2$ value of 11.73 (df = 3, n = 927), p = .008, and preparedness with a $\chi2$ value of 8.24, p = .041. A trend in mean rank was identified, where the younger the age group, the higher the mean rank was. Similarly, a significant difference was found between age and communication with a $\chi2$ value of 26.02, p = .000. A trend in the mean rank was also identified with younger groups having a higher mean rank, except for the “50 or above” group, which was slightly higher than the 40-49 group. A significant difference in the clinical factor was found with a $\chi2$ value of 11.88, p = .008, with the younger groups being more likely to have a higher mean rank.

No significant difference was found regarding the personal factor based on age, with a $\chi 2$ value of 6.00, p = .111, but like the other factors, younger groups corresponded to a higher mean rank.

After the Kruskal-Wallis H tests, a post hoc Dunn pairwise analysis with a Bonferroni adjustment to alpha level was conducted for each significant factor. The Bonferroni adjustment indicated an acceptable p value of .008 based on six pairwise comparisons for each significant factor. In total, 24 different comparisons were analysed, only four of which achieved the required adjusted p value. The next step was to perform a Mann-Whitney U test for each of the significant comparisons, as presented in Table 4.21.

Table 4.18: Kruskal-Wallis H Tests for SPECS Model Factors According to Age

Construct	**Age Group**	***N***	**$\chi 2$**	**df**	***p***	**MR**	**Md**
Factor 1	18-28	230	11.73	3	.008	481.89	8.88
	29-39	552				473.92	8.88
	40-49	122				407.73	8.77
	50 or above	23				345.37	8.55
Factor 2	18-28	230	8.24	3	.041	488.82	9.00
	29-39	552				468	9.00
	40-49	122				411.68	8.83
	50 or above	23				397.37	8.50
Factor 3	18-28	230	26.02	3	.000	521.69	9.00
	29-39	552				462.59	9.00
	40-49	122				375.14	8.60
	50 or above	23				392.17	8.40
Factor 4	18-28	230	11.88	3	.008	508.25	9.00
	29-39	552				458.61	8.75
	40-49	122				419.39	8.75
	50 or above	23				387.43	8.50
Factor 5	18-28	230	6.00	3	.111	493.49	9.33
	29-39	552				461.90	9.00
	40-49	122				426.64	9.00
	50 or above	23				417.57	9.00

The Mann-Whitney U tests revealed a significant difference in terms of communication for the 29-39 and 40-49 groups (U = 27021.5, p = .001), 18-28 and 49-50 groups (U = 9812, p = .000), 18-28 and 29-39 groups (U = 55089, p = .003), and 18-28 and 40-49 groups (U = 11489, p = .005).

Table 4.19: Mann-Whitney U Tests Following Kruskal-Wallis H Tests for Age

Construct	**Factor 3**		**Factor 3**		**Factor 3**		**Factor 4**	
Group	29-39	40-49	18-28	40-49	18-28	29-39	18-28	40-49
N	552	122	230	122	230	552	230	122
U	27021.50		9812		55089		11489	
z	3.43		-4.66		-2.93		-2.81	
p	.001		.000		.003		.005	
r	.12		.25		.10		.15	
MR	349.55	282.99	194.84	141.93	427.98	376.30	187.55	155.67

4.28. Education and the SPECS Model Factors

The third inferential analysis of the SPECS model factors was based on participant education level. This independent variable was divided into four groups, indicating the highest education each participant had obtained: certificate, diploma, Bachelor degree, Master degree, and PhD. As there were more than two groups, the association between education and confirmed factors was examined via the Kruskal-Wallis H test, which revealed a significant difference for all five factors at < 0.05, as shown in Table 4.22.

The Kruskal-Wallis H test showed a significant difference in all education levels for professionalism with a $\chi 2$ value of 18.12 (df = 4, n = 927), p = .001. The mean rank was highest for certificate and diploma and lowest for the Bachelor degree group. Further tests showed a significant difference in all education levels for preparedness with a $\chi 2$ value of 29.79 (p = .000), communication with a $\chi 2$ value of 28.31 (p = .000), and clinical with a $\chi 2$ value of 19.4 (p = .001). In these three tests, the mean rank was highest for certificate and diploma and lowest for the PhD group. The fifth test showed a significant difference in all education levels for personal with a $\chi 2$ value of 23.45 (p = .000). In this case, the mean rank was highest for certificate and diploma and lowest for the Master group.

Table 4.20: Kruskal-Wallis H Tests for SPECS Model Factors According to Education

Construct	**Education**	***N***	**χ2**	**df**	***p***	**MR**	**Md**
Factor 1	Certificate	68	18.12	4	.001	580.24	9.61
	Diploma	707				463.42	8.88
	Bachelor	114				411.99	8.77
	Master	24				417.19	8.66
	PhD	14				432.29	8.11
Factor 2	Certificate	68	29.79	4	.000	611.11	9.75
	Diploma	707				463.33	9.00
	Bachelor	114				403.19	8.75
	Master	24				423.15	8.83
	PhD	14				348.43	8.00
Factor 3	Certificate	68	28.31	4	.000	607.70	9.80
	Diploma	707				461.74	9.00
	Bachelor	114				420.83	8.80
	Master	24				420.13	8.90
	PhD	14				307.04	7.30
Factor 4	Certificate	68	19.40	4	.001	588.63	10.00
	Diploma	707				461.58	9.00
	Bachelor	114				425.12	9.00
	Master	24				407.54	8.50
	PhD	14				394.14	9.33
Factor 5	Certificate	68	23.45	4	.000	602.71	10.00
	Diploma	707				457.01	9.00
	Bachelor	114				448.35	9.00
	Master	24				356.67	8.50
	PhD	14				454.71	9.33

Following the Kruskal-Wallis H tests, a post hoc Dunn pairwise analysis with a Bonferroni adjustment to the alpha level was conducted with an acceptable *p* value of .005 based on 10 pairwise comparisons for each significant factor. In total, 50 different comparisons were analysed, and only 14 achieved the required adjusted *p* value. The next step was to perform a Mann-Whitney U test for each significant comparison, as presented in Table 4.23.

Table 4.21: Mann-Whitney U Tests Following Kruskal-Wallis H Tests for Education

Construct	**Comparison Number**	**Education**	***N***	**U**	***z***	***p***	***r***	**MR**
Factor 1	1	Certificate	68	17787.5	-3.55	.000	.12	479.92
		Diploma	707					379.16
	2	Certificate	68	2637	-3.62	.000	.27	109.72
		Bachelor	114					80.63
Factor 2	1	Certificate	68	16083	-4.53	.000	.16	504.99
		Diploma	707					376.75
	2	Certificate	68	2361.5	-4.45	.000	.32	113.77
		Bachelor	114					78.21
	3	Certificate	68	494.5	-2.94	.003	.30	51.23
		Master	24					33.10
Factor 3	1	Certificate	68	16249	-4.44	.000	.16	502.54
		Diploma	707					376.98
	2	Certificate	68	2451.5	-4.18	.000	.30	112.45
		Bachelor	114					79.00
	3	Certificate	68	489	-2.99	.003	.31	51.31
		Master	24					32.88
	4	Certificate	68	245	-2.98	.003	.37	44.90
		PhD	14					25.00
Factor 4	1	Certificate	68	17132.5	-3.94	.000	.14	489.55
		Diploma	707					378.23
	2	Certificate	68	2727.5	-3.40	.001	.26	108.39
		Bachelor	114					81.43
Factor 5	1	Certificate	68	502.16	-4.45	.000	.16	502.16
		Diploma	707					377.02
	2	Certificate	68	2684	-3.55	.000	.26	109.03
		Bachelor	114					81.04
	3	Certificate	68	468.5	-3.24	.001	.24	109.03
		Master	24					81.04

Professionalism had two Mann-Whitney U tests that showed a significant difference: certificate and diploma (U = 17787.5, p = .000) and certificate and Bachelor (U = 2637, p = .000). Preparedness had three tests that showed a significant difference: certificate and diploma (U = 16083, p = .000), certificate and Bachelor (U = 2361.5, p = .000), and certificate and Master (U = 494.5, p = .003). Communication had four tests that showed a significant difference: certificate and diploma (U = 16249, p = .000), certificate and Bachelor (U = 2451.5, p = .000), certificate and Master (U = 489, p = .003), and certificate and PhD (U = 245, p = .003). Clinical had two tests that showed a significant difference: certificate and diploma (U = 17132.5, p = .000) and certificate and Bachelor (U = 2727.5, p = .001). Personal had three tests that showed a significant difference: certificate and diploma (U =

502.16, p = .000), certificate and Bachelor (U = 2684, p = .000), and certificate and Master (U = 468.5, p = .001).

4.29. Experience and the SPECS Model Factors

The fourth inferential analysis of the SPECS model factors was based on participant experience. This independent variable was divided into three groups: 1-4, 5-9, and 10 or more years of experience. As there were more than two groups, the association between experience and confirmed factors was examined via the Kruskal-Wallis H test, which revealed a significant difference in four out of five factors at < 0.05, as shown in Table 4.24.

Table 4.22: Kruskal-Wallis H Tests for SPECS Model Factors According to Experience

Construct	**Experience**	***N***	**$\chi2$**	**df**	***p***	**MR**	**Md**
Factor 1	1-4	315	6.77	2	.034	474.84	8.88
	5-9	508				470.38	8.88
	10+	104				400.00	8.66
Factor 2	1-4	315	3.57	2	.168	485.53	9.00
	5-9	508				456.23	9.00
	10+	104				436.73	9.00
Factor 3	1-4	315	12.81	2	.002	499.18	9.00
	5-9	508				456.23	9.00
	10+	104				395.38	8.60
Factor 4	1-4	315	13.13	2	.001	507.39	9.00
	5-9	508				445.02	8.75
	10+	104				425.29	8.62
Factor 5	1-4	315	7.05	2	.029	493.96	9.33
	5-9	508				453.33	9.00
	10+	104				425.38	9.00

The first Kruskal-Wallis H test showed a significant difference in professionalism for all three experience groups with a $\chi2$ value of 6.77, p = .034. In contrast, preparedness showed a non-significant difference with a $\chi2$ value of 3.57, p = .168. Kruskal-Wallis H tests showed a significant difference for all three experience levels in communication with a $\chi2$ value of 12.82 (p = .002), clinical with a $\chi2$ value of 13.13 (p = .001), and personal with a $\chi2$ value of 7.05 (p = .029). In all five cases, less experience was associated with a higher mean rank.

After the Kruskal-Wallis H tests, a post hoc Dunn pairwise analysis with a Bonferroni adjustment to alpha level was conducted for each significant factor. The Bonferroni adjustment indicated an acceptable *p* value of .016 based on three pairwise comparisons for each significant factor. In total, 12 different comparisons were analysed, and only five achieved the required adjusted *p* value. The next step was to perform a Mann-Whitney U test for each significant comparison, as presented in Table 4.25.

The Mann-Whitney U tests revealed a significant difference in professionalism with 1-4 and 10 or more years of experience (U = 13792.5, p = .015), professionalism with 5-9 and 10 or more (U = 22347, p = .013), communication with 1-4 and 10 or more (U = 12953, p = .001), clinical with 1-4 and 10 or more (U = 13801, p = .015), and clinical with 1-4 and 5-9 (U = 68920, p = .001).

Table 4.23: Mann-Whitney U Tests Following Kruskal-Wallis H Tests for Experience

Construct	**Factor 1**		**Factor 1**		**Factor 3**		**Factor 4**		**Factor 4**	
Group	1-4	10+	5-9	10+	1-4	10+	1-4	10+	1-4	5-9
N	315	104	508		315	104	315		315	508
U		13792.5		22347		12953		13801		68920
z		-2.42		-2.48		-3.21		-2.43		-3.362
p		.015		.013		.001		.015		.001
r		.12		.10		.16		.12		.12
MR	218.21	185.12	314.51	267.38	220.88	177.05	218.19	185.20	447.21	390.17

4.30. Discipline and the SPECS Model Factors

The fifth inferential analysis of the SPECS model factors was performed for the discipline demographic of the national study participants. This independent variable was divided into three groups, which are paramedic, nurse and physician. As there were more than two groups, the association between the discipline groups of the study participants and the confirmed factors was examined via the Kruskal-Wallis H test, which revealed a significant difference for two out of the five factors at < 0.05, as shown in Table 4.26.

The first Kruskal-Wallis H test showed no significant difference in professionalism based on discipline with a $\chi 2$ value of 1.85, p = .396. The highest mean rank was for paramedics (471.53) followed by physicians (460.42), and the lowest was for nurses (444.42). The second test showed no significant difference in preparedness with a $\chi 2$ value of 4.47, p = .107. The highest mean rank (476.89) was for paramedics followed by nurses (442.16), and the lowest was for physicians (429.62). The third test showed a significant difference in communication with a $\chi 2$ value of 12.97, p = .002. The highest mean rank was for paramedics (485.96) followed by nurses (432.11), and the lowest was for physicians (396.82). The fourth test showed a significant difference in clinical with a $\chi 2$ value of 11.33, p = .003. The highest mean rank was for paramedics (485.11) followed by physicians (439.48), and the lowest was for nurses (420.27). The fifth test showed no significant difference in personal with a $\chi 2$ value of .344, p = .842. The highest mean rank was for nurses (465.46) followed by paramedics (464.21), and the lowest was for physicians (446.86).

Table 4.24: Kruskal-Wallis H Tests for SPECS Model Factors According to Discipline

Construct	**Discipline**	***N***	**$\chi 2$**	**df**	***p***	**MR**	**Md**
Factor 1	Paramedic	585	1.85	2	.396	471.53	8.88
	Nurse	257				444.42	8.88
	Physician	83				460.42	9.00
Factor 2	Paramedic	585	4.47	2	.107	476.89	9.00
	Nurse	257				442.16	9.00
	Physician	83				429.62	9.00
Factor 3	Paramedic	585	12.97	2	.002	485.96	9.00
	Nurse	257				432.11	8.80
	Physician	83				396.82	8.80
Factor 4	Paramedic	585	11.33	2	.003	485.11	9..00
	Nurse	257				420.27	8.75
	Physician	83				439.48	8.75
Factor 5	Paramedic	585	.34	2	.842	464.21	9.00
	Nurse	257				465.46	9.00
	Physician	83				446.86	9.33

Following the Kruskal-Wallis H tests, a post hoc Dunn pairwise analysis with a Bonferroni adjustment to alpha level was conducted for each significant factor. The Bonferroni adjustment indicated an acceptable p value of .016 based on three pairwise comparisons for each significant factor. In total, six different comparisons were analysed, and only three achieved the required adjusted *p* value. The next step was to perform a Mann-Whitney U test for each significant comparison, as presented in Table 4.27.

The Mann-Whitney U tests showed a significant difference in communication with paramedics and nurses (U = 66239.5, p = .006), communication with paramedics and physicians (U = 19778, p = .006), and clinical with paramedics and nurses (U = 64383, p = .001).

Table 4.25: Mann-Whitney U Tests Following Kruskal-Wallis H Tests for Discipline

Construct	**Factor 3**		**Factor 3**		**Factor 4**	
Group	Paramedic	Nurse	Paramedic	Physician	Paramedic	Nurse
N	585	257	585	83	585	257
U	66239.5		19778		64383	
z	-2.76		-2.75		-3.34	
p	.006		.006		.001	
r	.10		.11		.12	
MR	436.77	386.74	342.19	280.29	439.94	379.52

4.31. Professional Role and the SPECS Model Factors

The sixth inferential analysis of the SPECS model factors was based on main professional role. This variable was divided into three groups: administrative/leadership, education/academic, and clinical/patient care. As there were more than two groups, the association between professional role and confirmed factors was examined via the Kruskal-Wallis H test, which revealed a significant difference in four out of five factors at < 0.05, as shown in Table 4.28.

The first Kruskal-Wallis H test showed no significant difference in professionalism in terms of main professional role with a $\chi 2$ value of 2.6, p = .273. The highest mean rank was for administrative/leadership (495.59) followed by clinical/patient care (460.45), and the lowest was for education/academic (454.41). The second test showed a significant difference in preparedness with a $\chi 2$ value of 8.16, p = .017. The highest mean rank was for administrative/leadership (505.56) followed by clinical/patient care (471.96), and the lowest was for education/academic (434.09). The third test showed a significant difference in communication with a $\chi 2$ value of 6.63, p = .036. The highest mean rank was for clinical/patient care (479.47) followed by administrative/leadership (479.47), and the lowest was for education/academic (433.55). The fourth test showed a significant difference in clinical with a $\chi 2$ value of 7.01, p = .030. The highest mean rank was for administrative/leadership (505.08) followed by clinical/patient care (469.64), and the lowest was for education/academic (437.5). The fifth test showed no significant difference in personal with a $\chi 2$ value of 16.11, p = .000. The highest mean rank was for administrative/leadership (543.21) followed by education/academic (452.68), and the lowest was for clinical/patient care (445.81).

Table 4.26: Kruskal-Wallis H Tests for SPECS Model Factors According to Role

Construct	**Professional role**	***N***	**$\chi 2$**	**df**	***p***	**MR**	**Md**
Factor 1	Administrative/Leadership	150	2.60	2	.273	495.59	8.94
	Education/Academic	328				454.41	8.88
	Clinical/Patient care	449				460.45	8.88
Factor 2	Administrative/Leadership	150	8.16	2	.017	505.56	9.16
	Education/Academic	328				434.09	9.00
	Clinical/Patient care	449				471.96	9.00
Factor 3	Administrative/Leadership	150	6.63	2	.036	479.47	9.00
	Education/Academic	328				433.55	9.00
	Clinical/Patient care	449				481.07	9.00
Factor 4	Administrative/Leadership	150	7.01	2	.030	505.08	9.00
	Education/Academic	328				437.50	8.75
	Clinical/Patient care	449				469.64	8.75
Factor 5	Administrative/Leadership	150	16.10	2	.000	543.21	9.33
	Education/Academic	328				452.68	9.00
	Clinical/Patient care	449				445.81	9.00

Following the Kruskal-Wallis H tests, a post hoc Dunn pairwise analysis with a Bonferroni adjustment to alpha level was conducted for each significant factor. The Bonferroni adjustment indicated an acceptable p value of .016 based on three pairwise comparisons for each significant factor. In total, 12 different comparisons were analysed, and only five achieved the required adjusted *p* value. The next step was to perform a Mann-Whitney U test for each significant comparison, as presented in Table 4.29.

The Mann-Whitney U tests revealed a significant difference in preparedness with administrative/leadership and education/academic (U = 20906, p = .008), communication with education/academic and clinical/patient care (U = 65915, p = .012), clinical with administrative/leadership and education/academic (U = 21129, p = .013), personal with administrative/leadership and education/academic (U = 19526.5, p = .000), and personal with administrative/leadership and clinical/patient care (U = 26866.5, p = .000).

Table 4.27: Mann-Whitney U Tests Following Kruskal-Wallis H Tests for Role

Construct	**Factor 2**		**Factor 3**		**Factor 4**		**Factor 5**		**Factor 5**	
Group	Admin	Edu	Edu	Clinical	Admin	Edu	Admin	Edu	Admin	Clinical
N	150	328	328	449	150	328	150	328	150	449
U		20906		65915		21129		19526.5		26866.5
z		-2.65		-2.51		-2.49		-3.66		-3.75
p		.008		.012		.013		.000		.000
r		.09		.09		.11		.17		.15
MR	264.12	228.24	365.46	406.20	262.64	228.92	273.32	224.03	345.39	284.84

4.32. Nationality and the SPECS Model Factors

The seventh inferential analysis of the SPECS model factors was based on nationality. This variable was divided into three groups: Saudi, Arab, and non-Arab. As there were more than two groups, the association between nationality and confirmed factors was examined via the Kruskal-Wallis H test, which revealed a significant difference in four out of five factors at < 0.05, as shown in Table 4.30.

The first Kruskal-Wallis H test showed a significant difference in professionalism with a $\chi 2$ value of 19.28, p = .000. The highest mean rank was for Saudis (479.72) followed by non-Arabs (415.60), and the lowest was for Arabs (366.28). The second test showed a significant difference in preparedness with a $\chi 2$ value of 24.17, p = .000. The highest mean rank was for Saudis (481.45) followed by non-Arabs (422.90), and the lowest was for Arabs (353.94). The third test showed a significant difference in communication with a $\chi 2$ value of 36.70, p = .000. The highest mean rank was for Saudis (485.78) followed by non-Arabs (376.43), and the lowest was for Arabs (331.20). The fourth test showed a significant difference in clinical with a $\chi 2$ value of 30.72, p = .000. The highest mean rank was for Saudis (483.67) followed by non-Arabs (415.83), and the lowest was for Arabs (340.18). The fifth test, however, showed no significant difference in personal with a $\chi 2$ value of 4.63, p = .099. The highest mean rank was for non-Arabs (489.20) followed by Saudis (470.83), and the lowest was for Arabs (415.80).

Table 4.28: Kruskal-Wallis H Tests for SPECS Model Factors According to Nationality

Construct	Nationality	*N*	χ2	df	*p*	MR	Md
Factor 1	Saudi	792	19.28	2	.000	479.72	8.88
	Arab	120				366.28	8.55
	Non-Arab	15				415.60	8.66
Factor 2	Saudi	792	24.17	2	.000	481.45	9.00
	Arab	120				353.94	8.50
	Non-Arab	15				422.90	8.83
Factor 3	Saudi	792	36.70	2	.000	485.78	9.00
	Arab	120				331.20	8.00
	Non-Arab	15				376.43	8.60
Factor 4	Saudi	792	30.72	2	.000	483.67	9.00
	Arab	120				340..18	8.00
	Non-Arab	15				415.83	8.50
Factor 5	Saudi	792	4.63	2	.099	470.83	9.00
	Arab	120				415.80	9.00
	Non-Arab	15				489.20	9.33

Following the Kruskal-Wallis H tests, a post hoc Dunn pairwise analysis with a Bonferroni adjustment to alpha level was conducted for each significant factor. The Bonferroni adjustment indicated an acceptable p value of .016 based on three pairwise comparisons for each significant factor. In total, 12 different comparisons were analysed, and only four achieved the required adjusted p value. The next step was to perform a Mann-Whitney U test for each significant comparison, as presented in Table 4.31.

The Mann-Whitney U tests revealed a significant difference among Saudis and Arabs in professionalism (U = 35935.5, p = .000), preparedness (U = 34442, p = .000), communication (U = 31758.5, p = .000), and clinical (U = 32847.5, p = .000).

Table 4.29: Mann-Whitney U Tests Following Kruskal-Wallis H Tests for Nationality

Construct	**Factor 1**		**Factor 2**		**Factor 3**		**Factor 4**	
Group	Saudi	Arab	Saudi	Arab	Saudi	Arab	Saudi	Arab
N	792	120	792	120	792	120	792	120
U	35935.5		34442		31758.5		32847.5	
z	-4.32		-4.88		-5.89		-5.48	
p	.000		.000		.000		.000	
r	.14		.16		.19		.18	
MR	471.13	359.96	473.01	347.52	476.40	325.15	475.03	334.23

4.33. Conclusion

This chapter described the statistical analysis of the national survey data concerning the core competencies of Saudi EMS graduates. The response rate and descriptive data were presented. The independent demographic variables were gender, age, qualifications, experience, medical discipline, main professional role, and nationality, and the dependant variables for the SPECS model consisted of 41 core competency statements. EFA was performed to use the exploratory capacity of the test to provide data reduction for the dependant variables and produce a theoretical model for the underlying processes. The dependant variables were reduced from 41 to 27, and a theoretical EFA model was identified with five factors: professionalism, preparedness, communication, clinical, and personal.

CFA was conducted to test how well the EFA model factors and variables explained the data. The CFA results for the complete SPECS model provided a good fitting SEM model. As all CFA fit indices met their respective generally acceptable fit values, the SPECS model's validity, reliability, and unidimensionality were confirmed. The SPECS model is an empirically developed, statistically tested instrument that could be adopted for any Bachelor program in Saudi Arabia. The seven independent demographic variables were also tested against the five confirmed SPECS model factors. Inferential statistical analyses were performed via Mann-Whitney U tests and Kruskal-Wallis H tests with post hoc analysis. The results identified 39 significant relationships, which are discussed in the next chapter along with the possible adaptation and integration of the SPECS model into Saudi EMS curricula.

Chapter 5: Discussion

5.1. Introduction

This study has sought to identify the most desirable emergency medical services (EMS) core competencies for Bachelor degree graduates in Saudi Arabia. Saudi university and college core competencies were identified in the initial study [58], and internationally desirable core competencies were extracted from research and international EMS associations in the second study [99]. Based on this research, the study instrument was developed and tested for face and content validity and followed by a Delphi study of key EMS leaders throughout Saudi Arabia in the third study. A national study of Saudi EMS providers was performed and captured a large sample of participants. A comprehensive statistical analysis of the national study data yielded a theoretical SPECS model through exploratory factor analysis (EFA) and a confirmation of the model through confirmatory factor analysis (CFA). Finally, the SPECS model factors were examined against the demographic data of the national study.

This chapter interprets the findings and explores their implications. The first section discusses the Delphi study results, the second discusses the EFA study in relation to similar competency frameworks, the third discusses the CFA framework and identified covariances, the fourth compares demographic variables to confirmed SPECS factors, and the final section describes the SPECS model and enabling of operationalisation into Saudi EMS curricula.

5.2. Delphi Study Consensus

The findings showed the Delphi methodology to be useful in establishing consensus about EMS core competencies. Within health research there is evidence of the Delphi method's usefulness since expert knowledge in different disciplines is held by a group of recognised field experts [111]. Moreover, educational research has often depended on the use of the Delphi method, especially for curriculum outcome development [73,132]. In the current study the method proved useful in overcoming the major disadvantages of nominal group techniques, including senior expert dominance, geographical distance, and difficulty reaching consensus [100].

Complete consensus was obtained in this study and all results were shown to be stable between rounds. The choice of a 75% consensus was decided upon prior to data collection, as it was expected that all items would be considered important for the newly established Saudi EMS education system [58]. As the core competency statements were extracted and clustered and duplicates removed from previous literature [58,99], the initial Delphi round for item generation was removed. Therefore, the study concentrated on the following two Delphi rounds to achieve item consensus.

The expert participants' overall ratings were high. However, five core competency statements emerged as the most important for Saudi EMS, namely legal and ethical practice, safety procedures, respect and non-discrimination, decision-making and critical thinking, and clinical practice. These results converged and diverged from previous research in other EMS settings [56,91]. When looking at the first concept of legal and ethical practice, a similarity can be observed with attributes from Australian graduates [91]. However, in the UK study by Kilner [56], the same law and ethics concept was only 30th in mean rank for paramedics, indicating a dissimilarity in the perception of importance between the UK and Saudi EMS systems. The importance of law and ethics can also be seen in the study by O'Brien [81] and the UK Health and Care Professions Council [93], which established an entire dimension for ethical and legal responsibilities, consisting of four and eight statements, respectively. According to the results of this study, legal and ethical EMS practice in Saudi Arabia represents the most important core competency, especially considering the nascent nature of the profession and the need to establish the associated legal structures.

Safety procedures were the second most important core competency for Saudi EMS. Overall, safety is the first step in any interaction between paramedics before and after arrival at a scene. Although not highly rated by UK paramedics (56) in the EMS field, safety remains a mandatory tenant of any professional EMS governing association (3,93,95,96).

Respect and non-discrimination were also important concepts for Saudi EMS in a country with a multi-cultural population, especially during the Hajj and Umrah. According to Spencer (85), the health outcomes of patients can deteriorate when medical professionals do not practice culturally appropriate care. The concept not only affects patient interaction but also other team members in their dealings with one another (62). In Saudi Arabia, EMS education should accommodate the need for education and training that represent societal needs, including a multi-cultural, multi-national, and multi-lingual workforce and community.

Decision-making and critical thinking were rated as the fourth most important core competency. This result was anticipated, as a previously conducted international literature review identified the same concept as the fourth most studied or endorsed core competency by eight different publications and professional EMS associations (99). Moreover, in the context of pre-hospital care, making critical decisions involves considerable cognitive and mental skills (56). In addition, the clinical duties of paramedics include many factors, such as working in an exposed pre-hospital environment and managing cases the paramedic may not have dealt with before (59). Overall, making critical decisions in the context of Saudi EMS is more holistic than simply providing clinical care (84). Therefore, curricula and simulations should involve other facets of pre-hospital care, such as the police, civil defence, and trauma centres, as they are directly or indirectly involved in the Saudi pre-hospital environment, including scene safety and medical collaboration.

Competence in clinical practice is central to being a pre-hospital care provider and is critical for all EMS providers [87]. The importance of clinical competence in paramedic practice was highly rated in this study and others [56,91]. Unlike other core competencies, clinical practice is theoretically well established in the curricula [56], especially when conducted with appropriate practical internships [59,81]. There is, however, a need for all other important core competencies to be accommodated in EMS curricula and training in combination with clinical skills, especially general or soft skills.

5.3. Exploratory Factor Analysis of SPECS Model

Internationally the EMS educational standards have changed rapidly in many countries into a pre-employment tertiary model [3]. Such changes have been coupled with advances in clinical treatments and high-quality community healthcare [3], yet the issue of an educational core competencies framework for Saudi EMS has not been properly addressed [58]. Therefore, the SPECS model has been created to fit the needs of Saudi EMS and community expectations. The SPECS model was designed to integrate an empirically-based core competency standard, and its development was appropriately sourced from international EMS literature and subjected to validation and consensus-building methods. The EFA-generated SPECS model is discussed below in relation to similar competency frameworks.

The number of factors generated for the SPECS model was different from other EMS studies that have used similar factor analytic approaches. The first EFA study performed by Kilner [192] generated only three factors for paramedics in the UK, while a pilot EFA study by Williams [90] resulted in 10 factors for Australian paramedics. However, a follow-up confirmatory validation was undertaken with the establishment of the Australian Paramedic Graduate Attribute Scale (PGAS), which confirmed seven of the initial 10 factors [193]. In a Canadian study by Tavares [87], six paramedic roles were identified using a mixed-methods literature review and interviews. Thus, in an international context, the appropriate number of factors representing an EMS core competency framework has not yet been identified or agreed upon, suggesting a lack of research and differing situational aspects influencing the EMS system in each country. However, three factors do not offer enough discrimination, while 10 might provide too many factors for classification and clarity. For example, the Health Professions Council of South Africa (HPCSA) identified six factors as representative of a competent healthcare practitioner [94]. Thus, the five competency factors revealed in the national EFA study may offer a middle ground in the current range identified by the literature.

Professionalism was the first and largest factor in the SPECS model. The EFA analyses by Kilner [192] and Chang [194] produced similar results, where core professional skills represented the largest factor for ambulance paramedics. However, in the study by Williams [90], professionalism was ranked as the fourth factor, with similar core competencies split over other factors. Nevertheless, similarities in core competencies between the SPECS and other studies were identified, including accountability [90], ethical practice [87,90], evidence-based practice [87,90], and lifelong learning and self-development [192].

The second largest factor in SPECS was preparedness. This factor represents the unique Saudi-based outlook on EMS, which appears to differ from other countries or studies. Concerns with disaster management in conjunction with terrorist incidents attacks do not generally feature in other EMS studies, emergency nursing practice standards, or physician competency frameworks [3,87,90,192,195,196]. Other unique preparedness core competencies include practice in the Hajj and Umrah, maintaining appropriate Islamic values, and English proficiency, all of which are specifically important in the conduct of a multi-ethnic and multi-lingual Hajj [197]. The only similarity identified was community health and involvement, which was represented as a distinct dimension by Tavares [87] in EMS and the Canadian Physician Competency Framework [195].

In contrast to preparedness, the communication factor is internationally recognised and is by far the most researched or recommended core competency in EMS [99]. In addition, research addressing EMS competency development identifies communication as a core competency [87,90,192], and within medicine and emergency nursing communication, it is also a distinctive factor [195]. Teamwork and leadership are either recognised as core competencies or distinct factors [90,192,195]. The term “information literacy” as a core competency was not identified in EMS research or emergency nursing practice standards [87,90,192,196]. However, the exact term with an associated description was recommended in the Canadian Physician Competency Framework as part of the scholar’s role [195].

Clinical care conducted by EMS providers is the cornerstone of the profession. Clinical skills and associated theoretical knowledge are referred to across EMS competency research but under various terms [87,90,192], such as decision-making and critical thinking, both important aspects of clinical care [90,195]. Other EMS research categorises decision-making under a different factor [87,192].

Personal was the final and smallest factor in the SPECS EFA model. While no exact equivalent was identified in EMS research or cognate professions [87,90,192,196], the South African HPCSA has important similarities, especially in the combination of commitment for increased emphasis on personal health, well-being, and career development of health practitioners [94]. In addition, paramedics are exposed to physical harm as well as traumatic events, such as mass casualty incidents, brutal rape, or child victims of violence, which may lead to post-traumatic stress disorder (PTSD) [198]. Therefore, a holistic paramedic well-being approach should be encouraged and accommodated, as poor well-being is associated with poor patient safety outcomes, including medical errors and burnout (199).

5.4. Confirmatory Factor Analysis Competency Model

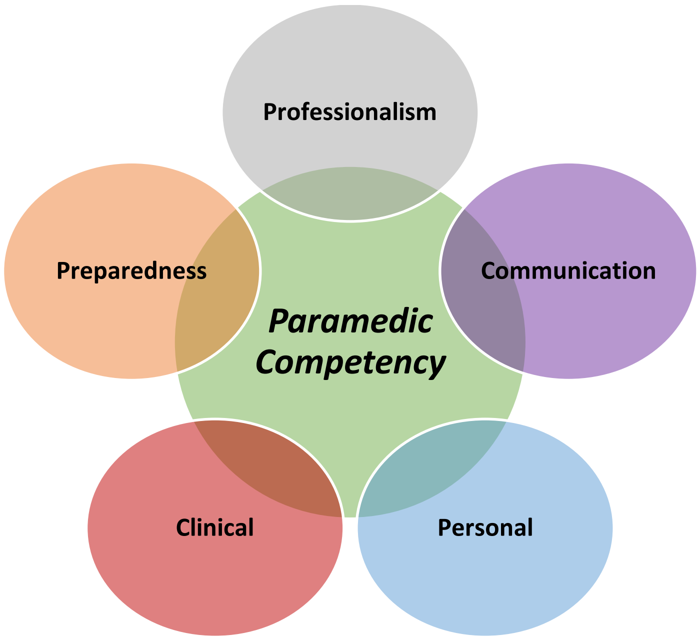
All previously presented fit indices met their respective commonly acceptable fit values, and the results verified an acceptable fit for the SPECS model with regard to the national study dataset. The CFA results for the SPECS model therefore represent a confirmed model. Construct validity was also established as an adequately fitting model through the CFA (184). The model's reliability was supported with strong Cronbach's alpha coefficients. Item reliability was supported by tests that used the squared multiple correlation, which indicated the underlying factors explained more than the 50% accepted threshold of variance in each observed variable (184).

Given the importance of developing empirical core competency frameworks for EMS healthcare providers, previous studies have explored different EMS competency frameworks by conducting EFA and Rasch Measurement Modelling (90,192,194). However, the current study is the first to confirm and validate a theoretical EFA model using CFA through SEM in the field of EMS. The CFA for the SPECS model represents the final empirical step in the development of a Saudi EMS competency framework. The SPECS model was composed of local and international core competency items and subjected to initial validation and expert consensus. Finally, the SPECS model was a product of this study's statistical exploratory generation, reduction, and confirmation (147).

Generally, EMS competency framework standards are represented by long lists of items that are often based on vocational training or are direct adaptations from different organisations rather than being classified under specific empirically developed factors (2,34,93). However, internationally recognised competency standards from other healthcare disciplines have been represented by six factors and an overarching concept, such as “medical expert” or “health practitioner” (94,195).

The SPECS model structure is similar to international medical norms, with core competency items grouped under specific factors and an overarching higher order concept representing paramedic competency (see Figure 5.1). However, as the model was developed for Saudi EMS the actual factors are somewhat different. For example, the leadership factor was accommodated as an item under the SPECS preparedness factor, emphasising the importance of an EMS leadership role in preparedness for disasters, terrorist attacks, and the Hajj.

Figure 5.1: SPECS Model



The SPECS model was represented by four covariances within three factors. Although the co-varying items seem natural, some such as Item 8 (“Be able to provide appropriate and effective clinical care”) and Item 7 (“Have the theoretical knowledge of key concepts in the EMS profession”) naturally link clinical skills with theoretical knowledge. Nevertheless, the communication factor represented the most interesting relationships with covariances identified between Item 1 (“Be able to effectively communicate information verbally and non-verbally to patients, colleagues and others") on the one hand and Item 2 ("Be able to practice with respect and non-discriminatory manner") and Item 3 ("Be able to work as part of a team in a collaborative and professional approach") on the other.

The link between improved communication in Item 1 and non-discrimination in Item 2 is not well researched in EMS. However, the concept is important in the multi-cultural context of Saudi society, especially during the Hajj [(197)]. Such a link is highly recommended when looking at improving communication in the wider Saudi healthcare system [(200)]. Even within the medical profession, the link between communication and non-discrimination is important and should be a source of learning and integration [(201)].

The association between communication in Item 1 and teamwork in Item 3 is vital in complex environments such as critical cases in a pre-hospital setting [(202)]. Furthermore, communication is an essential component of team dynamics as breakdowns in communication can endanger the quality of care and patient safety [(202,203)]. Interprofessional educational exercises or simulated wilderness exercises for paramedic students may be useful in researching and improving the link between communication and teamwork [(62,79)].

5.5. Sample Demographics

The demographic data accumulated in the national study provide a unique picture of Saudi EMS in contrast to other countries and even to different healthcare disciplines within Saudi Arabia. An important demographic aspect was gender, as only 6.6% of the sample was female compared to 93.4% being male. Similar samples in Australian EMS represented a 74.5% male majority [(91)], but the male dominance in the Saudi EMS field is still much higher than other countries. The stark difference in this gender imbalance can be seen when comparing Saudi EMS to other disciplines, where approximately three quarters of nurses in the Saudi Ministry of Health (MOH) are female [(8)]. There is a need for inclusion of female paramedics in the Saudi EMS workforce in training and clinical practice, especially when managing female patients [204].

Most participants (84.3%) were below the age of 40, representing the overall younger Saudi population, where approximately three quarters are below the age of 40 [5]. The results thus indicated a generally younger EMS workforce with a relative lack of senior, more mature providers. As stated previously, the EMS system is generally split between a post-employment and pre-employment model. The post-employment model is characterised by in-house basic life support training skills prior to working in EMS and was represented by 7.3% of certificate holders in this case [59]. The pre-employment model embodies all other education levels, including diploma, Bachelor, Master, and PhD [60]. Approximately three quarters of the participants held a diploma as the highest qualification, indicating that most of the sample were graduates of the second phase of educational transition in Saudi Arabia (2005-2012). Years of experience were also consistent with the overall younger age of participants, as a clear majority had 1-4 or 5-9 years of experience, roughly correlating with people graduating from diploma programs prior to their discontinuation in 2012. Seniority of experience was somewhat equivalent to age groups, with those 40 and older making up 15.7% of the sample and those with 10 or more years of experience accounting for 11.2%.

As expected in an Anglo-American EMS model where the provision of care is the primary responsibility of paramedics, most participants in the national study were paramedics (63.1%) [14]. Nevertheless, nurses (27.7%) and physicians (9%) represented sizeable proportions. The distribution of participant disciplines was appropriate to the aims of study, as it was designed for paramedic degrees, but the inclusion of other disciplines contributed to increasing variation of input. The variation in professional roles was also well distributed, with approximately one half being clinical/patient care and the other half split between education/academic (35.4%) and administrative/leadership (16.2%).

The main nationality of participants was Saudi (85.4%), with smaller numbers of Arab and non-Arab nationalities. However, when looking at the overall numbers for other disciplines, such as physicians in the Saudi MOH, less than a third of the workforce are Saudi and the rest are foreign expatriates [8]. Although feedback from Arab and non-Arab EMS providers is important, having a larger sample of Saudi nationals provides better feedback as the actual Saudi population contains considerably more Saudis than foreigners [5]. All demographic concepts had significant results between groups, as discussed later.

5.6. Gender and SPECS Model Factors

An important finding was the identification of significant differences between male and female participants in the professionalism, preparedness, communication, and clinical factors. Professionalism was represented by many core competency items. However, an interesting aspect of this study was that data collection was officially completed on 22 September 2017 (see Appendix D), four days before a royal decree was issued to add provisions to the previously issued traffic decree M/85, allowing women to drive [205]. Thus, the study provides valuable insight into the perception of female EMS providers prior to public awareness of the driving ban removal. The significant difference in this case may be attributed to women not wanting to appear less competent, as they were unable to drive ambulances or other motor vehicles at the time. Therefore, women would have been at a disadvantage to men, who could perform the dual role of driving or providing clinical patient care. An example of this limitation prior to the lifting of the driving ban can be seen in the 10KSA female-only breast cancer awareness charity event held in Saudi Arabia [206]. Out of the eight paramedics covering the event, only two were women, who were only performing station oversight for controlled narcotic and antiepileptic medications, while the six male paramedics were equipped to respond to patients with three ambulances [206].

A significant difference between the male and female participants in the preparedness factor was also identified. Women were generally associated with disasters as victims and not as prepared responders [207], and men were assumed to be stronger physically and emotionally to deal with disasters, while women were regarded as better at handling stress and emotionally charged issues [207]. The roles of men and women in EMS disaster response requires further research, but whatever differences are identified, if any, combining the strengths of each group could contribute to improved patient care.

Communication was likewise significantly different between male and female participants, which may be due to Saudi cultural norms. First, eye contact between genders may be performed but in certain contexts could be viewed as impolite [208]. Second, touching a person of a different gender is important for communication when providing medical care [208]. Third, smiling is important to establish communication and trust. Smiling is acceptable in all contexts for both genders, but while a face veil covers the mouth, smiling could be evident in the eyes and voice [208]. Finally, the Saudi context of inter-gender communication is complex and multi-layered [209] and should be further researched in the EMS setting.

Clinical care conducted by EMS providers is the essential cornerstone of the profession. The national study data identified a significant difference based on gender in the clinical factor. Although a plethora of important research has been conducted to explain inter-gender relations and clinical care, investigation in the EMS context is lacking. A study by Lord [210] examined the influence of the gender on the odds of administering pre-hospital analgesics and found no significant difference between male and female paramedics. Nevertheless, there are social differences between men and women in the EMS profession that affect decision-making [211]. Identified predictors for appropriate decision-making for men include extraversion, emotional stability, and quick reactions to the Stroop test [211]. The Stroop test is used in diagnosing perceptual load through different approaches, including naming of colours or words. Female paramedics were associated with quick reactions to the Stroop test and emotional intelligence represented by positive current conditions and low emotional awareness [211]. Although male paramedics were significantly different in extraversion (sociable, assertive, talkative, and active) [212,213], the gender of paramedics has a generally low influence on risk preference in decision-making [212]. The link between the SPECS clinical factor and gender should be researched in a Saudi EMS context, specifically addressing aspects of clinical skills, theoretical knowledge, decision making and problem solving.

The low representation of women in the EMS workforce is not limited to Saudi Arabia [198,211,212,214]. The employment preference for male paramedics over women has many reasons, such as the physical strain involved (198). However, women have been shown to equal men in various aspects and even outperform them in specific psychological traits. For example, young female paramedics can generally tolerate working for 24 hours under the same conditions as men [214], although certain menstrual symptoms and fatigue should be considered [214]. Furthermore, female paramedics can be more empathetic to patients, which can elevate the quality of patient care [215]. The trend of increasing female paramedic education is changing in certain regions, such as Victoria, Australia [216]. Finally, including more women in undergraduate Saudi EMS programs would provide many benefits and challenges specific to the Saudi context, and further research is recommended to formulate future educational and industry plans.

5.7. Age and SPECS Model Factors

The statistical analysis of the national study data identified significant differences between the younger (18-28) and older (29-39 and 40-49) age groups in the communication and clinical factors, except for a significant difference between 29-39 and 40-49 under the communication factor. The communication factor represented most significant differences with three out of the four significantly different age groups. There appears to be a paucity of research for effect of age on communication and clinical practice in EMS. However, differences in communication between older and younger people have been well researched in different fields [217-219]. Generally, the age group of employees at an organisation represents an important influence on the frequency of communication [219], since employees who share attitudes and experiences are more likely to like each other due to increased understanding [218]. In addition, similarities between people can self-reinforce as this ratifies personal views of self-qualities [218]. As an example, the time gaps between adjacent university faculty hires develop a clustered distribution in tenure [217]. With time, the difficulty of communication between the tenure groups increases [217], and isolation between age groups evolves into conflicts and power struggles [217]. A possible solution is increasing voluntary staff resignation, as differences between employee groups affect integration and cohesion [217].

According to the model developed by Pfeffer [218], similarity in the time of entry and age of an employee contributes to an increase in communication frequency and overall similarity between employee groups, which increases the integration and cohesion between group members. Although such research may be applicable to age groups in Saudi EMS, with the current lack of research, no realistic explanation or solution can be suggested without developing a sufficient body of research specific to the Saudi context.

The data identified a significant difference between younger (18-28) and older (40-49) age groups regarding the clinical factor. Although some research has been conducted to explain the relationship of age to clinical practice, the EMS literature is lacking in this area. Nevertheless, when looking at other clinical disciplines, such as medicine, some understanding of the difference may be empirically interpreted. In a study by Abadel [220], medical graduates were administered a self-assessment questionnaire regarding clinical competency covering different topics of clinical practice. Expert evaluators with direct observational knowledge of the graduate physicians were also asked to provide an assessment of the clinical competency of medical graduates. The self-assessment showed a statistical difference between the older and younger age groups, as about one fifth of graduates above the age of 30 professed an inadequate level of clinical competency, but only 6.2% and 11.9% of graduates aged 25-27 and 28-30 self-assigned as inadequate [(220)]. The near opposite was identified by expert evaluators, as more than 40% of the 25-27 and 28-30 age groups were identified as inadequate, while only 9.7% of the older (>30) group were identified as inadequate [(220)]. Similarly, in the present study, the younger the age group, the higher its mean rank was, indicating that younger graduates generally rated core competencies higher than older graduates. Therefore, in a Saudi context, empirical developments should be inclusive of younger and older EMS providers.

5.8. Educational Qualifications and SPECS Model Factors

The only independent demographic variable to have a significant difference across all five factors in the SPECS model was the educational qualifications held by participants. The statistical analysis of the national study data identified significant differences between the post-employment certificate group and the pre-employment diploma, Bachelor, Master, and PhD groups in the professionalism, preparedness, communication, clinical, and personal factors. Currently, no EMS literature explicitly covers the differences between certificate holders and other educational groups concerning each of the five factors. However, the statistical results indicated a clear split between the post-employment and pre-employment groups. Therefore, the interpretation of the data gives a brief explanation of the differences between these groups and a possible reason for them. A quote from an Australian paramedic student in a study by Wray [(221 p671)] offers a glimpse of how these groups view each other: “Some of them (‘ambos’) don’t welcome pre-employment students because it’s not the way they were taught, and it's not the way they see the future of the service. I don't know if they think we're coming in and taking over, I'm not sure."

The certificate holders represent the 1934-2005 stage of EMS in Saudi Arabia (58). Post-employment EMS education was restricted to certain courses, such as first aid, basic life support, and first responder training courses (9,12). These programs were mostly limited to the training provided by the EMS industry, sometimes called in-house training (59), as the expectation in this stage was to provide basic first aid and rapid transport to the nearest emergency facility (9,12). Similar post-employment training models can be found internationally. The 1966 Millar Report established the UK post-employment training requirements for EMS (31,192). Generally, the post-employment training was lacking in quality teaching material, professional outline for scope of practice, and definitions (2). However, the new model for EMS education is a pre-employment model represented by the diploma, Bachelor, Master, and PhD groups, where the educational process is undertaken at colleges and universities prior to employment (60). The first Australian university program of this kind was established at Charles Stuart University in 1994 and the first Saudi programs were launched in 2007 (42,44,222). The post-employment training model has been phased out in Saudi Arabia, leading to a small percentage (7.3%) representing this group in the study.

To understand the significant difference between the certificate group and the other groups, a comparable finding from Alexander (223) is discussed. The US study looked at the relationship between level of education in EMS and degree of occupational commitment (223). A significant difference was identified between certificate holders and paramedics with a higher level of education (223), which had a negative correlation with the educational qualifications of paramedics (223). In other words, the higher the educational qualification, the lower the levels of organisational and occupational commitments. EMS providers with a certificate believed they were more devoted to the current organisation than more educated paramedics (223).

Certificate holders were perceived to seek EMS training for vocational reasons, while paramedics who invested in higher levels of learning were seen as striving for personal and vocational reasons [223]. Higher education also gave paramedics improved employment opportunities in management and education [223].

Alexander [223] shed light on the stark differences between certificate holders and paramedics holding a higher degree. However, the US-based EMS system is different from the Saudi system, especially since gaining a certificate or diploma in EMS is no longer available in Saudi Arabia. Thus, the interpretation of the differences for higher levels of education being for personal and vocational reasons may only be applicable to older graduates. Nevertheless, the opportunities for employment with higher levels of education are much more applicable to Saudi Arabia. Unlike the US, where the National Registry of Emergency Medical Technicians (NREMT) provides certification examinations for the Paramedic, Emergency Medical Technician (EMT) Intermediate, EMT Basic, and First Responder [35], the Saudi system has evolved into a coherent system based on nationwide centralised regulations, registration, and licensing standards set by the Saudi Commission for Health Specialities (SCFHS) [30]. The SCFHS has categorised paramedics within different educational tiers, ranging from EMS Technician at the diploma level up to a Consultant Specialist for a PhD holder [30]. Therefore, certificate holders are restricted within the tier system set by the SCFHS. Also, a perception of increased commitment to the SRCA EMS system can be expected, in line with Alexander [223]. Finally, boundaries and development issues in the EMS profession are expected in an internationally emerging profession, especially with an increase in the educational standards and the foregoing of a post-employment educational model [224].

Overall, the differences between the pre-employment and post-employment educational models were beyond the scope of this study. The issue is multi-faceted, with many psychological, organisational, and social aspects. However, what can be understood through the national study is an unequivocal delineation between certificate holders and higher-level education groups. Thus, researchers addressing EMS in Saudi Arabia or other countries should consider the differences between these educational models.

5.9. Experience and SPECS Model Factors

The national study identified significant differences between the most experienced group with 10 or more years of experience and the less experienced groups with 1-4 or 5-9 years in terms of professionalism, communication, and clinical factors, except for a significant difference between the 1-4 and 5-9 groups in clinical. Professionalism is the largest SPECS factor and is represented by many core competency items, drawing many possible interpretations for these differences. However, in Saudi healthcare registration and certification, post-graduation experience is an important requirement of professional tier-based registration. The SCFHS requirement for experience ranges from one to three years and is mostly based on level of education [(30)], indicating that less experienced graduates may not be sufficiently competent to be classified under a specific professional tier. The UK National Health Services (NHS) [(225)] litigation authority has set "learning from experience" as one of five standard assessment criteria for ambulance organisation safety risk management [(226)]. According to a Norwegian study by Nordby [(227)] looking at the ethical dilemmas facing paramedics in cases of cardiac arrest for cancer patients, five out of 15 interviewed participants referred to lack of personal expertise when confronted with uncertainty and lack of knowledge regarding the condition of a patient [(227)]. In accordance with the expertise theories of Eteläpelto [(228)], the experience acquired in authentic professional practice is regarded as a requirement for developing competence and professional expertise. Therefore, the experience of learning in the workplace is accumulated and embedded with direct practice [(229)]. Such a perspective is reflected in the close integration of learning and working together

[230]. The context of professional experience in Saudi EMS requires further empirical research addressing legal, safety, ethical, and coping issues to inform policy and practice.

As previously discussed, experience and age can have a significant impact on the communication of EMS providers. The model developed by Pfeffer [218] further confirms the statistical analysis by indicating that similarity between age and experience (time of entry) of employees are contributing factors to an increase in integration, cohesion, and frequency of communication. However, it is not clear whether having the same experience level from different institutions would still be a contributing factor to communication when employees move to the same workplace. Currently, no research addressing the effect of experience of communication exists in Saudi EMS or similar settings. Thus, the data could not be compared to similar samples, limiting the empirical interpretation of the data. To alleviate this issue, researchers should study the correlations between level of experience and communication development in EMS.

The study identified a significant difference between less experienced (1-4) and more experienced (5-9, 10+) groups in the clinical factor, which is made up of four core competencies: theoretical knowledge, clinical skills, decision-making, and problem solving. The clinical factor has been researched within the EMS profession and other healthcare disciplines. However, current research may only explain specific aspects of the link between experience and clinical factors without offering a definitive holistic interpretation. Nevertheless, research in the US by Stevens [231] demonstrated that experienced EMS providers are more comfortable with paediatric assessment, knowledge, and technical skills than less experienced providers. The success rate of orotracheal intubation for paramedics is not significantly correlated with experience, but with the actual number of EMS patients in whom an orotracheal intubation was attempted [232]. According to Ryan [233], the decision-making processes of experienced paramedics are different from paramedics with less experience, where experienced paramedics rely on an intuitive decision-making process or "gut feeling", compared to new graduates applying a hypothetico-deductive reasoning approach [(233)]. Although experienced paramedics start with a hypothetico-deductive decision-making process, with experience, the same paramedics develop into the intuitive decision-making process [(233)]. Therefore, experience may improve skills and confidence of patient assessment. However, actual practice of specific skills and continuing professional education can be a tool for the advancement of clinical care. Finally, research on the effects of experience on clinical skills, theory, and decision-making are recommended in Saudi EMS.

5.10. Discipline and SPECS Model Factors

An important finding of the national study was the identification of significant differences between paramedics on the one hand and nurses and physicians on the other. Such differences were identified in relation to nurses and physicians in the communication factor and nurses in the clinical factor. The communication factor is represented by several core competency items. However, the field of EMS communication suffers from a deficiency in research addressing interpersonal skills, especially when compared to nursing [(234)]. The New South Wales Ambulance Service conducted 73 video analyses of handover cases in two emergency departments (EDs) [(235)]. The handovers ranged from 26 seconds to four minutes with considerable repetition of information [(235)]. After implementing a standardised handover protocol, a second analysis revealed average handover time decreased, information repetition decreased by half, and eye contact increased between paramedics and ED staff [(235)].

Paramedics report frustration with ED staff for a lack of active listening, disinterest, distraction, and in some cases not believing paramedics when handing over patients [(236,237)]. During handover, physicians are rarely present, particularly with lower acuity patients [(238)]. Moreover, physicians can poorly recall verbal reports from paramedics regarding trauma patients [239]. Physicians are also significantly less likely to remember severe cases compared to less severe cases (40% vs. 34%, $p = 0.02$) [239]. In a German randomised control trial by Rörtgen [240], physician staffed teams were compared to paramedic teams communicating through telemedicine. The paramedic teams were equal to physician staffed teams in most cases, and paramedic teams were significantly better in obtaining allergies (17 vs. 28, OR 7.69, CI 2.1–27.9, $p = 0.002$) and medications (17 vs. 27, OR 5.55, CI 1.7–18.0, $p = 0.004$) [240]. The results indicated paramedics could accommodate further autonomy in EMS and that communication concerns were evident between paramedics on the one hand and nurses and physicians on the other. Many solutions have been proposed by different publications, yet the majority agree that standardisation is the key for an improved handover procedure [235-237]. Therefore, it is highly recommended that a handover protocol and instrument be empirically developed for Saudi EMS.

As with the educational stages of EMS in Saudi Arabia, the clinical factor was not appropriately defined across disciplines. During the initial stage, the concept of a paramedic as a separate health profession did not exist, as apparent by the founding charter of SRCA in 1966, which states it will strive to elevate the nursing profession and work on training nurses in hospital work and emergency situations [9]. Generally, the current EMS literature is lacking in the study of the relationship between the nursing discipline and EMS clinical practice. However, the clinical autonomy of the paramedic and nursing disciplines in Australia is well established. Currently, nurses in remote areas can administer certain medications without reference to a physician [241]. Similarly, paramedics in New South Wales can administer five prescription medications without the approval of a physician [241]. In addition, the clinical autonomy of paramedics in Canada has increasingly developed with several complex interventions allocated for the pre-hospital setting [242].

The UK and Saudi EMS systems employ a paramedic-based Anglo-American EMS model [(58)]. Nurses in the UK are increasingly involved in EMS [(243)], although the role of nursing in the UK is mostly restricted to clinical call handlers, where "hear-and-treat" call services are responsible for assessment and medical advice for non-emergency patients [(243)]. However, the phone helpline services provided by nurses did not reduce the pressure on NHS ambulances [(244)]. Currently, nurses are not advised to be excluded from EMS and are recommended to train as paramedics prior to joining the EMS industry [(245)]. The role of nurses trained in ALS in conjunction with paramedics can be beneficial for inter-hospital transport [(246)]. The role of other disciplines in EMS is evolving, but the current trend may indicate a move toward autonomy and specialisation for paramedics. Physicians and nurses are important, but in specific roles, and the backbone of the Saudi EMS industry is the paramedic. Future research should address the roles of medical disciplines in EMS and how they can be streamlined.

5.11. Main Professional Role and SPECS Model Factors

The national study identified most of the significant differences between the administrative/leadership professional role group and the education/academic group in the preparedness, clinical, and personal factors. Significant differences were also identified between the administrative/leadership and clinical/patient care groups in the personal factor and the education/academic and clinical/patient care groups in communication.

The preparedness factor is the second largest of the SPECS factors and is represented by many core competency items. Therefore, many possible interpretations of the significant difference between administrative and educational groups can be identified. However, a long history of slow public administrative reaction to disaster organisational and policy issues has been observed [(247)]. Emergency management is universally the domain of public administration. The US-based Federal Emergency Management Agency (FEMA) was only established in 1979 [247]. The administration of the Hajj in Saudi Arabia involves many government organisations [248]. However, the sole pre-hospital care provider in Saudi Arabia and specifically the Hajj is the SRCA [197]. The emergency and transportation services provided by SRCA are also supported by the MOH, National Guard, and other organisations [197]. Although the Hajj is an annual gathering of nearly 3.5 million pilgrims speaking hundreds of languages involving more than 300 ambulances and 1750 EMS personnel [197], research on the Hajj from an EMS perspective is scarce. The concern with a lack of disaster preparedness and terrorism research in the US has been addressed through the involvement of academic researchers in conferences, workshops, postgraduate degrees, and research associations, such as the American Society for Public Administration's Section on Emergency and Crisis Management [247]. Therefore, the employment and empowerment of paramedic academics in the field of preparedness and disaster research can be a contributing factor in increasing research output and the establishment of postgraduate degrees.

The significant difference in communication between education/academic and clinical/patient care groups has many explanations. Productive collaboration between the EMS industry and universities requires clear communication and consistent expectations [249], and yet poor communication has been identified in some cases between educational institutions and the clinical industry. University students have complained that station staff would not even know of their arrival [250]. Students would be treated as only observers and not participant observers [221,250]. Learning objectives have to be communicated by the students to the supervising paramedics who are unaware of current university curricula [221,250]. To improve the partnership and communication between educators and service providers, a clinical placement booklet could be developed based on the collaboration of both stakeholders [249], and students could be assigned for a longer period with a specific EMS crew to improve communication on a personal level [249]. This could lead to less focus on paperwork and more on breaking communication barriers over time [249].

The significant difference between administrative and educational groups in the clinical factor has several possible explanations, and misgivings about the EMS system and providers can be viewed from an administrative and educational perspective. Administratively, EMS is viewed as a high-risk work environment where split-second clinical decisions are made and the actions of the human factor are a risk to patients [251]. In a video-recorded observation of simulated patient scenarios involving German paramedics, unsafe clinical procedures were identified in ALS, asthma, pulmonary embolism, and multiple trauma [251]. Thus, a sub-set of paramedics were recommended for improved education through a needs-based program [251]. In addition, there is generally a lack of qualified EMS educators, and even 20% of US-based educators are uncomfortable assessing psychomotor skills [252]. On the other hand, limited opportunities for clinical practice are offered to paramedic students, especially with endotracheal intubation [253]. Nevertheless, current research recommendations may reduce some of the misgivings in the administrative and educational domains. Advanced airway techniques can be improved through a simulation-based airway management curriculum [254]. Management skills delivered through computer simulation exercises for EMS personnel are viewed as valuable teaching tools [255]. The national EMS research strategic plan recommends the development of research in the fields of EMS education, system design, and operation [256]. Finally, the newly released US EMS agenda 2050 emphasises the need for empirical research in the development of future EMS practice [257].

In the personal factor, a difference between the administrative/leadership group on the one hand and the clinical/patient and education/academic care groups on the other may point to a Saudi EMS industry-based difference. However, with the lack of research covering this topic, an overview of the complexity surrounding the issue is given from a healthcare industry management perspective. A recent systematic review associated poor patient safety outcomes, including medical errors, with poor well-being [199]. Generally, poor well-being is associated with stress, anxiety, poor quality of life, depression, and high levels of burnout [199]. A possible overarching model proposed by Hall [199] is that overworked healthcare providers suffer burnout, leading to depression. Furthermore, management thinking perceives a well-functioning organisation to be like a machine, where every part is dealt with in isolation [258], and fighting resistance to change and decreasing variation will improve performance [258]. Employing a complex adaptive system that allows a novel and more productive leadership style has been proposed for the UK healthcare system [258]. Australian healthcare leadership has recommended adopting high-performance work systems, which have been associated with positive outcomes, such as improved organisational performance [259]. The Saudi EMS management system is not well researched. Therefore, no specific healthcare management system can be proposed without adequate empirical data. However, the adoption of consultant paramedics can contribute to improved clinical governance, education, management, professionalism, research, and quality improvement and assurance [260]. Nevertheless, the escalation of management responsibility with an ongoing clinical role is not recommended, as the expected organisational effectiveness has not been identified [261]. The transition of a clinician into a leadership position can have different effects for nurses and physicians [262]. Therefore, consultant paramedics are recommended to be elevated into leadership roles and not be burdened with clinical roles. Also, research into EMS leadership, transition, and management styles is recommended in a Saudi context.

The EMS system in Saudi Arabia shows differences based on the main role of the provider. Recommendations include the involvement of paramedic scholars in conducting research, stronger collaboration between universities and the EMS industry, and promoting paramedic consultants to leadership roles.

5.12. Nationality and SPECS Model Factors

The national study identified significant differences between Saudi and Arab nationalities in the professionalism, preparedness, communication, and clinical factors. The reasons for these consistent differences were unclear, especially since non-Arabs were never significantly different in any factor. The literature to explain such a difference in Saudi EMS is non-existent and drawing on the scarce international EMS and medical research addressing the differences between immigrant and local healthcare providers is inappropriate for two main reasons. First, the labour force in Saudi is made up of expatriate workers rather than immigrants. Second, Arabs are linguistically and for the most part religiously similar to Saudis with certain cultural and economic differences. Thus, the relationship between Arabs and Saudis cannot be compared to relations, for example, between English locals and Chinese immigrants. To affirm the second point, in a study by Bozionelos [263] regarding nursing in Saudi Arabia, Saudis were clustered under the Arab group, indicating similarity. However, other Saudi research addressing health or demographics has considered Saudis and Arabs as distinct groups [264-266]. Therefore, the difference between Saudis and Arabs is neither well specified nor adequately researched.

Certain holistic and non-specific interpretations may be proposed from the few available publications. Saudi Arabia is a wealthy G20 economy, while the countries under the Arab group are relatively much poorer [266,267]. However, since Saudi Arabia conducted a massive student scholarship program for higher education to Western countries, such as the US, UK, Canada, and Australia [268], many graduates are finding difficulty attaining employment after graduation [268]. Therefore, the differences may be based on economic opportunities rather than other reasons. Expatriate Arab healthcare workers are also more prone to violence than Saudi healthcare workers [265], while professional attitudes of Arab healthcare workers can be different as they are generally more accepting of vaccinations than their Saudi counterparts

[264]. The differences between Saudis and Arabs in an EMS context is unclear without further research, but the current vague picture conveys a more economic perspective than a professional or educational one.

5.13. Operationalisation of the SPECS Model

The SPECS model represents a hierarchy containing many concepts, such as factors, roles, graduate capabilities, and attributes, which represent the heart of academic learning outcomes [269,270]. These describe the qualities, knowledge, capabilities, habits, and skills students are expected to reliably demonstrate after completing an academic program [269]. They describe learning that is both significant and durable on a long-term professional basis [271].

Curriculum design involves the analytical review of current or new academic programs to revitalise curriculum based on the needs of the industry and long-term professional interests of students [270]. The process is reflective, analytical, collaborative, and should be based on empirically developed disciplinary and generic graduate attribute frameworks [270]. The link between generic and disciplinary capacities was discussed in Chapter 2 (see Figure 2.1).

This study developed the SPECS model to empirically accommodate generic and disciplinary core competencies based on a Saudi EMS framework. Generally, each university has a governing organisational structure and theoretical framework for the design and implementation of learning outcomes on a macro and micro level [269]. Thus, it was beyond the scope of this study to align the SPECS model with the requirements of specific universities.

The SPECS model shown in Figure 4.2 is based on three layers, namely the high order construct of paramedic competency, the five factors/roles, and the 27 core competency items under each role. In order to assist and simplify the operationalisation of the SPECS model by colleges and universities, an additional fourth layer of enabling competencies was added under each core competency item. Enabling competencies are essential components of a core competency, as combining several enabling competencies can provide a better explanation of the components of a core competency [272]. The fourth layer represents a recommended set of 84 enabling competencies with associated research, which can assist in the implementation of each aspect of the SPECS model. The 84 enabling competencies are based mostly on paramedic research with some publications from medicine and nursing. The research is of varying quality and levels of evidence, from systematic reviews, meta-analyses, and randomised control trials to qualitative research, indicating the overall inconsistency of research in the EMS field. Although enabling competencies are not a systematic, definitive answer to each aspect of the model, they provide a valuable approach to implementing SPECS and offer insight into current levels of paramedic research. Enabling competencies have generally not been used in EMS competency framework development but are a well-established component in internationally recognised competency framework standards, such as the South African HPCSA and Canadian CANMED Physician Competency Framework [94,195].

Table 5.1-5 and the associated definitions and description are a representation of the four-layered SPECS model. The first layer is an overarching definition of the higher order paramedic competency. The second is a definition and description of each of the five factors/roles: professionalism, preparedness, communication, clinical, and personal. The third represents the 27 core competencies defined and listed under each factor and numbered accordingly. The fourth layer contains 84 enabling competencies with associated citations listed alphabetically under each core competency.

Higher Order Paramedic Competency: Paramedic competency represents the integration of the SPECS model’s professionalism, preparedness, communication, clinical, and personal factors in the provision of exemplary EMS practice.

Professionalism: A paramedic is a professional, meaning someone accountable for the health and well-being of patients and society through safe, ethical, and comprehensive procedures and attitudes (see Table 5.1). The role of a professional is represented in the ability to practise within established legal and ethical boundaries, maintain proper safety procedures, be trustworthy and accountable, use evidence-based practice, work as an autonomous professional with good judgment, work in different transportation modes, commit to lifelong learning and professional development, maintain good coping skills under stressful situations, and be flexible in learning from a variety of sources.

Table 5.1: Professionalism

Core Competency	Enabling Competency
1. Be able to practise within the legal and ethical boundaries of the profession	A. Understand legal and ethical boundaries and the need to gain informed consent from patients (273)
	B. Assume the right for a patient to provide consent, unless proven otherwise, where the well-being of a patient is of paramount importance (274)
	C. Understand the law in relation to the possession of medications and their administration to patients (275)
	D. Demonstrate an ability to ethically manage life and death choices under pressure (227)
	E. Understand the legal and ethical issues concerning end-of-life (EoL) care and do not attempt cardiopulmonary resuscitation (DNACPR) (276)
	F. Determine the medical necessity of patient transport based on the needs and well-being of patients above all (277)
2. Be able to maintain appropriate and effective safety procedures	A. Ensure that patient safety is correctly and effectively maintained (278)
	B. Demonstrate an ability in the use of personal and patient safety equipment (279)
	C. Recognise patient safety errors and speak up when patient safety is compromised (280)
	D. Promote patient safety as an important EMS industry value (281)
	E. Recognise the educational value of simulated technology in safe medical practice (282)
	F. Engage in the prevention and reporting of workplace violence (216)
3. Be able to maintain the appropriate personal characteristics of being trustworthy and accountable	A. Develop an accountable, trusting relationship with patients and their community (283)
	B. Develop patient trust by offering patients the ability and time to express concerns (284)
4. Be able to provide care according to evidence-based practice	A. Develop an understanding of evidence-based practice skills and competencies (285)
	B. Engage in collaborative learning and implement evidence-based practice (286)
	C. Understand the value of evidence-based practice and its impact on patients (287)
5. Be able to work as an autonomous professional with high levels of personal professional judgment	A. Understand the importance of developing EMS into an autonomous profession, especially through higher education (245)
	B. Recognise the importance of an extended role for paramedics in rural and metropolitan areas (288)
	C. Develop the required theoretical and clinical capacity to autonomously administer pre-hospital thrombolysis therapy (PHT) (289)
6. Be able to work in different transportation modes	A. Demonstrate an ability to safely transport patients with appropriate speed in relation to clinical status and incident location (290)
	B. Understand the need to mitigate safety risks during patient transport through technology and safety procedures (291)
	C. Recognise the effect of a vehicle's patient compartment design on equipment reach, patient access, ergonomics, and posture (292)
	D. Understand the limitations on communication during patient transport, especially in air medical transport (293)
7. Be committed to a process of continuous lifelong	A. Develop an intrinsic motivation for assessing current knowledge, engaging in professional improvement, and maintaining a record of what has been achieved (294)

learning and professional development	B. Engage in professional skill development through self-directed learning (SDL) in and outside the structured educational periods [295]
	C. Understand the importance of reflective practice in exploring and engaging in professional development [296]
8. Be able to maintain good coping skills to deal with stressful situations	A. Recognise the prevalence of EMS occupational stress and importance of social peer support [297]
	B. Understand the association between acute stress and possible impairment of paramedic performance [298]
	C. Engage in emotional support following work-related critical incidents [299]
9. Be flexible in learning from different sources, including guidance from colleagues	A. Accommodate a flexible and interactive approach to learning from different sources, including e-learning and online communication [44]
	B. Engage in peer-to-peer learning with colleagues, including brainstorming and group activities [300]

Preparedness: A paramedic should be well prepared for disasters, terrorist attacks, and practice during the Hajj through technology and community outreach (see Table 5.2). The role of preparedness is represented in the ability to prepare for and manage disasters and terrorist incidents, practise during Umrah and the Hajj, recognise appropriate Islamic values, maintain public and community health, understand new technologies, and demonstrate proficiency in English.

Table 5.2: Preparedness

Core Competency	Enabling Competency
1. Be able to prepare for and manage disasters and terrorist incidents	A. Engage in disaster plan review and modification for mass casualty incidents and terrorist attacks [301]
	B. Establish an improved level of disaster preparedness through table-top exercises and direct on-site practice [302]
	C. Understand the importance of virtual reality and high-fidelity simulators in disaster training [303]
	D. Develop autonomous skills and knowledge for disaster response and only use proven technology [304]
	E. Search for evidence-based practice in disaster response via a range of databases, including EMBASE and MEDLINE [305]
2. Be able to effectively practise during Umrah and the Hajj	A. Understand the importance of planning, communication, public surveillance, and response in mitigating medical risks when managing large numbers of pilgrims [306]
	B. Demonstrate an effective level of training and knowledge for the Hajj and engage in practice during the annual event [248]
3. Be able to practice with appropriate Islamic values	A. Engage in culturally and religiously appropriate patient-centred care (307)
	B. Understand the Islamic outlook on patient care, including managing brain death [308]
4. Be able to maintain involvement with public and community health	A. Understand the evolving evidence regarding the practice and knowledge associated with community care paramedicine [309]
	B. Engage the community with outreach programs to assess and mitigate health risks [310]
5. Be able to demonstrate English proficiency to an adequate level for professional communication	A. Incorporate English and associated medical terminology into paramedic practice [311]
	B. Understand the usefulness of English as a means of communication with pilgrims [312]
6. Be able to demonstrate an understanding of new technologies for clinical practice	A. Understand the importance of incorporating new technology, such as ultrasound, for improved patient care and paramedic autonomy [313]
	B. Recognise that new technology might not improve patient survival or well-being [314]
	C. Understand the value of new technology in the surveillance of possible risks and infectious diseases during mass gatherings, such as the Hajj [315]

Communication: A paramedic is a communicator responsible for forming a respectful relationship with patients and their relatives through effective collaboration within and outside the healthcare system (see Table 5.3). The role of communication is represented in the ability to communicate verbally and non-verbally, engage in collaborative teamwork, demonstrate information literacy by searching and applying information, practise respectfully without discrimination, and demonstrate leadership skills.

Table 5.3: Communication

Core Competency	Enabling Competency
1. Be able to effectively communicate information verbally and non-verbally to patients, colleagues, and others	A. Develop a friendly, attentive rapport with patients, relatives, and the community (77)
	B. Demonstrate effective overall interpersonal communication skills, especially during assessment, history taking, and management of patients (83)
	C. Engage in active listening during contact with patients and relatives (88)
	D. Understand holistic, specific communication skills for effective patient-centred care (92)
2. Be able to work as part of a team in a collaborative and professional approach	A. Demonstrate an ability to collaborate with other medical professionals in providing high-quality care during patient transport in a pre-hospital and interfacility environment (246)
	B. Engage in a standardised written and verbal handover procedure to other medical professionals, while maintaining respectful non-verbal communication and eye contact (235)
	C. Conduct effective teamwork communication by minimising barriers to interprofessional practice (79)
	D. Give appropriate feedback communication to colleagues during patient care (202)
3. Be able to practise respectfully and in a non-discriminatory manner	A. Establish an empathetic relationship with patients to convey respect, value, and validation (215)
	B. Promote empathy and positive prosocial behaviour through self-reflection and emotion skills (316)
	C. Acknowledge the importance of respect in a diverse and multicultural workforce (200)
4. Be able to demonstrate leadership skills	A. Demonstrate key leadership qualities of confidence, humility, creativity, and emotional intelligence (317)
	B. Understand the intrinsic need for leadership skills within the healthcare system (318)
	C. Promote an environment of shared leadership with the aim of advancing the quality of patient care (319)
	D. Engage in quality assurance through identification, evaluation, and improvement of EMS service on-scene and in-transit (320)
5. Be information literate by having the capacity to search and apply information	A. Demonstrate an ability to analyse questions, search relevant databases, plan, and understand academic writing and reference research (78)
	B. Engage in advanced information searches, assess literature and website trustworthiness, and differentiate between information sources (321)

Clinical: A paramedic is a clinician responsible for the acquisition and application of clinical knowledge and skills for the provision of high-quality patient care (see Table 5.4). The role of a clinician is represented in the ability to provide effective clinical care, demonstrate appropriate theoretical knowledge, and engage in decision-making, critical thinking, and problem solving.

Table 5.4: Clinical

Core Competency	**Enabling Competency**
1. Be able to provide appropriate and effective clinical care	A. Understand the importance of planning, preparation, continuity, and standards in clinical placements (249)
	B. Integrate clinical simulation and paramedical practice (322)
	C. Demonstrate competence in advanced clinical assessment procedures, such as interpretation of ST-segment elevation myocardial infarction (323)
	D. Understand the importance of clinical practice experience, such as proficiency in endotracheal intubation (253)
2. Have the theoretical knowledge of key concepts in the EMS profession	A. Recognise the important relationship between theoretical knowledge and clinical practice (324)
	B. Demonstrate knowledge associated with patient care in paramedicine (325)
	C. Integrate peer-assisted learning (PAL) into knowledge acquisition within paramedicine and other disciplines (326)
3. Be able to conduct appropriate decision-making and critical thinking	A. Understand the importance of clinical decision-making during emergency care (242)
	B. Integrate a structured and hypothetico-deductive approach into decision-making to maintain safe patient care (233)
4. Be able to problem-solve by assessing professional issues and calling upon the required experience and knowledge to resolve them	A. Develop problem-solving skills and paramedical knowledge through constructive methods, such as problem-based learning and case-based learning (327)
	B. Understand the value of problem-solving skills in the EMS industry (59)

Personal: As a responsible person, a paramedic should maintain physical, mental, emotional, and professional fitness to support personal well-being and safe patient care (see Table 5.5). The personal role of a paramedic is represented in the ability to maintain an appropriate level of physical and mental fitness, manage personal emotions, and maintain an appropriate level of training.

Table 5.5: Personal

Core Competency	Enabling Competency
1. Understand the need to maintain an appropriate level of physical and mental fitness	A. Demonstrate physical fitness for the conduct of paramedic duties (328)
	B. Understand the importance of physical fitness for the adequate conduct of clinical duties, such as cardiopulmonary resuscitation (CPR) (329)
	C. Understand the need to mitigate the risks of occupational fatigue, depression, and poor sleep quality on paramedics (330)
2. Be able to manage personal emotions and those of patients and relatives	A. Understand the possible emotional connection to emergency incidents and patient experiences and the need to seek care (331)
	B. Engage in organisational and peer support even with regular patient transport if associated with heavy emotional burdens (332)
3. Be able to maintain an appropriate level of training through different professional courses	A. Demonstrate a personal commitment to acquiring and maintaining professional certification (333)
	B. Engage in a continuous cycle of clinical courses to improve confidence and knowledge (334)
	C. Understand the rapid effect of acquired knowledge decay, especially in paediatric patients (335)

5.14. Application and Integration of the SPECS Model

Educational Theories

The SPECS model represents an empirically developed curriculum blueprint for university programs in Saudi Arabia. However, to understand and integrate this research-based model with educational practice, academics and curriculum designers should develop an understanding of and apply learning theories and associated approaches. The connection between educational practice and learning research has had a long history of scholarship [336,337]. To link practice and research, the theories of human learning have been proposed as the established solution [336,337]. The emphasis on learning theories is attributed to four reasons. First, they are a source of verified techniques, tactics, and instructional strategies [338]. Second, they offer a basis for selecting a strategy [336-338]. Third, the integration of a strategy with the instructional context is important, as research and learning theories can indicate the best strategy to employ within a given context [336,338,339]. Fourth, as the aim of theory is to provide reliable results, an educational solution based on research provides a much more reliable solution than one solely based on instructional phenomena [338]. Therefore, applying the SPECS model in the context of established learning strategies can provide reliable outcomes for educational institutions in Saudi Arabia.

Leaning theories have developed over a long period of time [337,338]. Currently, there are four main established learning theories [338]. The first is behaviourism, which emphasises the outside environmental stimulus on learning [336-338]. The strategies in implementing behaviourism include lecturing, practice, and repetition [338]. The second theory, cognitivism, de-emphasises overt observable behaviour in favour of inner cognitive processes, such as thinking and information processing [336-339]. Implementing cognitivism is generally based on the strategies of outlining, framing, mnemonics, concept mapping, and analogies [336,338]. The third theory is constructivism, which argues that learning is constructed through personal interpretation rather than acquisition from the outside world [337,338]. Constructivism has used several educational approaches to learning, that emphasise collaboration and peer review, such as problem-based learning [338]. The fourth learning theory is connectivism, which bases learning on a networking phenomenon affected by socialisation and technology [340]. Strategies for implementing connectivism include massive open online courses, online scholarly resources, and social media in education [340]. The integration of the SPECS model through the strategies of learning theories can be very useful. For example, the behaviourist and cognitivist theories can provide a basis of didactic and established learning, while the constructivist and connectivist strategies provide a student-centred approach to learning.

Teaching Approaches

This section presents various teaching approaches, including student-centred learning (SCL), case-based learning (CBL) and, problem-based learning (PBL), interprofessional learning (IPL), simulations, and clinical placements. All of these could be used to support and implement the SPECS model. Teaching approaches generally refer to principles and pedagogical strategies used in teaching and are seen as part of a continuum from teacher-based to student-based learning [341]. As medical education has seen a continuous process of evolution, the amount of knowledge to be imparted is great and the time to deliver it is limited [342]. The high level of expected knowledge retention and effective interpretation of information by students is considerable [342]. Therefore, a shift away from teacher-centred didactic learning to interactive SCL, CBL and PBL is very well established [300,342]. The introduction of PBL into conventional curriculum has demonstrated encouraging results in health disciplines [342]. Currently, CBL has been integrated into EMS education at Monash University and appears to present a useful, enjoyable educational tool [300]. Therefore, the integration of the SPECS model with SCL approaches could provide a useful tool for Saudi EMS programs.

A recommended approach for medical and healthcare education in many countries is IPL sometimes called interprofessional education (IPE) [79,82,343]. This approach involves the process of learning between the different medical and healthcare professions with the aim of improving the quality of patient care and collaboration [79]. This is also important for EMS, for example, in patient handover between paramedics and ED staff. Scholars have advocated for the empirical standardisation of handover procedures that are supported by people in different professions working and understanding each other's roles better [235]. The integration of IPL in EMS education has seen success and improved interprofessional competence, especially through the utilisation of IPL workshops and simulations [79,82]. Integrating IPL with the SPECS model could thus improve the quality of patient care, teamwork, collaboration, preparedness for the Hajj and disasters, and communication, especially during patient handover.

Simulation-based education has gained considerable importance in the field of EMS education [62,251,255,303,322,344]. Simulation includes the techniques used to imitate the environments, settings, and conditions of patients [344]. Simulation is important in the development of medical education as it allows the replication of patient medical conditions, development and assessment of student competencies, and standardisation of care [282,344]. Moreover, simulations can be used in different formats, including immersive virtual reality, high-fidelity human simulation, and DVD simulation [303,322,327]. In EMS-related education, simulation has been suggested as a useful approach for the assessment and improvement of EMS management skills, communication, and as a possible replacement for some aspects of paramedic placements [62,254,255,322]. Finally, simulation-based research can help advance EMS educational research [240,251,298]. Thus, simulations are an integral part of any EMS program and should be integrated with the SPECS model not only for clinical competence but also to develop generic skills, such as communication and management skills.

The role of a university is to provide theoretical knowledge on concepts such as patient care, anatomy, physiology, and simulated disciplinary practice [249]. To link theory with practice, students must be enrolled in clinical placements or internships [249]. However, clinical placements for paramedics are reported to be lacking in the frequency and variety of cases, and students were only able to practise half of what they learned at university [81,324]. Factors that influence learning during clinical placements include adequate educational and logistical preparation, appropriate placements, capacity building, and communication between students and other stakeholders [250]. Theoretically, universities can only provide a novice paramedic, but with integration between clinical evidence, clinical skills, and supporting competencies, a student can transition from a novice to a beginning practitioner [61]. The empirical development of a national clinical placement standard between the EMS industry and universities with clear expectations and associated essential elements of quality is an important factor in improving patient care [345]. Integrating the SPECS model with internship programs is vital to achieve competency in clinical and supporting competencies and transition students into work-ready EMS professionals.

Integrating learning theories with the SPECS model offers an educational platform from which many strategies can be implemented to fit the context of each institution. Teaching approaches have been demonstrated to be useful tools in EMS programs. Therefore, the integration of learning theories and approaches with the SPECS model could help bridge the gap between research and practice.

5.15. Conclusion

This chapter provided a comprehensive discussion and interpretation of the results. The results discussed included those of the expert consensus Delphi method, the EFA in relation to similar international competency frameworks, the CFA model framework in relation to the structure and covariances, and the demographic aspects of the national study in relation to confirmed SPECS model factors. Finally, the SPECS model was provided to simplify the integration and alignment of core competencies into current Saudi EMS Bachelor programs.

Chapter 6: Conclusion, Limitations, and Recommendations

6.1. Introduction

This chapter outlines the key findings of the study. The first section summarises Saudi Emergency Medical Services (EMS) history, educational context, and international literature regarding EMS competency (Chapter 1-2). The second section presents a summary of the Delphi study, statistical analysis results, and the confirmed Saudi ParamEdic Competency Scale (SPECS) model (Chapters 3-5). In addition, the chapter describes limitations and offers recommendations for practice and research.

6.2. Section 1 (Chapters 1-2)

This study is the first to provide an overview of the evolution of EMS in Saudi Arabia, describing its history, organisational service providers, governance, EMS statistics, the educational development of the field, and the disparity in educational approaches. EMS in Saudi Arabia has seen a number of positive changes over the past decade, some of which include the development of universities and colleges, the transition of the profession from a post-employment first aid model into a pre-employment Bachelor degree model, generous scholarship grants overseas, and the official accreditation of EMS as a profession. It has been approximately 12 years since the first EMS Bachelor degree programs were developed in Saudi Arabia, some of which were directly adopted from universities in developed countries, such as Australia. Despite these positive changes, the current EMS system in Saudi is faced with many challenges, both organisational and educational, including the lack of research, community involvement, the educational status of practitioners, and the inconsistencies of statistics relating to response time and rate. In this chapter, the disparity in the educational outcomes and approaches adopted by colleges and universities in the kingdom are identified. The evolution of Saudi EMS can be divided into three broad stages:

- First aid provider, workplace training, 1934–2005
- Professional technician, EMS diplomas, 2005–2012
- Specialist, Bachelor in EMS, 2007–present

The second chapter provided the first scoping review to systematically identify potential core competencies for paramedic students. It provided insight into the scope of knowledge, abilities, skills, and education important in this field. The EMS education system has seen a rapid transition from a post-employment training model to a pre-employment education model. However, there is a lack of clarity on what core competencies EMS students are expected to hold. Therefore, the objective of this scoping review was to identify EMS student core competencies in the literature. The scoping review considered journal articles and grey literature (peer-reviewed and non-peer reviewed). The following databases were employed: CINAHL, MEDLINE, EMBASE, Scopus, and ERIC. In total, 127 core competency statements were extracted. For clarity and removal of duplications, these were reviewed and clustered into a final list of 33 core competencies. These were combined with seven core competencies from Chapter 1, forming the first version of the 40-item instrument used in the following studies.

6.3. Section 2 (Chapters 3-5)

The studies conducted as part of this project provide several important contributions to Saudi EMS. The first Delphi study represents the views of key experts and stakeholders in Saudi EMS with the aim of reaching consensus on a core competency framework. This study achieved the required recommendations for majority, consensus, stability, and response rate. The findings produced core competencies expected for paramedics in Saudi Arabia.

Using half the large national EMS study data, the EFA theoretical SPECS competency model was identified, consisting of the most influential factors associated with EMS core competencies in Saudi Arabia. The SPECS model has many similarities to EMS and other medical competency frameworks, but the SPECS model maintains aspects appropriate and specific to Saudi EMS. The model represents an important advance towards a more standardised and empirically based EMS education system.

The second half of the national study results supported the SPECS as a reliable, valid, unidimensional, and psychometrically sound model for operationalisation in Saudi university curricula. The national study identified and confirmed 27 items represented by five factors and a higher order construct. The SPECS model offers all Saudi universities an EMS program blueprint to ensure curriculum standardisation that will help EMS programs maintain excellence in curriculum standards based on empirical input from the local and international EMS industry. Finally, a SPECS model was provided with enabling competencies to simplify its integration and alignment with Saudi EMS Bachelor programs.

In the inferential analyses, the seven independent variables were tested against the five SPECS model factors of professionalism, preparedness, communication, clinical, and personal. In total, 39 significantly different results were identified and were discussed in relation to competency perception based on participant gender, age, qualifications, experience, discipline, primary role, and nationality. This study represents the first step in contextualising professional stakeholders in Saudi EMS. An EMS competency framework designed for curricula has also been observed from the different perspectives of diverse groups. Thus, the research used the large sample in the national study to explore how participants' professional profiles compared to the confirmed SPECS model factors. This is expected to improve the understanding of the current status and paradigms of Saudi EMS. Finally, the most noticeable disadvantage of EMS internationally and locally is a lack of research addressing professional, demographic, and educational aspects of the profession.

6.4. Limitations

This study had a number of limitations. First, the scoping review identified a considerable number of core competencies for paramedics. Therefore, the author amended the list to avoid overlapping and redundant items. This process may have removed subtle nuances between overlapping items. While considerable care was taken when amending the list, ultimately this process is open to interpretation. Moreover, any studies written in other languages were not included, which may have limited the number of studies and information that could have been relevant.

Second, while the Delphi methodology is an accepted technique that has been practiced for more than 50 years (104), the methodology has been criticised for its limitations, primarily difficulties in generalising the results to the larger population. Small sample size is a common factor in Delphi studies (123). Due to the nature of such studies, timing, and logistical restraints, patient perspectives were not included in this study.

Third, although the SPECS model represents the first EMS competency framework to be confirmed with confirmatory factor analysis (CFA) through structural equation modelling (SEM), the current model cannot be compared to other CFA EMS models, as none have yet been developed. The self-reporting nature of the study is another limitation; this approach, however, was the only viable one as a large sample size was required for advanced statistical analysis. Moreover, the cross-sectional design was limited to the specific period of time the data were collected. Finally, the Delphi and national studies depended on self-reported data the participants provided. Thus, the results may be affected by social desirability bias.

6.5. Recommendations

Based on the findings and prior research, this study offers the following recommendations for paramedics, academics, policymakers, and researchers in Saudi Arabia:

1. Adoption of the SPECS model as a standardised blueprint for EMS academic programs in Saudi Arabia, since this model represents the only empirically based competency framework developed for the Saudi EMS industry.
2. Development of a Saudi evidence-based approach to EMS education and practice.
3. Implementation of constructive student-centred learning methods (e.g., problem-based learning, case-based learning).
4. Engagement of a systematic culture of empirical research for SRCA and EMS practice during the Hajj.
5. Building more collaboration between the EMS industry and Saudi community by providing better outreach and awareness to improve services and training.
6. The SPECS model could be useful in other countries with similar requirements to Saudi Arabia (e.g., United Arab Emirates, Kuwait, Oman).
7. The empirical development of the SPECS model could serve as a blueprint to generate other core competency models internationally.
8. Further research into barriers and enablers to female paramedic practice in accordance with the Saudi context should be undertaken.
9. The benchmarking of EMS educational programs to achieve measurable standards through an empirical approach.
10. Universities should develop local Master and PhD programs based on the successful academic examples in Australia.

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Appendix A: Delphi Study Instrument

MONASH University

Title: What are the desirable core competencies of EMS Bachelor degree graduates in Saudi Arabia?

PART A: Demographic Section (7 questions)

Please circle the answer that best describes your current demographic information.

Q1.1 What is your gender?
- ❍ Male
- ❍ Female

Q1.2 What is your age? (in years)
- ❍ 18-28
- ❍ 29-39
- ❍ 40-49
- ❍ 50 or above

Q1.3 What is your highest qualification?
- ❍ Certificate
- ❍ Diploma
- ❍ Bachelor degree
- ❍ Master's degree
- ❍ PhD
- ❍ Other (please specify) ____________________

Q1.4 How long have you been working in the field of EMS?
- ❍ 1-4 years
- ❍ 5-9 years
- ❍ 10 or more years

Q1.5 What is your medical/health discipline?
- ❍ Paramedic
- ❍ Nurse
- ❍ Physician
- ❍ Other (please specify) ____________________

Q1.6 What is your primary professional role?
- ❍ Administrative/Leadership
- ❍ Educational/Academic
- ❍ Clinical/Patient care
- ❍ Other (please specify) ____________________

Q1.7 What is your nationality?
- ❍ Saudi
- ❍ Other (please specify) ____________________

SECTION B: Paramedic Competencies (41 questions)

Below are statements regarding EMS core competency, please circle the most appropriate number of each statement on a scale of 1-10 where 10 indicates extremely important and 1 is not important at all

A graduate of a Saudi Bachelor degree in EMS should:

Q2.1 Be able to effectively communicate information verbally and non-verbally to patients, colleagues and others.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.2 Be able to practice with respect and non-discriminatory manner.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.3 Be able to work as part of a team in a collaborative and professional approach.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.4 Be information literate, by having the capacity to search and apply information.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.5 Be able to demonstrate leadership skills.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.6 Be able to effectively supervise students and colleagues.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.7 Have the theoretical knowledge of key concepts in the EMS profession.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.8 Be able to provide appropriate and effective clinical care.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.9 Be able to conduct appropriate decision making and critical thinking.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.10 Be able to problem-solve, by assessing professional issues and calling upon the required experience and knowledge to resolve them.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.11 Be able to maintain situational awareness at all times whilst working in unpredictable situations.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.12 Be able to manage both their own emotions and those of patients and relatives.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.13 Be able to provide health and social advocacy responsibly.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.14 Be able to be mentor and educator when training others.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.15 Be able to reflect on their own experience and practice as professionals.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.16 Be able to maintain appropriate patient interaction and ensure the welfare of patients.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.17 Be able to provide care according to evidence based practice.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.18 Be responsible for the patient quality of care.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.19 Be able to conduct themselves in a high professional behavioural standard.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.20 Be able to maintain good coping skills to deal with stressful situations.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.21 Be committed to a process of continuous lifelong learning and professional development.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.22 Be able to practice within the legal and ethical boundaries of the profession.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.23 Be able to maintain appropriate and effective safety procedures.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.24 Have the ability to take patient history and conduct examination and assessment of both adults and children.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.25 Be able to conduct appropriate scene management.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.26 Be able to maintain the appropriate personal characteristics of being trustworthy and accountable.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.27 Be flexible in learning from different sources including guidance from other colleagues.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.28 Be able to work as autonomous professionals with high level of personal professional judgment.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.29 Be able to work in different transportation modes.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.30 Be able to maintain a high level of training through different professional courses.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.31 Understand the need to maintain an appropriate level of physical and mental fitness.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.32 Be able to work with different equipment and technology within the scope of practice.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.33 Be able to maintain accurate and comprehensible record keeping within the scope of practice.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.34 Be able to practice an appropriate level of quality management.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.35 Be able to demonstrate a high level of understanding for practice standards and protocols.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.36 Be able maintain preparedness and an ability to manage disasters.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.37 Be able to demonstrate an understanding of new technology on practice.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.38 Be able to practice with appropriate Islamic values.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.39 Be able to maintain involvement with public and community health.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.40 Be able to effectively practice in Umrah and Hajj.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.41 If there is another Core Competency statement that you think is missing, please write it here.

MONASH University

EXPLANATORY STATEMENT

Title: What are the desirable core competencies of EMS Bachelor degree graduates in Saudi Arabia?

Associate Professor Brett Williams
Department of Community Emergency Health and Paramedic Practice (DCEHPP)

Talal AlShammari
email: talal.m.alshammari@monash.edu

You are kindly invited to take part in this study. Please read this Explanatory Statement in full before deciding whether to participate in this research. If you would like further information concerning any part of this study, you are encouraged to contact the researchers via the email address listed above.

What does the research involve?
The objective of this research is to examine which Emergency Medical Services (EMS) Bachelor graduate core competencies best represent EMS in the Kingdom of Saudi Arabia. You are kindly asked to respond to the survey whether in paper form or electronically, this will take you between 10-15 minutes.

Why were you chosen for this research?
The feedback from health care professionals working in the field of EMS, either clinical, educational/academic or administrative/leadership is central to building an understanding of the important and desirable core competencies for EMS Bachelor degree graduates in Saudi Arabia. The Department of Research and Development at the Saudi Red Crescent Authority have kindly agreed to and facilitate the conduct of this research.

Consenting to participate in the project and withdrawing from the research
Conducting this study is voluntary and you are under no obligation to consent to participation. However, if you do consent to participate, you may only withdraw prior to submitting the survey.

Possible benefits and risks to participants
There may not be an obvious direct benefit to the participants in the research. But as the results obtained from this study are disseminated to the current EMS educational programs in Saudi, your input will help to influence the next generation of EMS

professionals and assist in developing new core competency standards according to the needs of Saudi Arabia. These results will also contribute to new knowledge in the limited literature available on EMS core competency in Saudi Arabia, the Arabian Gulf countries and the wider world research on this topic. There should be no inconvenience, risk or discomfort when completing the survey.

Confidentiality
The survey is anonymous with no identifying names, marks or codes. The data collected from the survey will be analysed on a group basis and the aggregated data published in a thesis, journal publications and conferences.

Storage of data
Storage of the data collected will adhere to the University regulations and kept in a safe location within the university premises for 5 years after which the data will be destroyed. A report of the study may be submitted for publication, but individual participants will not be identifiable in such a report.

Results
If you are interested to know the results of the study, kindly email Talal AlShammari at talal.m.alshammari@monash.edu

Complaints
Should you have any concerns or complaints about the conduct of the project, you are welcome to contact the Mansour Al-Qahtani through:
Tel : +966506290686 Email : masqd07@hotmail.com

Thank you,
Assoc Prof Brett Williams

PART A: Demographic Section (7 questions)
Please circle the answer that best describes your current demographic information.

Q1.1 What is your gender?
- ❍ Male
- ❍ Female

Q1.2 What is your age? (in years)
- ❍ 18-28
- ❍ 29-39
- ❍ 40-49
- ❍ 50 or above

Q1.3 What is your highest qualification you currently hold?
- ❍ Certificate
- ❍ Diploma
- ❍ Bachelor degree
- ❍ Master's degree
- ❍ PhD

Q1.4 How long have you been working in the field of EMS?
- ❍ 1-4 years
- ❍ 5-9 years
- ❍ 10 or more years

Q1.5 What is your medical discipline?
- ❍ Paramedic
- ❍ Nurse
- ❍ Physician
- ❍ Other (please specify) ____________________

Q1.6 What is your **main** professional role?
- ❍ Administrative/Leadership
- ❍ Educational/Academic
- ❍ Clinical/Patient care

Q1.7 What is your nationality?
- ❍ Saudi
- ❍ Egyptian
- ❍ Jordanian
- ❍ Syrian
- ❍ Indian
- ❍ Pakistani
- ❍ Other (please specify) ____________________

SECTION B: Paramedic Core Competencies (41 questions)

Below are statements regarding EMS core competencies. Please tick the most appropriate number of each statement on a scale of 1-10 where 10 indicates extremely important and 1 is not important at all

A graduate of a Saudi Bachelor degree in EMS should:

Q2.1 Be able to effectively communicate information verbally and non-verbally to patients, colleagues and others.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.2 Be able to practice with respect and non-discriminatory manner.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.3 Be able to work as part of a team in a collaborative and professional approach.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.4 Be information literate, by having the capacity to search and apply information.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.5 Be able to demonstrate leadership skills.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.6 Be able to effectively supervise students and colleagues.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.7 Have the theoretical knowledge of key concepts in the EMS profession.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.8 Be able to provide appropriate and effective clinical care.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.9 Be able to conduct appropriate decision making and critical thinking.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.10 Be able to problem-solve, by assessing professional issues and calling upon the required experience and knowledge to resolve them.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.11 Be able to maintain situational awareness at all times whilst working in unpredictable situations.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.12 Be able to manage personal emotions and those of patients and relatives.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.13 Be able to provide health and social advocacy responsibly.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.14 Be able to provide mentoring and education when training others.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.15 Be able to reflect on their own experience and practice as professionals.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.16 Be able to maintain appropriate patient interaction and welfare of patients.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.17 Be able to provide care according to evidence based practice.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.18 Be responsible for the quality of patient care.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.19 Be able to conduct themselves in a high professional behavioural standard.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.20 Be able to maintain good coping skills to deal with stressful situations.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.21 Be committed to a process of continuous lifelong learning and professional development.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.22 Be able to practice within the legal and ethical boundaries of the profession.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.23 Be able to maintain appropriate and effective safety procedures.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.24 Have the ability to take patient history and conduct examination and assessment of both adults and children.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.25 Be able to conduct appropriate scene management.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.26 Be able to maintain the appropriate personal characteristics of being trustworthy and accountable.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.27 Be flexible in learning from different sources including guidance from other colleagues.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.28 Be able to work as autonomous professionals with high levels of personal professional judgment.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.29 Be able to work in different transportation modes.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.30 Be able to maintain an appropriate level of training through different professional courses.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.31 Understand the need to maintain an appropriate level of physical and mental fitness.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.32 Be able to work with different equipment and technology within the scope of practice.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.33 Be able to maintain accurate and comprehensible record keeping within the scope of practice.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.34 Be able to conduct an appropriate level of professional management.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.35 Be able to demonstrate a high level of understanding for practice standards and protocols.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.36 Be able to prepare for and manage disasters and terrorist incidents.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.37 Be able to demonstrate an understanding of new technologies for clinical practice.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.38 Be able to practice with appropriate Islamic values.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.39 Be able to maintain involvement with public and community health.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.40 Be able to effectively practice in Umrah and Hajj.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Q2.41 Be able to demonstrate English Language proficiency to an adequate level for appropriate professional communication.

	1	2	3	4	5	6	7	8	9	10	
Not important at all	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Extremely important

Appendix C: Monash University Human Research Ethics Committee approval

Monash University Human Research Ethics Committee

Approval Certificate

This is to certify that the project below was considered by the Monash University Human Research Ethics Committee. The Committee was satisfied that the proposal meets the requirements of the *National Statement on Ethical Conduct in Human Research* and has granted approval.

Project Number: 8072
Project Title: What are the desirable core competencies of EMS bachelor degree graduates in Saudi Arabia?
Chief Investigator: Assoc Professor Brett Williams
Expiry Date: 28/02/2022

Terms of approval - failure to comply with the terms below is in breach of your approval and the *Australian Code for the Responsible Conduct of Research*.

1. The Chief Investigator is responsible for ensuring that permission letters are obtained, if relevant, before any data collection can occur at the specified organisation.
2. Approval is only valid whilst your hold a position at Monash University.
3. It is responsibility of the Chief Investigator to ensure that all investigators are aware of the terms of approval and to ensure the project is conducted as approved by MUHREC.
4. You should notify MUHREC immediately of any serious or unexpected adverse effects on participants or unforeseen events affecting the ethical acceptability of the project.
5. The Explanatory Statement must be on Monash letterhead and the Monash University complaints clause must include your project number.
6. Amendments to approved projects including changes to personnel must not commence without written approval from MHUREC.
7. Annual Report - continued approval of this project is dependent on the submission of an Annual Report.
8. Final Report - should be provided at the conclusion of the project. MUHREC should be notified if the project is discontinued before the expected completion date.
9. Monitoring - project may be subject to an audit or any other form of monitoring by MUHREC at any time.
10. Retention and storage of data - The Chief Investigator is responsible for the storage and retention of the original data pertaining to the project for a minimum period of five years.

Thank you for your assistance.

Professor Nip Thomson

Chair, MUHREC

CC: Mr Talal Alshammari

List of approved documents:

Document Type	File Name	Date	Version
Questionnaires / Surveys	What are the desirable core competencies of EMS bachelor degree graduates in Saudi Arabia	17/02/2017	1
Supporting Documentation	explanatory statement (BW)	18/02/2017	1
Supporting Documentation	Mansour AlQahtani Agreement for MUHREC	18/02/2017	1
Supporting Documentation	SRCA approval	18/02/2017	1
Supporting Documentation	What are the desirable core competencies of EMS bachelor degree graduates in Saudi Arabia	18/02/2017	1
Explanatory Statement	explanatory statement (BW)	24/02/2017	1
Supporting Documentation	Email Script	24/02/2017	1

Appendix D: Saudi Red Crescent Authority approval and letters of facilitation and completion

بسم الله الرحمن الرحيم

Kingdom of Saudi Arabia
Saudi Red Crescent Authority
General Administration
(259)

المملكة العربية السعودية
هيئة الهلال الأحمر السعودي
الإدارة العامة
(٢٥٩)

February 15, 2017

Dear Mr. Talal Al Shammari

The Saudi Red Crescent Authority is pleased to extend to you the opportunity to conduct your PhD research thesis at SRCA.

Saudi Red Crescent Authority understands the importance of the development of emergency medicine researches and would like to inform you that your request has been accepted.

Please feel free to contact us should you have any questions or comments.

[redacted]

الإدارة العامة للخدمات الإسعافية
GEN'L ADM. EMRG

الرقم: ٨١٢١١ التاريخ: ١٨ / ٥ / ١٤٣٨ المشفوعات:
Endosures: Date: / / No:

سنترال: ٢٨٠٥٥٥٥ - فاكس: ٢٨٠٦٦٦٦ - الرمز البريدي ١١١٢٩ - الرياض
Central: 2805555 - Fax : 2806666 - Code 11129 - Riyadh - www.srca.org.sa - E-mail: info@srca.org.sa

Kingdom of Saudi Arabia
Saudi Red Crescent Authority
General Administration

بسم الله الرحمن الرحيم

هيئة الهلال الأحمر السعودي
Saudi Red Crescent Authority

المملكة العربية السعودية
هيئة الهلال الأحمر السعودي
الإدارة العامة

سعادة مدير عام فرع المنطقة الشرقية   المحترم

السلام عليكم ورحمة الله وبركاته   وبعد

أساس المعاملة : دراسة بحثية للباحث/طلال بن ممدوح بن محمد الشمري.

الموضـــــوع : إجراء بحث علمي لدرجة الدكتوراه بعنوان (بناء الكفاءات الأساسية لبرنامج بكالوريوس الخدمات الطبية الطارئة في السعودية).

الافــــادة : أفيد سعادتكم بموافقة هيئة الهلال الأحمر السعودي على إجراء الدراسة البحثية التي يقوم بها الباحث / طلال الشمري في منطقة الرياض بناء على موافقة سعادة المشرف العام على الشؤون الاسعافية بالخطاب رقم ٧٧٨٣٧ وتاريخ ١٦ / ٥/ ١٤٣٨ هـ وذلك من خلال توزيع استبيان ورقي للعاملين بالمراكز الاسعافية .

المطلـــوب : نأمل من سعادتكم تسمية منسق من إدارة الشؤون الاسعافية للتعاون مع المذكور وتسهيل مهمته والتواصل مع الباحث/طلال بن ممدوح بن محمد الشمري جوال ٠٥٠٢٨٨٨٨٩٨.

وتقبلوا سعادتكم وافر تحياتي وتقديري ،،،،

مدير عام الخدمات الطبية الاسعافية

[redacted]

الرقم: .... التاريخ: ١٥ / ١٠ / ١٤٣٩هـ المشفوعات: ....

No.: .... Date: / / Endosures : ....

سنترال: ٠١١ ٢٨٠٥٥٥٥ – فاكس: ٠١١ ٢٨٠٦٦٦٦ – الرمز البريدي ١١١٢٩ – الرياض
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Kingdom of Saudi Arabia
Saudi Red Crescent Authority
General Administration

بسم الله الرحمن الرحيم

المملكة العربية السعودية
هيئة الهلال الأحمر السعودي
الإدارة العامة

سعادة مدير عام فرع منطقة الرياض المحترم

السلام عليكم ورحمة الله وبركاته وبعد

أساس المعاملة : دراسة بحثية للباحث/طلال بن ممدوح بن محمد الشمري.

الموضـــــوع : إجراء بحث علمي لدرجة الدكتوراه بعنوان (بناء الكفاءات الأساسية لبرنامج بكالوريوس الخدمات الطبية الطارئة في السعودية).

الافـــــادة : أفيد سعادتكم بموافقة هيئة الهلال الأحمر السعودي على إجراء الدراسة البحثية التي يقوم بها الباحث / طلال الشمري في منطقة الرياض بناء على موافقة سعادة المشرف العام على الشؤون الاسعافية بالخطاب رقم ٧٧٨٣٧ وتاريخ ١٦ / ٥/ ١٤٣٨ هـ وذلك من خلال توزيع استبيان ورقي للعاملين بالمراكز الاسعافية .

المطلـــــوب : نأمل من سعادتكم تسمية منسق من إدارة الشؤون الاسعافية للتعاون مع المذكور وتسهيل مهمته والتواصل مع الباحث/طلال بن ممدوح بن محمد الشمري جوال ٠٥٠٢٨٨٨٨٩٨.

وتقبلوا سعادتكم وافر تحياتي وتقديري ،،،،،

مدير عام الخدمات الطبية الاسعافية

[redacted]

الرقم: ...٢٣٢٩٧... التاريخ : ١٥ / ١٠ / ١٤٣٨ المشفوعات: ....

No.:.......... Date: / / Endosures :..........

سنترال: ٢٨٠٥٥٥٥ ٠١١ – فاكس: ٢٨٠٦٦٦٦ ٠١١ – الرمز البريدي ١١١٢٩ – الرياض

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Kingdom of Saudi Arabia
Saudi Red Crescent Authority
General Administration

بسم الله الرحمن الرحيم

المملكة العربية السعودية
هيئة الهلال الأحمر السعودي
الإدارة العامة

To whom it may concern

We would like to inform you that **Mr. Talal Alshammari** holding ID number (1054105349) had finished collecting data for his scientific research under the name of "What are the desirable core competencies of EMS Bachelor degree graduates in Saudi Arabia".

Collection starting date: 22/6/2017
Collection finishing date: 22/9/2017
Total duration: 90 days

TH

[redacted]

الرقم: .... التاريخ: / / المشفوعات: ....

No.: .... Date: / / Endosures : ....

سنترال: ٠١١ ٢٨٠٥٥٥٥ - فاكس: ٠١١ ٢٨٠٦٦٦٦ - الرمز البريدي ١١١٢٩ - الرياض

Central: 011 2805555 - Fax: 011 2806666 - Code 11129 - Riyadh - www.srca.org.sa - E-mail: info@srca.org.sa

Appendix E: Evolution of emergency medical services in Saudi Arabia

JEMTAC
Journal of Emergency Medicine
Trauma & Acute Care
A PEER REVIEWED JOURNAL

Review article

Evolution of emergency medical services in Saudi Arabia

Talal AlShammari*, Paul Jennings, Brett Williams

Department of Community Emergency Health and Paramedic Practice, Monash University, Victoria, Australia

*Email: talal.m.alshammari@monash.edu

ABSTRACT

Aim: The purpose of this study was to provide an overview of the evolution of emergency medical services (EMS) in Saudi Arabia to describe its history, organisational service providers, governance, EMS statistics and the educational development of the field with the disparity of educational approaches.

Background: The EMS is an important part of the healthcare system as it is often the first point of contact for medical emergencies. The EMS in Saudi Arabia has seen a number of positive changes over the past decade, some of which include the development of several university and college programs dedicated to teaching EMS, the evaluation of the profession from a post-employment first aid model into a pre-employment bachelor's degree model, the generous governmental scholarship grants overseas and the official accreditation of EMS as a profession. It has been approximately nine years since the first EMS bachelor's degree programs were developed in Saudi Arabia, some of which were directly adopted from universities in developed countries such as Australia. Despite these positive changes, the current EMS system in Saudi is faced with many challenges, both organisational and educational, including the lack of research, community involvement, the educational status of practitioners and the inconsistencies of statistics relating to response time and rate of transfer. This paper describes the history of EMS in Saudi Arabia with a specific focus on identifying the disparity in the educational outcomes and approaches adopted by colleges and universities in the Kingdom.

Methods: The data utilised for the research of the EMS profession in Saudi Arabia were obtained from the literature using search tools such as MEDLINE, Google Scholar, Saudi health journals, Saudi university websites, government reports and statistics.

Conclusion: The EMS profession in Saudi Arabia has advanced greatly in the past 12 years. Yet there is still scope for considerable improvement, especially with regards to developing empirically identified core competencies for EMS bachelor's degree graduates. There is also the need for providing more outreach to the public to improve awareness of current services and available training, building more collaboration between the industry employers and academic institutions and investing further in EMS research through the development of Saudi-based postgraduate master's and PhD EMS degrees. This paper is the first to provide an overview of the EMS service in Saudi Arabia, for institutions and researchers to gain a better understanding of the history and current standing of the service from an educational and operational perspective.

Keywords: Emergency medical services, paramedics, Saudi Arabia, EMS core competencies

http://dx.doi.org/10.5339/jemtac.2017.4

Submitted: 6 November 2016
Accepted: 20 February 2017

كيوساينس
QSCIENCE
دار جامعة حمد بن خليفة للنشر
HAMAD BIN KHALIFA UNIVERSITY PRESS

Cite this article as: AlShammari T, Jennings P, Williams B. Evolution of emergency medical services in Saudi Arabia, *Journal of Emergency Medicine, Trauma & Acute Care* 2017:4
http://dx.doi.org/10.5339/jemtac.2017.4

INTRODUCTION

Saudi Arabia

The Kingdom of Saudi Arabia (KSA) was established in 1932. It is approximately a quarter the size of the United States with over 2,150,000 km^2 in size, constituting nearly 80% of the Arabian Peninsula.[1] Saudi Arabia is made up of 13 regions, each of which contains a capital city. Eight countries border Saudi Arabia starting from the north clockwise: Jordan, Iraq, Kuwait, Bahrain, Qatar, Emirates, Oman and Yemen. The geography of Saudi Arabia is varied, with coastlines on the Arabian Gulf and Red Sea, mountains in the southwest and plains and deserts covering more than half the country. According to the General Authority of Statistics in KSA, the estimated population of Saudi Arabia in 2016 was 31,742,580.[2]

Healthcare system

In terms of the number of healthcare workers in comparison to the population for every 10,000 people, there are 26.5 physicians and dentists, 53.7 nurses, 7.2 pharmacists and 30.8 allied health professionals, including emergency medical services (EMS) providers.[3] The Ministry of Health (MOH) budget for 2014 was 59.985 billion Saudi Riyals, which is 7.01% of the total governmental budget. This does not include the budget for the other healthcare sectors of the country, and 43.5% of the MOH budget was being allocated to staff salaries.[4] In total, there are 453 hospitals and 67,997 beds in all of the country, 59.3% of which are run by the MOH.[4] In addition, 29.5% of the population of Saudi Arabia are under the age of 15, and the life expectancy is 74.2 years, which is four years more than the global average and six years in excess of the regional average.[4] The five leading causes of death are ischaemic heart disease (21.7%), stroke (16%), lower respiratory infections (6.3%), road injury (5.8%) and diabetes mellitus (4.6%).[3]

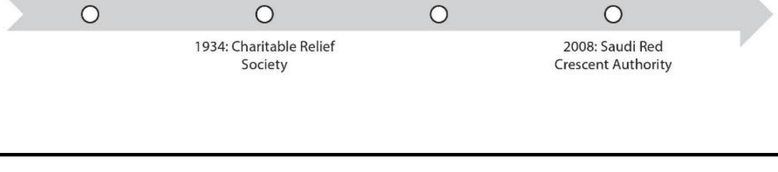
HISTORY OF EMS IN SAUDI ARABIA

The history of EMS in Saudi Arabia is directly related to the Saudi Red Crescent Authority (SRCA). The SRCA constitutes the beginning of pre-hospital care being provided by the Saudi government for the general public from the early decades of the development of healthcare in KSA.[5] According to the SRCA official site, EMS care was only officially institutionalised by an independent ambulance provider after the formation of the National Ambulance Health Association (NAHA) in 1353 Hijri (Islamic Calendar) equivalent to 1934.[5] The role of the ambulance service was initially part of the Public Health and Ambulance Authority, which was the governmental provider of health and ambulance care for the general public and especially to the pilgrims visiting Mecca and Medina.[5] The development of the NAHA came about by the response to the Saudi Yemeni War in 1934 by providing medical care for the military.[5]

Following the Saudi Yemeni War, pre-hospital care was mostly limited to Mecca and Medina and was a charitable and private initiative under the Charitable Relief Society (CRS).[5] However, after World War II, the income of these private institutions was greatly diminished, leading to dependence on the government rather than charity. Eventually, in 1383 Hijri (1963), a royal decree from King Faisal was issued to convert the CRS from a private into a public institution under the name Saudi Red Crescent Association.[5,6] The name was later amended in 2008, to the Saudi Red Crescent Authority.[7]

The main objectives of the SRCA encompass providing aid relief, ambulance services and performing humanitarian work through international treaties.[6] The SRCA is the 91st member of the International Federation of Red Cross and Red Crescent Societies.[6] Furthermore, the office of the United Nations High Commissioner for Refugees (UNHCR) was involved in providing an emergency management training programme collaborating with SRCA in 2000.6

History of Saudi EMS Timeline:



ORGANISATION AND SERVICE PROVIDERS

The EMS in Saudi Arabia is a vital first point of contact for pre-hospital patients and the responsibility for providing pre-hospital care and transport falls on the SRCA[8]. This responsibility is inclusive of the entire country with some exceptions. For example, certain areas of the country which are within the catchment zones of the military sectors or large companies are responded to by these organisations. The inter-facility patient transfer is generally the responsibility of hospitals and not SRCA, with these hospitals running their own ambulance transfer service.[8,9] The EMS service in Saudi Arabia is based mostly on an Anglo-American model, which aims for the rapid transport of patients to an emergency department by clinically competent paramedics.[10] Other countries that adopt this model are the United Kingdom, the United States, New Zealand, Australia and the Sultanate of Oman.[10]

The pre-hospital care system in Saudi Arabia is still developing in issues pertaining to community awareness, attitudes and the knowledge deficiencies of pre-hospital care providers. One of the issues reported by Salleeh[11] is that the majority of patients with cardiac arrest in Riyadh are being brought to hospitals in private vehicles by people who are seldom educated in cardiopulmonary resuscitation (CPR). In a recent study, AlHabib[12] compared the EMS and non-EMS patient transfers in the Arabian Gulf countries for acute care and described the importance of clinical arrival within 24 hours of the onset of symptoms of ST segment Elevation Myocardial Infarction (STEMI). The study found that out of the 2,928 patients transferred, only 109 (3.7%) used the Red Crescent EMS service, which the study described as a "disturbing finding".[12] In addition, the study reported a significant lack of basic life support (BLS) and advanced cardiac life support (ACLS) certifications of the paramedics involved.[12] The majority of patient ECGs were also performed in hospitals and not by EMS providers,[12] which may indicate a limitation in the current clinical and theoretical competence of EMS providers.

In the case of Motor vehicle accidents (MVA), the accident scenes regularly involve friends, family members and spectators, which may lead to significant interruption to on-site patient care.[13] Furthermore, in a recent Saudi Arabian study, it was found that the majority of the pre-hospital care providers suffered from a lack of knowledge regarding important stroke symptoms. The study recommended addressing educational needs in addition to screening tools.[14] This deficiency in knowledge gives an indication of the lack of development in EMS education in Saudi Arabia.

The issue of transferring patients directly to hospitals in private cars by family members or strangers involved in accidents can be linked to many factors, which include socioeconomic, education, public awareness or media.[12,13] However, a concept that may also have an effect is the Arab culture of 'Fazaa', which can be explained as helping those in need and is considered a virtue. Therefore, this concept may be turned around and used in the media. For example, to convey the message that the best way to perform 'Fazaa' duty is to be educated in CPR or the Heimlich manoeuvre and to call the EMS hotline, following the dispatcher's instructions and answering their questions. Although, the current and future plans for the EMS development in Saudi are not clear, there are positive examples of how research can help in planning and improving the EMS service. The study by Alsalloum[15] contributed to the development of a model for SRCA to pinpoint the most appropriate locations for EMS stations, with the aim of reducing morbidity and mortality in the Riyadh population by improving response time.[15] Another plan, with the aim of significantly decreasing morbidity and mortality of patients with trauma in Saudi Arabia, was proposed by Al-Naami.[16] The plan calls for establishing a multidisciplinary trauma system with pre-hospital care focus as an essential component of such a plan.[16] However, the ideas proposed regarding pre-hospital care, such as the establishment of a pre-hospital registry and research agenda, have yet to come into effect.[16]

Other organisational issues facing EMS in Saudi and specifically SRCA is the lack of publications regarding key performance indicators, such as the response time for pre-hospital cases. According to Al-Ghamdi,[17] the average response time for ambulances was 10.23 min. However, another observational cross-sectional study involving 1534 persons, 355 of whom had previous experience of utilising the services of SRCA, reported that 40.3% ($n = 143$) of the ambulances arrived after 1 hour.[18] In addition to the respondents of the study, only a third knew the actual dispatch number for SRCA.[18] These results suggest a substantial lack of public awareness of the services provided by EMS in Saudi Arabia. The SRCA should strive to provide better community outreach programs through universities, municipal and public institutions to better educate the public and to support research in the field of Saudi EMS in order to empirically analyse and empower the profession.

STATISTICS

In 2014, SRCA responded to and transported 260,789 cases throughout the Kingdom.[4] When comparing this number to other countries in the same year, Ambulance Victoria, Australia, responded to 840,188 cases, inclusive of emergency and non-emergency cases.[19] The population of Saudi Arabia in 2014 was 30,770,375, whereas that of Australia in 2015 was 23,860,100 and specifically the population of Victoria was 5,596,670.[20,21] Despite the fact that the population of Saudi Arabia is 5.49 times that of Victoria, their overall utilisation of the EMS services is approximately one-third (0.31) of that of Ambulance Victoria. Moreover, a resident of Victoria utilises EMS 17.7 times more compared to a resident of Saudi Arabia (Table 1).

Although Ambulance Victoria constitutes only part of the EMS providers in Australia and does not represent the entire EMS system, the disparity in the utilisation of pre-hospital care in Saudi is extreme. Another example is the National Health Services (NHS) England Ambulance Services, which had 9,000,000 service calls in 2014.[22] Another closer example to Saudi Arabia is Qatar, which has reported, according to Hamad Medical Corporation, 168,332 ambulance service calls in 2014.[23]

The figures from different countries strongly indicate that the EMS environment and associated variables are very different in KSA from those found in other countries. As such, the unique nature of the entire EMS process in Saudi Arabia warrants a strong emphasis on developing a research-based approach to improve the service specific to the country. Research should investigate all aspects of EMS such as the cultural, ethical and EMS education in the Kingdom, in order to understand these service variables and accommodate them.

Table 1. Comparison of population and ambulance response rate of Saudi Arabia with other countries and states.

EMS provider	Number of cases	Country or state population	Per 1000 persons a year
SRCA	260,789	30,770,375	8.47
AV (State of Victoria)	840,188	5,596,670	150.12
Hamad Medical Corporation	168,332	2,003,700	84.01
NHS	9,000,000	54,300,000	165.74

Source: Hamad Medical Corporation,[23] Ambulance Victoria,[19] Australian Bureau of Statistics,[20] General Authority for Statistics,[21] National Health Service England,[22] Qatar Ministry of Development Planning and Statistics,[24] Office of National Statistics.[25]

GOVERNANCE

The quality and development of an EMS system in any country cannot be measured using a specific classifications scale of the stages of development in EMS, to assess whether the country is developed or underdeveloped. Therefore, it can be helpful to provide a comparison of certain aspects of the current situation between developed countries, such as Australia, the United Kingdom (UK) and the United States of America (USA), and Saudi Arabia, as can be seen in Table 2.

Table 2. Overview of EMS governance in Saudi Arabia compared with other countries.

Country	Registry and licensing	Primary pre-hospital care provider	Industry-based governance	Professional health associations
Australia	Employer based (state based)	State providers	CAA	PA
Saudi Arabia	SCFHS	SRCA	Employer-based	SASEM, SAEMS
United Kingdom	HCPC	Regional trusts	JRCALC	College of Paramedics
United States	NREMT and state-based	State providers	NHTSA and state-based	NAEMT

Source: Saudi Red Crescent Authority,[5] Health & Care Professions Council UK,[26] Saudi Society of Emergency Medicine,[27] Saudi Commission for Health Specialties,[28] Brooks et al.,[29] Whitmore and Furber,[30] Paramedics Australasia,[31] Council of Ambulance Authorities,[32] National Highway Traffic Safety Administration,[33] National Association of Emergency Medical Technicians.[34]

In the KSA, the governance of the EMS practice is split into two parts. The first includes different industry employers, such as the SRCA, MOH, other military and certain private sectors. These institutions do not have an overarching body that regulates the EMS profession specifically.[35] According to Alanazi "there is no National Saudi Registry of EMS personnel, which ensure professional responsibilities to adapt new protocols or implement any new courses".[35] By contrast, the Council of Ambulance Authorities (CAA) in Australia, established in 1962, comprises EMS employing agencies.[36] The CAA has a significant role especially in Australian paramedic education as they have formed an accreditation process for paramedic programs in universities. The aim of which is to guarantee that paramedic graduates from these institutions have attained the necessary entry-level competencies for paramedic employment with an Australasian Ambulance Service.[36] The role of CAA in the ambulance industry also includes providing input into the development of public policies regarding EMS and developing exchange information and research.[32] The Joint Royal College of Ambulance Liaison Committee (JRCALC) was established in 1989 due to the development of the paramedic role in the United Kingdom. The role of JRCALC is to provide expert consultation to the UK EMS service providers and conduct clinical oversite.[29] Furthermore, the first practice guidelines for paramedics in the United Kingdom was published in 2000 by the JRCALC; these guidelines emphasise paramedic discretion and clinical judgment over rigid protocols.[29]

The second part of governance in Saudi Arabia is undertaken by the Saudi Commission for Health Specialities (SCFHS). The role of the SCFHS is to govern the practice of all health professions (not just specific to EMS). This governance includes clinical practice registration, licensing of healthcare workers, approving health-specific courses and certificates and establishing scientific associations for health speciality.[28] In the United States, the National Registry of Emergency Medical Technicians (NREMT) provides certification examination for the paramedic, EMT intermediate, EMT basic and first responder.[33] The NREMT is generally accepted by many states as a facilitator that provides uniform competency standards through examining the EMS candidates.[33]

It should be noted that the health industry employers are required to follow the regulations, registration, licencing and other similar requirements that are set by out by the SCFHS.[28] In the United States, the title EMT–paramedic was officially recognised as an allied health occupation in 1975.[37] The EMS speciality has also been recognised professionally by the SCFHS and is categorised within three tiers for university and college graduates: specialist for a bachelor's degree, senior specialist for a master's degree and consultant specialist for a PhD holder (Table 3) with other specific requirements, such as experience and certain short courses.

Table 3. SCFHS specialist tiers and requirements.

University degree held	Level of recognition	Required experience
Bachelor's (4 years degree and 1 year internship)	Specialist	4 years study 1 year internship
Master's (2 years)	Senior specialist	2 years postgraduate Speciality experience
PhD (4 years)	Consultant specialist	3 years post-PhD Speciality experience

Note: tier upgrade is granted post-experience. For example, a person who graduated with a PhD will be classified as a senior specialist. After completion of the required experience, he/she will be upgraded to a consultant specialist. They are not required to pass through every tier but are granted the tier on the basis of their current qualification.
Source: Saudi Commission for Health Specialties.[28]

The establishment of scientific associations for health specialities by the SCFHS has led to the creation of the Saudi Association Society of Emergency Medicine (SASEM), which initially included all health specialities in emergency medicine, including doctors, nurses and paramedics.[27] Although paramedics can vote in the SASEM, they cannot be nominated to the Board of Directors membership election according to Element No. 19 of the SASEM bylaws and regulations.[27] The main activities of SASEM include establishing scientific committees, holding symposia and conferences, encouraging research and providing public knowledge and awareness.[27]

This was followed with the establishment of the SAEMS (Saudi Association of Emergency Medical Services), which has similar objectives but is oriented towards EMS.[28] Although these associations have no governance over the profession or the practitioners, they may play a future role in developing professional healthcare workers in the field of pre-hospital care.[28] Such a role can be compared to that of the British Paramedic Association, which is now called the College of Paramedics, whose aim is to provide a professional voice for EMS clinicians in legislation, education and the community.[30] These types of associations can also be compared with Paramedics Australasia (PA), which is a professional association representing pre-hospital practitioners in Australia. One of the roles of PA is to provide a voice for paramedics in determining the changes in legislation, services and clinical practice, which affect the healthcare system in Australia.[31]

In conclusion, the EMS system governance in Saudi Arabia is developed in areas such as the SCFHS, where registration and licencing of the profession is concerned. Yet the system also requires support and maturity in other sectors, especially when compared to other countries such as the United Kingdom and Australia, as there is a lack of advocacy for the profession by important groups. There is also no overarching body for employers in the EMS industry, which can enforce competency standards on academic institutions. In addition, the development of associations and authorities that represent the professional interest of the EMS practitioners, similar to the UK College of Paramedics, the Australian PA and the many EMS speciality associations in the United States,[38] can provide another aspect of development for the profession.

EDUCATIONAL TRANSITION

The EMS educational transition in KSA can be identified within three broad stages:

- Stage 1: Beginnings: The first aid provider, workplace training 1934–2005;
- Stage 2: Development: The professional technician, EMS diplomas 2005–2012;
- Stage 3: Academic transition: The specialist, bachelors in EMS 2007–present.

Stage 1: Beginnings: The first aid provider, workplace training 1934–2005

The first stage of EMS education in Saudi was by far the longest when EMS education was somewhat restricted to certain courses, such as BLS, First Aid and First Responder training courses.[5,8] These programs were mostly limited to the training provided by the industry, as this was the expectation at that time to provide basic first aid and transport to the nearest emergency department.[5,8]
An educational parallel to this can be drawn from the history of EMS in Australia, whereby, in the past, several of the mainstream healthcare professional training was originally either industry-based, hospital-based or through private institutions. These professions were eventually recognised in an official manner by the Australian Health Practitioners Regulation Agency (AHPRA) including nursing, osteopathy and Chinese medicine.[36] As such, educational requirements for paramedics in the past were minimal and may have been limited to first aid training.[36] Another example from the United Kingdom would be the 1966 Millar report, which specified the post-employment training requirements for ambulance staff under the umbrella of the Institute of Health Care Development that provided the certification for the graduates.[29]

During this stage, the concept of a paramedic as a separate health profession did not exist in Saudi Arabia; this is made evident by the founding charter of SRCA 1386 H (1966), which states, in the second part (article 6), that the Saudi Red Crescent will strive to elevate the nursing profession and train both male and female nurses on hospital work and emergency situations.[5] This was thought to be achieved by training courses and the creation of ambulance and nursing schools.[5] In the United States, the start of an organised civilian EMS system was initiated in the 1960s, as the operations of the EMS system continued to develop, so did the educational sector.[37] In the early 1970s, physicians and registered nurses were the trainers for the majority of EMS educational courses. Very little of the instructor and student material was related to emergency pre-hospital patient care.[37] There was no apparent outline of the pre-hospital scopes of practice as well as no standards for the definition of practice in EMS.[37]

Stage 2: Development: The professional technician, EMS diplomas 2005–2012

The second phase in the development of pre-hospital care in Saudi Arabia came with the creation of the first diploma programs in EMS. These programs started to develop in the early 21st Century, with a focus on delivering professional well-trained paramedics.[39] By adapting the scope of paramedic education to a new model of advanced life support (ALS) care, these programs had a significant impact on what it is to be a pre-hospital care provider in KSA. Ultimately, the level of professional accreditation was recognised as that of a technician by the SCFHS. With the introduction of the first Red Crescent-operated ALS unit in Riyadh by 2005,[39] the stage was set for a new phase in pre-hospital education and the provision of care in KSA. A comparison can be drawn from the adoption of ALS clinicians for ambulance care in other more developed countries, such as the 1969 ALS trained fire-fighter paramedic adoption in six of the US states.[29] The 1971 intensive care paramedics in the state of Victoria, Australia, and the 1979 UK adoption of the Medical Commission on Accident Prevention recommended ALS trained ambulance clinicians to provide pre-hospital care for patients with trauma.[29]

Unlike the previous stage of EMS progression in Saudi, which was a gradual process, the EMS diploma came to an abrupt end. This was a process of social dialogue involving the national media in Saudi, as a large number of health diploma graduates from all specialities in the Kingdom had faced considerable unemployment.[40] According to the SCFHS, such an issue, coupled with a recommendation by the WHO to expect a bachelor's degree as the minimum requirement for all healthcare professionals, required change. In 2012, the SCFHS stopped all diplomas in the medical sciences, including EMS, and made the bachelor's degree the new standard.[40]

Stage 3: Academic transition: The specialist, bachelor's in EMS 2007–present

The third phase of evolution in EMS education in KSA was the development of the university- or college-based bachelor's degree. These programs were first started in King Saud University (KSU) and King Saud bin Abdulaziz University for Health Sciences (KSAU-HS) following 2007. Although both universities go by the same royal name, they are two different universities.[41] According to Alanazi,[9] the reason for the establishment of a bachelor's degree at KSAU-HS was the lack of quality and quantity of Saudi paramedic nationals. In order to establish a model for EMS education and to support research in the field, it should be noted that one of the first programs to begin in Saudi was the paramedic bachelor's program adopted from Flinders University in South Australia. The reason for this choice was the unique approach in developing a problem-based, student-based and patient-based curriculum, which is integrated into work practice.[9]

Academic institutions providing higher-level EMS educational programs are associated with the improvement of professionalism of EMS as a recognised discipline. These programs also increase the accessibility of educational prospects that may recognise previous EMS educational and academic accomplishments. They also expand the management skills and protect the significance of societal and individual resources devoted to education.[33] In general, the lack of research publications in the field of EMS is an international aspect of the profession, as it is considered a developing area in medical and health education programs.[42] Therefore, a potential future approach to resolve the lack of research is to develop the research capacity by establishing Saudi master's and PhD programs in order to empirically study the current EMS issues and develop plans to address them.

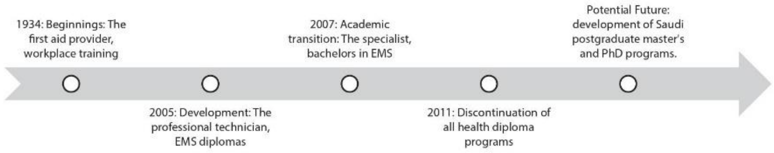
In different regions of the country, bachelor's programs are now being offered by 10 universities and colleges, both private and public (Table 4), some of which are offering their programs in different campuses. In comparison, Australia has 17 universities that are offering paramedic bachelor's degree programs.[43] Moreover, the UK Health and Care Professions Council has 65 recognised programmes that offer the paramedic title.[26]

Table 4. Saudi universities and colleges with an EMS bachelor's degree.

Name of university/college	Public/ private	Name of the bachelor's program
AlGhad College	Private	Emergency Medicine
Marefa College	Private	Emergency Medical Services
Dammam University	Public	Emergency Medical Care
Inaya College	Private	Emergency Medical Services and Critical Care
Jazan University	Public	Emergency Medical Services
King Khaled University	Public	Emergency Medical Services
King Saud University Prince Sultan bin Abdulaziz College for Emergency Medical Services (PSCEMS)	Public	Emergency Medical Services
King Saud bin Abdulaziz University for Health Sciences (KSAU-HS)	Public	Emergency Medical Services
Prince Sultan Military College	Public	Emergency Medical Technology
Umm Al-Qura University	Public	Emergency Medical Services

Source: King Saud University,[41] Ministry of Education,[44] University of Dammam,[45] Umm Al-Qura University,[46] Prince Sultan Military College,[47] King Saud bin Abdulaziz University for Health Sciences,[48] Jazan University,[49] Inaya College,[50] AlMaarefa Colleges,[51] AlGhad Colleges,[52] King Khaled University.[53]

Timeline of key stages in the educational transition of Saudi Arabian EMS:



DISPARITY OF EDUCATIONAL APPROACHES

With the rapid development in the field of pre-hospital care from limited first aid post-employment training courses into recognised university bachelor's programs, the universities and colleges developed their own expectations, and core competencies, which in the case of KSAU-HS, were based on scientific research.[9] These disparities are apparent when reviewing the different EMS university and college programs in Saudi Arabia. Moreover, no official discernible competency standards have been adopted from other developed EMS countries and there is a lack of apparent development in local Saudi Arabian competency standards, with the exception of the model developed by Alanazi[9] (which has by itself limitations such as being localised and that 50% of the candidates are physicians with the other 50% having a US background). The ability to analyse the current disparity in the approach of competency standards is limited because of the scarcity of research. Yet, it may be prudent to gain an understanding of these competencies by analysing each college and university program.

These academic agencies offer the certification for their graduates and are expected to provide them competency standards. This is defined by the US department of National Highway Traffic Safety Administration (NHTSA) as "Certification – the issuing of a certificate by a private agency based upon standards adopted by that agency that are based upon competency."[37] Moreover, to be able to define the criteria by which each college or university specifies their goals, expectations and competencies of their students, the definition by the CAA Paramedic Professional Competency Standard will be utilised "the combination of skills, knowledge, attitudes, values and abilities that underpin effective and/or superior performance in a profession/occupational area"[54]. Another definition stated by the NHTSA National Emergency Medical Services Education Standards report is that for "Competency – expected behaviour or knowledge to be achieved within a defined area of practice."[37] The method by which the different EMS program competencies were identified was based on these definitions. The official website of each university or college EMS bachelor's program recognised by the Ministry of Education in Saudi Arabia was analysed. The available competencies under the different headings of values and goals for students in the undergraduate program were extracted and have been included in Table 5.

As can be seen in Table 5, there are 23 competencies. The classic domains associated with learning are cognitive, affective and psychomotor, which are associated with knowledge and intellect, attitudes and values and motor skills, respectively.[55] Some of the stated program competencies focus on attitudes, values and intellectual skills, whilst others address the knowledge, practical and psychomotor skills of the profession. Moreover, the only competency with a majority consensus was 'decision making'. In addition, two more core competencies were each endorsed by five programs, which are as follows: safety and communication. Yet, what is apparent in the competencies of each university and college is the disparity in the expectations of the degree graduates. The result of such disparity is that there is an uncertainty about what a paramedic should be in Saudi Arabia. Such inconsistency could cause a mismatch between the educational institutions and employment industry competencies specific to Saudi Arabia. This issue could result in a variation of ways paramedics from different institutions communicate with and treat their patients, as medical oversite and paramedical guidelines have an inherently limited capacity to deal with the range of medical ambiguity, diverse pre-hospital contexts and circumstances.[56] Consequently, the degree to which paramedics adequately and safely deliver patient care is dependent on the competency of making reliable and accurate decisions regarding the scene, patient condition, available equipment, safety concerns and the many other factors contributing to the complexities of pre-hospital care. Therefore, providing the correct competency for the students who are expected to be at entry to practice level will probably be a contributing factor in improving patient care.[56]

Table 5. Saudi universities and colleges with EMS bachelor's competencies, with X representing the available competency at the institution.

Competency	GHD	MRF	DMM	INA	JAZ	KKU	KSU	KSAU	PSM	UMQ
Safety	X					X		X	X	X
Assessment	X							X		
Decision making	X	X					X	X	X	X
Communication	X	X	X			X		X		
Understanding standards	X			X			X			
Medical and trauma skills	X						X	X		
Patient safety	X									
ACLS	X									
Paediatric	X									
Disaster preparedness	X						X	X		X
Ethics		X	X					X	X	
Leadership		X					X		X	
Teamwork		X	X	X		X				
Technology		X			X					
Research			X	X	X					
Islamic values			X			X				X
Public/community health			X		X				X	
Evidence-based practice						X		X		
Teaching								X		
Continuous learning				X			X	X	X	
Physical/emotional readiness									X	
Umrah/Hajj preparedness										X
First aid										X

GHD: AlGhad College, MRF: Marefa College, DMM: Dammam University, INA: Inaya College, JAZ: Jazan University, KKU: King Khaled University, KSU: King Saud University (PSCEMS), KSAU: King Saud University for Health Sciences (KSAU-HS), PSM: Prince Sultan Military College, UMQ: Umm AlQura University.
Source: King Saud University,[41] University of Dammam,[45] Umm Al-Qura University,[46] Prince Sultan Military College,[47] King Saud bin Abdulaziz University for Health Sciences,[48] Jazan University,[49] Inaya College,[50] AlMaarefa Colleges,[51] AlGhad Colleges.[52]

An example of how another country has dealt with the issue of standardising the educational competence of academic institutions is the CAA in Australia. The CAA has adopted a UK model of competence as a foundation to build the CAA model, which would then grant accreditation to academic institutions based on this model of competence.[32] This type of approach can work for Saudi Arabia but with certain amendments. The complete adoption of certain western core competencies may not be the ideal process to address the needs of Saudi Arabia, as the Saudi context is different from other western countries in many ways, some of which have been previously mentioned in this paper.

Future directions

An improved pathway to resolve the disparity of educational approaches in Saudi EMS is as follows:

1. To empirically develop a Saudi-based model of competence based on the needs and concerns of Saudi Arabia.
2. The approach in developing the core competencies model should be a combination of international standards and local Saudi requirements.
3. The process of development should include inputs from academic, clinical and leadership to represent the different stakeholder groups.
4. A standardisation of the Saudi core competencies model at Saudi universities and colleges that offer the bachelor's degree of EMS.

In conclusion, it would appear that there is a lack of cohesion in the current status of graduate competencies from Saudi colleges and universities, as such, it may be prudent to anticipate this gap by developing a Saudi Arabian specific set of bachelor's level core competency standards, which are more appropriate for the country and reflect the needs of the Saudi EMS industry.

CONCLUSION

The field of EMS in Saudi Arabia has seen substantial advancements in the profession throughout the preceding few decades in many aspects, including organisational and educational. Nonetheless, there remain considerable issues facing the service providers, such as the lack of published material, presentation of current statistics, the level of awareness of EMS by the community and the need to improve the level of education of the pre-hospital practitioners. The educational development of EMS programs in Saudi universities and colleges is significant, yet there is a lack of cohesion between the expectations of the graduates from these institutions. Therefore, it is recommended that empirical research should be developed to study and present remedies for challenges facing the advancement of the EMS profession.

Competing interests

The authors declare that they have no competing interests.

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Appendix F: Emergency Medical Services Core Competencies: A Scoping Review

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Emergency Medical Services Core Competencies: A Scoping Review

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Abstract

Introduction: the emergency medical services (EMS) are an important part of the health care system as they are the first point of contact for medical emergencies. Moreover, the EMS educational system has seen a rapid transition from a post-employment training model into a pre-employment educational model. Despite this, there is a lack of clarity on what core competencies EMS students are expected to hold.

Purpose: the objective of this scoping review was to identify the EMS student core competencies in the literature.

Method: the scoping review considered journal articles and grey literature (peer-reviewed and non-peer reviewed) and the following databases were utilized: CINAHL, MEDLINE, EMBASE, Scopus and ERIC. Grey literature was also searched using www.greylit.org, Google Scholar and Trove, and expert consultation and EMS professional associations were also considered.

Results: the search yielded 301 publications (CINAHL $n=53$; MEDLINE $n=103$; EMBASE $n=84$; Scopus $n=6$; ERIC $n=42$; miscellaneous grey literature $n=13$). After removal of duplicates, $n=241$ citations remained. Abstract and title screening produced $n=35$ publications, following which a full-text review was conducted. Consensus was reached on the inclusion of $n=25$ publications for review. In total, $n=127$ core competency statements were extracted which were then reviewed for clarity and removal of duplicates and clustered into a final list of $n=33$ core competencies.

Discussion: the publications were discussed in a thematic approach. The review will provide insight into the scope of knowledge, abilities, skills and education that can be important to the conduct of paramedic students. Moreover, the review would be part of a greater project to develop a set of core competencies specifically designed for Bachelor EMS degrees in Saudi Arabia. This is the first scoping review that has attempted to systematically identify potential core competencies for paramedic students.

Keywords: Attributes; Competence; EMS; Paramedic; Student

Contents

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1. Introduction

The field of emergency medical services (EMS) in many countries, including Saudi Arabia, has come a long way from the post-employment training model where the educational requirements of being a paramedic were minimal, such as completion of first aid certificates. This training was also only provided after employment.[2] The new model for EMS education is a pre-employment model whereby the educational process is facilitated in university laboratories and classrooms, with the expectation that an EMS provider is trained prior to being employment,[3] with the general pre-requisite for entering these courses being a high school qualification. The issue with such an elevation of educational standards, however, is that new EMS graduates have been reported to hold less than desirable core competencies, including a lack of maturity, poor skills in relation to communication, teamwork and empathy, deficiencies in clinical skills and shortcomings in overall work readiness for the paramedic role.[4–7] Such deficiencies provide insight into the lack of direction in the ever-growing and expanding field of EMS, which is evolving and becoming part of a holistic health care model.[8]

In a previous publication, an overview of the evolution of EMS in Saudi Arabia was undertaken.[1] This review will be a next step in the process of identifying the desirable core competencies of paramedic students, by performing a scoping review to provide an international context of what has been deemed as important and desirable paramedic core competencies. For the purposes of this review, the World Health Organization (WHO) definition for core competencies will be utilized: "Identifies units of competency that an industry (health, education etc.) has agreed are essential to be achieved by a person to provide quality services".[9] The objective of this scoping review is to identify the EMS student core competencies in the literature. Students in this context are accepted at any different level of training including pregraduate and post-graduate. The term paramedic can be understood as EMT, critical care paramedic, community care paramedic or any other similar terms, but excludes other professions such as nurses, physicians and other health care providers. Moreover, no existing scoping reviews were revealed in the preliminary search, highlighting a gap in the current literature.

2. Methods and results

Arksey and O'Malley's methodology suggests six stages for undertaking scoping reviews.[10] The development of this scoping review was conducted to answer the following research question: "What are the desirable core competencies of paramedic students?".

2.1. Identify relevant studies

The scoping review considered journal articles and grey literature (peer-reviewed and non-peer reviewed) and the following databases were utilized: CINAHL, MEDLINE, EMBASE, Scopus and ERIC. Grey literature was also searched using www.greylit.org, Google Scholar and Trove, and expert consultation and EMS professional associations were also considered. The key search terms were based on the research question and applied to the concept of Population, Concept and Context (PCC), which are as follows,[11] Population: Paramedic, Emergency Medical Services and Emergency Medical Technician, Concept: Competence and Attributes, Context: Student.

Based on the research question and PCC, the resulting Boolean search string was as follows:

(Paramedic OR "Emergency Medical Technician*" OR "Emergency Medical Service*") AND (Competence* OR Attribute*) AND Student*.

In addition to findings from the research literature, as an expansion to the grey literature element of the scoping review, core competencies from $n=5$ professional associations' EMS guidelines were also incorporated.

2.2. Study selection

For literature to be selected for inclusion in the review, the primary step was to search the titles and abstracts of identified sources. This process produced $n=301$ publications (CINAHL $n=53$; MEDLINE $n=103$; EMBASE $n=84$; Scopus $n=6$ and ERIC $n=42$; miscellaneous grey literature $n=13$). Following removal of duplicates, $n=241$ citations remained and the literature was then independently reviewed by two authors (TA and BW) who reviewed the abstracts and titles to determine inclusion for the full-text review. The review yielded $n=35$ publications and the inclusion and exclusion criteria utilized were, articles involving EMS student core competencies, articles in English and/or Arabic and published between 2000 and 2016 and the study population were paramedic students enrolled in all types of educational and training programs.

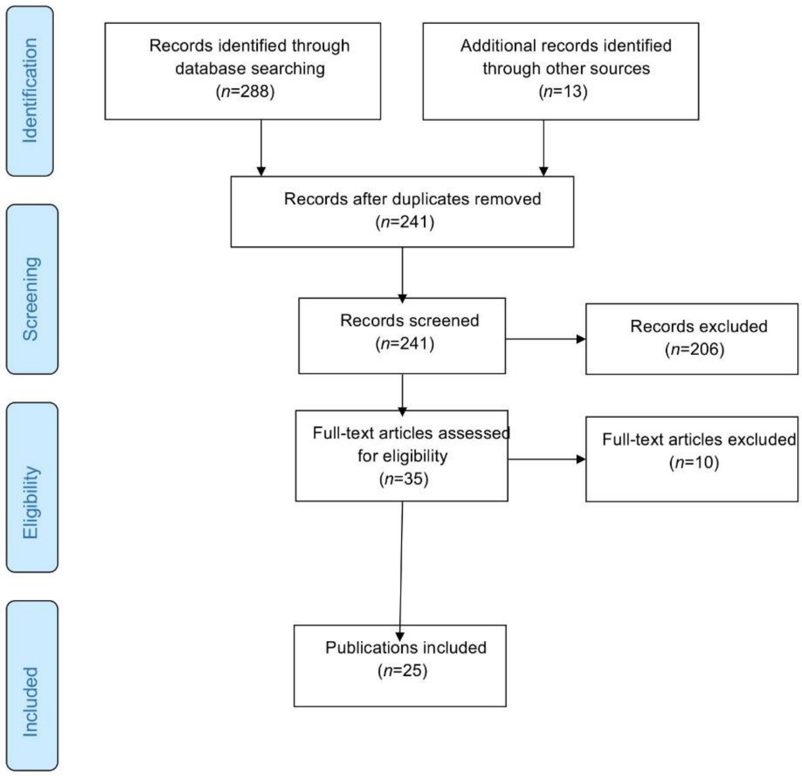

Fig. 2.1. Flow diagram of scoping review results. Source of PRISMA template[12].

Table 2.1
Researched based journal articles and reviews.

Author	*Year of publication*	*Study location*	*Study type*	*Study population and cohorts*	*Study findings: core competencies*
Alanazi[13]	2012	Saudi Arabia	Modified Delphi	Participants (n=20): paramedics (n=10); emergency consultants (n=10)	1. Safety 2. Communication 3. Critical thinking 4. Assessment 5. Scene management 6. Clinical skills 7. Professionalism 8. Team approach 9. Teaching skills 10. Research
Boyle et al[14]	2011	Australia	Cross-sectional survey	Paramedic students (n=114)	1. Listening and communication
Ford et al[6]	2014	Australia	Qualitative	Paramedic students (n=29)	1. Interpersonal relating 2. Maturity, respect and tolerance 3. Self-awareness in the team environment 4. Belonging and professional identity
Hamilton[15]	2008	Australia	Review	N/A	1. Information literacy
Johnston, MacQuarrie and Rae[16]	2014	Australia	Quantitative	Paramedic and nursing students (n=200); academics (n=6); paramedic tutors (n=4); technical support staff (n=5)	1. Inter-professional communication
Kilner[17]	2004	United Kingdom	Delphi	Paramedic profssionalsFirst round (n=34); Second round (n=42)	1. Clinical skills 2. Professionalism 3. Personal qualities 4. Knowledge base 5. Clinical decision making 6. Mentoring and clinical supervision 7. Intellectual skills 8. Communication skills 9. Management 10. Learning and professional development 11. Assessment and history taking 12. Driving 13. Self-awareness 14. Educational background 15. Policy/ guidelines 16. Manual handling/health and safety 17. Fit for role 18. Equipment 19. Evidence base/research 20. Knowledge of common emergencies 21. Professional issues 22. Teaching/ education skills 23. Course-based knowledge and skills 24. Range of experiences 25. Mental health skills
Mantha et al[18]	2016	India	Quantitative, pre- and post-training	Paramedic students (n=40)	1. Leadership 2. Communication 3. Teamwork
O'Brien et al[2]	2013	Australia	Qualitative	Paramedic employers (n=11)	1. Theoretical knowledge 2. Clinical skills 3. Critical thinking 4. Problem solving
O'Brien et al[19]	2013	Australia	Mixed	Paramedic students (n=23)	1. Theoretical knowledge 2. Clinical skills 3. Practical skills 4. Interpersonal skills 5. Communication with colleagues and other professionals 6. Coping skills 7. Lifelong learning 8. Ethics and legal responsibilities
Riesen et al[20]	2012	Canada	Mixed, pre- and post- training	Participants (n=60): paramedic students (n=14); other (n=46)	1. Inter-professional competence
Ross et al[21]	2014	Australia	Quantitative	Paramedic students (n=56)	1. Interpersonal communication
Shields and Flin[22]	2012	United Kingdom	Review	N/A	1. Situation awareness 2. Decision making 3. Communication 4. Team working 5. Leadership
Spencer and Archer[23]	2015	Australia	Review	N/A	1. Cultural diversity
Spencer and Archer[24]Spencer (1)	2008	Australia	Review	N/A	1. Cultural competency
Tavares, Bowles and Donelon[25]	2016	Canada	Mixed method (review and qualitative interview)	Participants (n=20)	1. Clinician (effective clinical care) 2. Team member (team-based care in broad inter-professional settings) 3. Health and social advocate

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Table 2.1 (*continued*)

Author	*Year of publication*	*Study location*	*Study type*	*Study population and cohorts*	*Study findings: core competencies*
					4. Educator 5. Reflective practitioner (self-awareness, self-monitoring, and self-reflection) 6. Professional (behaving ethically, morally, with integrity and respecting the individual while avoiding further harm)
Twinley[26]	2012	United Kingdom	Quantitative	Participants ($n=80$): paramedic students ($n=28$); occupational therapy students ($n=52$)	1. Communication
Williams[27]	2013	United Kingdom	Qualitative	Paramedic students ($n=8$)	1. Emotional work
Williams, Onsman and Brown[28]	2010	Australia	Delphi Pilot	Paramedic experts ($n=63$)	1. Personal characteristics 2. Clinical reasoning skills 3. Interpersonal and team skills 4. Professionalism 5. Continuing professional development 6. Social awareness 7. Flexible learning. 8. Accountability 9. Evidence-based practice 10. Self-directed practice
Williams[29]	2011	Australia	Delphi	Paramedic experts ($n=872$)	1. Personal behavior and attitudes 2. Patient interaction and welfare 3. Scientific approach to patient care 4. Paramedic and society 5. Commitment to professional and health care outcomes 6. Professional behavior 7. Interaction skills
Wloszczak-Szubzda, Jarosz and Goniewicz[30]	2013	Poland	Mixed method	Participants ($n=105$): paramedic ($n=31$); paramedic students ($n=74$)	1. Communication

Table 2.2
EMS professional association guidelines.

Professional association	*Country*	*Year*	*Domains (core competencies)*
Health and Care Professions Council[31]	United Kingdom	2014	1. Be able to practise safely and effectively within their scope of practice 2. Be able to practise within the legal and ethical boundaries of their profession 3. Be able to maintain fitness to practise 4. Be able to practise as an autonomous professional, exercising their own professional judgement 5. Be aware of the impact of culture, equality and diversity on practice 6. Be able to practise in a non-discriminatory manner 7. Understand the importance of, and be able to maintain, confidentiality 8. Be able to communicate effectively 9. Be able to work appropriately with others 10. Be able to maintain records appropriately 11. Be able to reflect on and review practice 12. Be able to assure the quality of their practice 13. Understand the key concepts of the knowledge base relevant to their profession 14. Be able to draw on appropriate knowledge and skills to inform practice 15. Understand the need to establish and maintain a safe practice environment
Health Professions Council of South Africa[32]Health Professions Council of South Africa (2)	South Africa	2014	1. Health care practitioner (clinical skills and professional attributes) 2. Communicator (patient-carer relationship) 3. Collaborator (work effectively within a team) 4. Leader and manager 5. Health advocate (advance the health and well-being of individuals and communities) 6. Scholar (commitment to reflective learning as well as the creation, dissemination, application and translation of knowledge)
Paramedic Association of Canada[33]Paramedic Association of Canada (3)	Canada	2011	1. Professional responsibilities 2. Communication 3. Health and safety 4. Assessment and diagnostics 5. Therapeutics 6. Integration (differential diagnosis skills, decision-making skills and psychomotor skills) 7. Transportation 8. Health promotion and public safety
Paramedics Australasia[34]Paramedics Australasia (4)	Australia	2011	1. Professional autonomy and accountability 2. Professional relationships (communication) 3. Evidence-based practice 4. Identification and assessment of health and social care needs 5. Teamwork

Table 2.2 (*continued*)

Professional association	*Country*	*Year*	*Domains (core competencies)*
			6. Safe practice 7. Critical evaluation of paramedic practice 8. Theoretical knowledge
The Council of Ambulance Authorities[35]	Australia	2010	1. Acts in accordance with accepted standards of conduct and performance 2. Makes informed and reasonable decisions 3. Demonstrates professional autonomy and accountability 4. Develops and maintains professional relationships 5. Demonstrates the knowledge and understanding required for practice as a paramedic 6. Operates within a safe practice environment 7. Identifies and assesses health and social care needs in context 8. Formulates and delivers clinical practice to meet health and social care needs within the context of the environment 9. Critically evaluates the impact of, or response to, the paramedic's actions

Studies that did not address students but were targeted at clinical staff were excluded. The exclusion criteria also included all other health care providers who were not paramedics. Any publications that provided no statement related to the core competencies of paramedic students were also excluded. The full-text publications were then independently revised by two reviewers (TA and BW) and consensus was reached on the inclusion of $n=23$ publications for the scoping review – see Fig. 2.1. The reference lists for the included full-text studies were also searched for relevant articles, which yielded another $n=2$ publications. This brought the total number of included studies to $n=25$.

2.3. Charting the data

The approach of charting all data according to a common descriptive analytical framework with general study information is part of the narrative tradition, and recommended by Arksey and O'Malley to fit the aims of the review.[10] Furthermore, for the publications included, all terms related to the core competencies for paramedic students were collected under the study findings section (Tables 2.1 and 2.2).

2.4. Collating, summarizing and reporting results

The studies included in the review comprised quantitative ($n=5$), qualitative ($n=3$), review ($n=4$), mixed method ($n=4$) and Delphi method ($n=4$). The distribution of studies and EMS professional association guidelines according to country were as follows: Australia $n=13$; United Kingdom $n=5$; Canada $n=3$; India $n=1$; Poland $n=1$; Saudi Arabia $n=1$; and South Africa $n=1$. A total of $n=20$ research-based journal articles were considered relevant to paramedic students' core competencies which yielded a total of $n=85$ identified core competency statements. In addition, EMS professional association guideline publications provided a total of $n=42$ core competency statements. Pooling these two sets of competency statements together produced a total of $n=127$ identified statements. For clarity and removal of duplicated competencies the statements were then reviewed and clustered, and a final list of $n=33$ core competencies were identified (see Fig. 2.2).

According to Levac, Colquhoun and O'Brien, a scoping review should involve thematic analysis of a topic, where the product is associated with the purpose of the scoping review.[36] This process has been considered in a thematic approach, involving the five prevalent core competencies extracted from the literature: communication; clinical skills; teamwork; critical thinking and decision making; and professional behavior.

2.5. Expert consultation

Two of the key expert authors in the field of EMS core competency were consulted on the current research and provided with a full list of the included articles. The contribution of Professor Björn-Ove Suserud generated

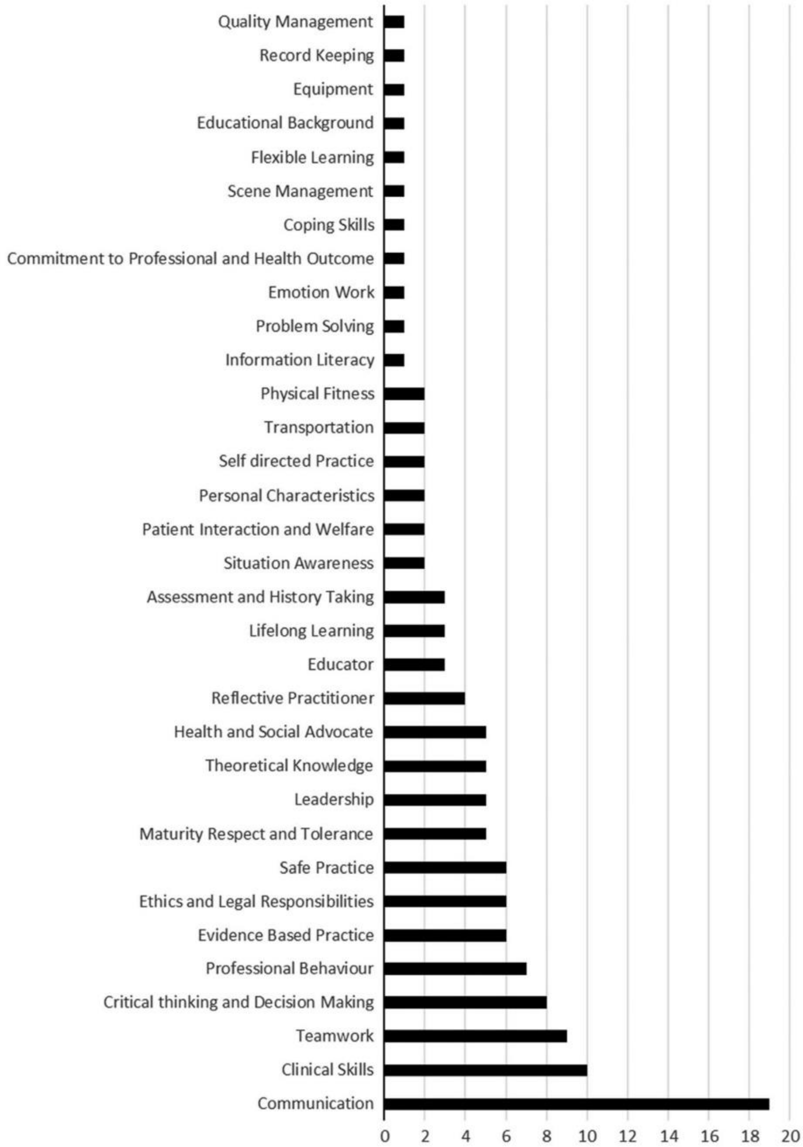

Fig. 2.2. Frequency of core competencies in the publications.

three research articles that addressed ambulance nursing, although these did not meet the inclusion criteria. Dr Walter Tavares provided two research articles, one of which was included in the review while the other paper had already been found in the initial search process.

3. Discussion

The review found $n=25$ relevant publications from seven different countries, spanning a period of more than 14 years. The annual trends for research articles on this topic were limited; for example, only three studies were published in 2000-2009. This increased considerably to 17 studies published between 2010 and 2016 which corresponds with the EMS professional associations guidelines that appeared in the period 2010-2014. The trends indicate a move towards professionalism and the need for competency standards and research within the field of EMS.

The rising trend of research explains the need for this review. By systematically searching and extracting the current international core competencies, the review provides EMS organizations and researchers with access to, and a basic map of, desirable core competencies for paramedic students. This scoping review forms a comprehensive list of core competencies for EMS students. The five prevalent themes of communication, clinical skills, teamwork, critical thinking and decision making and professional behavior which have emerged from this scoping review will now be discussed.

3.1. Communication

Communication is by far the most researched core competency for paramedic students. Communication not only featured in $n=19$ of the $n=25$ publications, but $n=5$ articles were specifically designed to solely examine paramedic communication. Communication was mentioned in different forms and expressed through different constructs, such as interpersonal communication, professional communication, interprofessional communication, communication skills or divided into hearing and communication styles. The importance of communication in the field of EMS has been stressed by researchers, particularly in relation to effective listening, the ability to conduct inter-professional communication during patient handover and interpersonal skills in communication.[14,16,21,26,30]

Research also suggests that competency in communication is a key component in providing high-quality care and gaining the respect and trust of patients during their hour of need.[21] In circumstances where paramedics are working under pressure of time it is imperative they communicate appropriately with their patients and do not convey an impression of being in a hurry or avoiding communication.[30]

In a Polish study that investigated paramedics' competence in professional communication, it was found that paramedic students who were enrolled in communication courses were more competent communicators, in contrast to professional paramedics and other students.[30] Wloszczak-Szubzda et al argue that the issue lies within paramedic educational programs in Poland where curricula content failed to address paramedics' specific communication needs.[30] Other research on hearing and communication reported that paramedic students' listening style focused on the feelings and concerns of other people, with students adopting a friendly and attentive communication style that rendered them less prone to hostility in conversation.[14] Boyle et al argue that such communication styles are appropriate for paramedic students and that persons inclined towards these styles may be drawn to become paramedics, a profession characterized by concern for others and interest in their wellbeing.[14] The issue of communication in general, and inter-professional communication specifically, was addressed by Johnston, MacQuarrie and Rae through the use of inter-professional education exercises.[16] The week-long exercise involved a total population of 200 students, of whom 130 were paramedic students and 70 were nursing students. Students from both disciplines were involved in the handover and management of different scenarios involving trauma and different age groups.[16] This approach was reported to have had a positive effect on students' competence and improved their confidence and effectiveness in clinical handover and communication. The importance of embedding communication as a core competency in EMS education is recommended by several authors, although there needs to be further work in this area particularly on examination of measures of communication as a core competency.[26,30]

3.2. Clinical skills

Clinical skills are the second theme in the review and featured in $n=10$ publications. While the definition of clinical skills may differ between publications, it is generally considered to be a variety of clinical skills used to manage a range of common emergency conditions. The clinical skills core competency is generally considered essential for a paramedic student to excel in performing.[2,13,17,19,25] Examples of clinical skills include defibrillation, drug administration and airway management.[17] The earliest research found by this review was Kilner's 2004 UK study in which the aim was to identify desirable paramedic attributes using the Delphi expert technique.[17] Clinical skills scored highest for collected competency statements and also recorded a high mean score, alongside other core competencies which had similar or higher means, such as self-awareness, evidence-based practice mentoring and supervision.[17] While clinical skills were considered to feature prominently in educational curricula, other core competencies were not present.[17] Bowden and

Masters have linked this with the lack of an underlying capacities model, where level two and three capacities do not feature prominently in vocational training.[37] In contrast, the new generation of university paramedic students are reported to have concerns with clinical practice; however, the evidence is that when students are transitioned into an internship phase to link theory with practice, their clinical practice improved.[2,19] The strength of university educated paramedics lies in the flexibility of new graduates who are considered to have appropriate clinical skills, excellent theoretical knowledge and employability competencies, including problem solving and critical thinking.[2] Therefore, embedding the clinical skills core competency with other important core competencies in university programs, provides a framework for an educational system that produces competent, well-rounded, patient-centered paramedics.

3.3. Teamwork

Teamwork emerged as the third theme from the review and featured in $n=9$ publications. Teamwork is regarded as an important core competency for paramedics, since the field of EMS involves working as part of an interdisciplinary team and is associated with handing over patients to physicians and nurses in an emergency department or working with fire fighters, police and other paramedics on-scene.[6,16,22,25] Mantha et al. report the findings of a study that investigated the development of the first non-technical skills curriculum in India where a training course was developed to address concerns about crowd control and safety risks for the patient and EMS professional. Differences in culture, religion, language and public awareness of the EMS profession were all cited as reasons for on-scene resistance towards paramedics.[18] The training course was found to have improved non-technical skills core competencies in 58–80% of the participants ($n=37$), providing evidence of the importance of including non-technical skills, including teamwork training, in EMS educational curricula.[18] The teamwork core competency was also addressed by Ford et al who stressed deficiencies in the relational competence of fresh EMS graduates when applied to their work roles.[6] In an effort to address the issue, a simulated and challenging wilderness exercise involving 29 senior paramedic students was conducted over three days. The students kept field diaries and were invited to focus groups after the exercise.[6] The exercise was reported to have contributed to an improved level of understanding about communication strategies, with benefits for team cohesion and the transitioning of graduates into the workforce.[6]

The current literature highlights the elevation of the teamwork core competence either through exercise simulations or short courses.[6,16,18] There are concerns, however, regarding the paucity of research into the integration of the teamwork competency in university curricula. While simulated exercises and training courses are recognized as important, they are only a stop-gap process for remedying the issue before or after graduation and are not part of academic university or college programs.[6,16,18] The focus should be on pre-hospital EMS research that addresses the concerns of teamwork in the EMS profession.

3.4. Critical thinking and decision making

The fourth theme of critical thinking and decision making is thought to be especially relevant to the EMS discipline and featured in $n=8$ publications.[2] Interviews with $n=11$ senior educational and operational EMS personnel who worked for Australian ambulance services that employed Bachelor degree graduates, highlighted the importance of critical thinking for paramedics. The everyday duties of paramedics can be very different to those of other health professionals and they are often presented with cases that the individual has not dealt with before.[2]

The process of decision making during clinical care is very important and this can be evident during emergency calls where paramedics are expected to make many on-scene decisions on the best way to deal with a medical situation. These types of decisions include whether or not to provide patient care en route to hospital or to offer on-scene patient care.[22] This may be why in certain studies such as Kilner's, the term is called 'clinical decision making' and is defined as the mental and cognitive skills associated with the ability to understand clinical data, the process of applying clinical judgement and decision making and, finally, formulating a clinical diagnosis.[17] Kilner's definition is specific to the clinical aspects of the EMS profession, whereas Shields and Flin adopt a broader definition where judgement and course of action specific to any situation defines decision making.[17,22] The outlook on the decision making core competency can be understood in the context of the Bowden and Master's model which stresses the importance of the links between the different levels and not simply the representation of one level.[37] In contrast, Kilner focused on the first level of observable practice which is similar to the outlook of the vocational training sector. Shields and Flin, however, adopted a broader approach that was influenced by other more established professions but also includes the underlying levels of the Bowden and Master's model.[22,37]

3.5. Professional behavior

Professional behavior is the fifth and last theme in this review and featured in $n=7$ publications. The term 'professional behavior' is a broad core competency that encompasses many concepts.[6,17,25] For example, Tavares, Bowles and Donelon describe many aspects that may be associated with professional behavior such as empathy, compassion, ethics and morality of the health provider, care, honesty and a continued commitment to excellence.[25] One of these, honesty, was the highest ranked desirable attribute by all participants in Kilner's study and was recommended as an essential quality to be considered when recruiting EMS professionals.[17] In Ford et al's research, which involved a simulated wilderness exercise, the participants regarded their professional teams very favourably.[6] The stated reasons for this were the benefits gained from individuals' diverse set of skills, the experience of belonging to the team which contributed to the learning experience and the satisfaction of being recognized for contributions made to the team.[6] These positive outcomes gave individuals a sense of belonging to their professional group and pride in their professional identity which is associated with personal accountability for practice and responsibility for the wellbeing of colleagues within the profession.[6] This suggests that professional behavior is imperative for EMS students to ensure their successful pathway into the profession and for appropriate standards of performance once they have joined the workforce.

This review has demonstrated that many core competencies overlap, such as the importance of communication in teamwork. Moreover, when paramedics are on-scene these core competencies are practiced simultaneously; to quote one of the paramedic student participants in the study by Ford et al: "I think I learnt more about communication, teamwork and leadership than I did about my clinical skills. It became obvious… that leadership is very important and communication/teamwork is vital to good care. I felt that… you don't understand how important it is until you are in that situation."[6]

4. Limitations

The review identified a considerable number of core competencies for paramedics which the authors amended to create a total number of core competencies without overlapping and redundant items. This process may therefore have removed some subtle differences and nuances between overlapping core competencies and while considerable care was taken when amending the list, ultimately, this process is to a certain degree open to interpretation. Moreover, any studies that were written in other languages such as French, German and Swedish were not included, which may have limited the number of relevant studies and information. Finally, Professors. Brett Williams, who is a co-author in this review has a long repertoire of publications in EMS, especially paramedic competency, therefore some of his authored and co-authored research has been included in this review, as per research protocols.

5. Future directions

It is important that future research builds on the findings from this scoping review and the authors' previous study.[1] This scoping review discovered a modest amount of research concerning EMS student core competencies which can be used as a starting evidence base for further research on EMS core competencies in Saudi Arabia and other countries. In the Saudi Arabian context, development of the core competencies model should involve a combination of international standards and local Saudi requirements. The research aims of the current study have been met with the extraction of $n=33$ international core competency statements from the scoping review and $n=7$ core competency statements from the review of Saudi universities and colleges. The next step in this process is to combine international and national core competencies and subject them to Delphi research, followed by a national study involving Saudi Arabian EMS. Finally, the development of a systematic review based on this scoping review, may be a future step to assess the quality of the research in the field.

6. Conclusion

This is the first scoping review to systematically identify the potential core competencies for paramedic students. Moreover, this review has provided an insight into the scope of knowledge, abilities, skills and education that can be important to the conduct of paramedic students. The other important aspect of the review is that the findings contribute to a greater project to develop a set of core competencies specifically designed for Bachelor EMS degrees in Saudi Arabia. This review and future projects lay the evidence-based groundwork for establishing EMS competencies in Saudi Arabia, the Arabian Gulf states and other countries.

Disclosure

The authors declare that they have no competing interests.

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Emergency Medical Services Core Competencies: A Delphi Study

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Abstract

Introduction

The emergency medical services (EMS) education in Saudi Arabia has evolved considerably during the past decade and this rapid improvement has seen a disparity of educational approaches. Therefore, a core competency framework which aligns with the requirements of Saudi EMS education was identified and accommodated. The aim was to obtain professional group consensus on the desirable core competencies for EMS Bachelor degree graduates in Saudi Arabia. In order to develop a core competency framework for Saudi Arabian EMS.

Methods

A two-round Delphi method, using a quantitative survey with a purposeful sampling technique of expert information rich participants, was used. The instrument comprised 40 core competency statements (rated on a 1-10 Likert scale, with 1 being 'Not important at all' and 10 being 'Extremely important') and an open-ended question. An international systematic scoping review and local national review informed the items in this study.

Results

At the end of the second round, the response rate was 70%, and the sample demonstrated diversity in terms of qualifications, expertise and discipline. All core competencies achieved a majority and stability in the first and second rounds. Core competency items achieved the 75% consensus requirement.

Conclusion

This study provided consensus on 41 core competencies specific to Saudi EMS industry requirements. However, the findings do not represent a definitive blueprint model for

alignment into EMS curricula. Further research and statistical modelling for the core competencies are highly recommended.

Keywords:

attributes; competence; EMS; paramedic; Saudi Arabia

Introduction

While the history of EMS in Saudi Arabia dates back to 1934, (1) educationally and academically the system remained stagnant for more than 70 years. In the past decade, however, the education of EMS has been revolutionised; first, with the development of local EMS diplomas, whereby paramedics were trained to provide Advanced Life Support (ALS) care to patients; and second by the replacement of diplomas in 2012 with Bachelor degrees, according to recommendations made by the World Health Organization. (2)

Starting in 2007, Bachelor degree programs were developed either indigenously or in collaboration with other established universities, such as Flinders University in South Australia. Saudi Arabia has one of the most established EMS academic training programs, (3) and currently offers over ten university or college Bachelor degree programs. (1) However, a diversity of educational approaches between the different universities and colleges is evident (1) and this inconsistency between academic programs risks the development of a mismatch between educational output and industry competency requirements specific to Saudi Arabia.

Such disparity of educational approaches can also result in variation in terms of how graduates from different EMS programs manage and communicate with patients, particularly as paramedic guidelines and medical oversight are fundamentally restrictive in managing the range of pre-hospital contexts and circumstances and levels of medical ambiguity. (4) Furthermore, the delivery of adequate and safe patient care by paramedics is reliant on competence in making critical decisions about the incident scene, safety concerns, available equipment, the patient’s condition and other complex aspects of pre-hospital care. As such, identifying the correct core competencies and applying them to EMS educational programs will facilitate the progression of competent EMS graduates into the workforce and the improvement of overall patient care.

Methods

Study design

This study utilised a Delphi method, a quantitative survey technique that gathered the opinions of selected experts in the field of Saudi EMS with the aim of obtaining group consensus on the desirable core competencies for EMS Bachelor degree graduates. According to Crutzen (5) where there is scarcity of scientific knowledge on a certain topic, it is useful to adopt the Delphi method. This is particularly relevant in the context of Saudi Arabia, where a relatively small disciplinary field, geographical distance and a lack of anticipated conferences and scientific gatherings means there is limited scope for EMS experts to meet face-to-face. The anonymity of a Delphi study is also conducive to merit-based responses and limits the effects of peer pressure. (6) The iteration of a Delphi study was conducted to give the experts opportunity to amend their responses between rounds.

Setting

The surveys were distributed and returned using an internet-based Qualtrics questionnaire, which was delivered to participants via e-mail. Ensuring participants’ anonymity was crucial as it enabled them to freely divulge their professional judgements on the topic. The survey was sent to participants on an individual basis, and not part of a group, to ensure their identity remained anonymous and email addresses were protected. Individual responses were received via Qualtrics for collection by the researcher, thereby adding another layer of anonymity. (7)

Participants

As expert information-rich participants were the target sample, a purposeful sampling technique was utilised. There are generally no specific guidelines for choosing experts in the Delphi method; (8) however, there are three general criteria for eligibility as a Delphi participant. Firstly, that the participants hold a relevant degree and have the requisite background and experience in the field; to meet this criterion in the current study, a minimum qualification of a Bachelor's degree was set. Secondly, participants willingness to contribute to the study. Thirdly, a willingness to review the initial judgements with the aim of attaining study consensus. (8, 9) It is important to acknowledge that the expert selection method utilised may be subjective.

The expert participants on the Delphi study panel comprised two main groups. The first group represented the ten academic EMS programs in Saudi Arabian universities and colleges and were targeted for their specific perspectives on academic practice, student concerns, research and, ultimately, the core competencies they deemed would best serve the Saudi EMS system. The second group of ten experts represented industry stakeholders from the different hospital and EMS providers, and occupied leadership, clinical and administrative positions. This group also included one of the few Saudi female paramedic leaders. This group of experts represented the different fields involved in Saudi EMS provision including disaster management, emergency medicine, quality management, EMS training, accreditation, and medical and operational supervision. The literature on the Delphi method recommends 10-18 expert participants (10); therefore, 20 individuals were invited to participate in the study to allow for drop outs between Delphi rounds and those who declined to participate. (11)

Instrumentation

Prior to delivering the instrument via the Delphi process, a pilot face and content validity study was undertaken. Validity measures an instrument's scientific utility, specifically how well an instrument measures what it purports to measure. (12) The study involved the nomination and sending of invitations to eight academics from various health professional disciplines involved in EMS education and research. The instrument was prepared in English and the nominated participants included two native Arabic speakers who were fluent in the English language. Several amendments were performed based on participants' feedback.

The purpose of the Delphi study was to produce a Saudi-specific EMS core competency instrument, which is the result of an international scoping review (13) and a review of Saudi national EMS Bachelor programs. (1) The first part of the survey comprised seven demographic questions which included gender, age, qualification, experience, medical discipline, professional role and nationality. The second part comprised 40 core competency statements rated on a 1-10 Likert scale where 1 represents 'Not important at all' and 10 represents 'Extremely important'. Finally, an open-ended question was added as follows: 'If there is another Core Competency statement that you think is missing, please write it here'. The survey was amended following each round. This is an important advantage of the Delphi technique as the sequential nature of Delphi questionnaire rounds permits modification of the study instrument between rounds. (14)

Procedures

First round: The 20 prospective expert participants were contacted by email via a Qualtrics software anonymous link, and consent to participate in the study was implied by their accessing of the Qualtrics email link and completion of the survey. One week after the initial email, a follow-up reminder email was sent, after which the first round of the study concluded.

Feedback report: Of the 20 expert prospective participants contacted, 17 agreed to participate in the study. All participants completed the entire survey and five participants responded to the optional open-ended question. Following a review of comments by the authors a decision was made to add another core competency item, 'Be able to demonstrate English language proficiency to an adequate level for appropriate professional communication', to reflect the fact that English is the medical language used in Saudi Arabia. Another item regarding disaster preparation and management was amended to include the phrase 'and terrorist incidents', based on input from three of the expert participants. Two other responses were disqualified for the following reasons:

3. Statement: 'Health advocacy for the community' was already included under item 13, 'Be able to provide health and social advocacy responsibly'.
4. Statement: 'Be able to maintain personal well-being & fitness' was already included under item 32, 'Understand the need to maintain an appropriate level of physical and mental fitness'.

The statistical feedback report was made up of seven categories as follows: Minimum, Maximum, Central tendency (Mean), Level of dispersion (Standard Deviation), Variance, Count (frequency) and the number and percentage of responses to each of the item levels. The feedback report omitted the demographic information and was limited to collective responses and individual participant's responses to ensure anonymity of the participants during the collection process. The adopted consensus level was 75%, as per the recommendation of

Keeney (15) While all core competency statements reached consensus above 75%, the statements were included in the second round of the Delphi survey to allow participants an opportunity to change their opinion based on the feedback report and personal judgement. Moreover, since only one new statement was generated and one amendment made, carrying all statements through the entire Delphi process represented best practice. (16)

Second round: The feedback report from the first round was emailed to participants together with an invitation to complete the second round of the Delphi study. The response rate fell to 14, and only one response was received to the open-ended question to generate new or missing core competency statements. The generated statement 'be familiar and friendly to a multi-cultural society in hospitals, companies and Hajj' was disqualified as it was already included under item 2 'Be able to practice with respect and non-discriminatory manner'.

Data analysis

Delphi method consensus varies between different studies both statistically and in the use of terminology; some include post hoc figures while other studies assign specific ranges that vary from 51-80% or utilise other techniques. (6, 9) In the current study, the established 75% item consensus was adopted and a systematic procedure for Delphi termination was adopted from Dajani (17), where the basic tenets of the procedure are as follows:

- Consensus: complete and unanimous agreement between the participants.
- Majority: more than 50% agreement between participants.
- Bipolarity: when there is an equal divide between participants.
- Plurality: the agreement of the largest subgroup between the respondents.
- Disagreement: when each participant has differing views from all other respondents.

Another approach to testing consensus and stability is proposed by Scheibe (18), where the basic aim is to achieve a state of equilibrium between each iteration and a marginal change of less than 15% for each Delphi item. The survey data was exported from the Qualtrics software into a Microsoft Excel spreadsheet for analysis.

Ethics

Consent was implied when participants opened the Qualtrics email link and they completed the survey electronically. Approval from the Monash University Human Research Ethics Committee was granted on 28-2-2017, and the study ascribed project number 8072. In addition, the Saudi Red Crescent Authority granted approval on 18-5-1438 Hijra, equivalent to 15-2-2017, project number 81211.

Results

As presented in Table 1, a diverse range of qualifications, expertise and disciplines was found among the expert participants.

Table 1. Demographic information

	Category	**First Round**	**Second Round**
Gender	Male	16	13
	Female	1	1
	Total	17	14

Age Groups	18-28	1	1
	29-39	10	9
	40-49	6	4
	50 or above	0	0
	Total	17	14
Highest Qualification	Certificate	0	0
	Diploma	0	0
	Bachelor’s degree	6	5
	Master’s degree	8	7
	PhD	3	2
	Total	17	14
Years of EMS Experience	1-4	3	3
	5-9	4	3
	10 or more	10	8
	Total	17	14
Primary Medical Discipline	Paramedic	9	8
	Nurse	2	2
	Physician	5	4

	Respiratory Care	1	0
	Total	17	14
Main Professional Role	Administrative/Leadership	11	9
	Education/Academic	5	4
	Clinical/Patient care	1	1
	Total	17	14
Nationality	Saudi	15	13
	Egyptian	1	1
	Jordanian	1	0
	Total	17	14

In accordance with established Delphi stability and agreement criteria, Dajani (17) all core competency statements achieved a majority in each round. Moreover, all core competency items, whether original, new or modified surpassed the 75% consensus requirement (Table 2) (15). All items in this study achieved the Scheibe (18) criteria, with the highest marginal difference in item 36 at 9.1% change between the two rounds. All items demonstrated an increase in the level of consensus between rounds, with a minimum increase of 0.2% for item 9, and indicated the highest level consensus possible. (16)

The initial round generated five statements with a new core competency and an amendment, whilst the second round only generated one disqualified statement which therefore indicated stability. (19) In order to maintain research rigor, a 70% response rate is considered the minimum recommended rate (16). In the current study, the response rates in the first and second rounds were 85% (17 out of 20) and 70% (14 out of 20), respectively. It was therefore anticipated that the response rate would fall below 70% if another round was introduced. (20, 21)

Table 2. List of core competencies for both rounds

	First Round		**Second Round**	
Item	**Mean**	**Std Deviation**	**Mean**	**Std Deviation**
Be able to practice within the legal and ethical boundaries of the profession (ITEM 22)	9.59	.69	9.64	.61
Be able to maintain appropriate and effective safety procedures (ITEM 23)	9.59	1.19	9.64	.48
Be able to practice with respect and non-discriminatory manner (ITEM 2)	9.41	1.09	9.64	.48
Be able to conduct appropriate decision making and critical thinking (ITEM 9)	9.41	1.46	9.43	.49
Be able to provide appropriate and effective clinical care (ITEM 8)	9.35	1.23	9.79	.56
Be able to work as part of a team in a collaborative and professional approach (ITEM 3)	9.18	1.38	9.64	.61
Have the ability to take patient history and conduct examination	9.18	.86	9.50	.63

and assessment of both adults and children (ITEM 24)				
Be able to conduct appropriate scene management (ITEM 25)	9.18	.98	9.57	.49
Be able to effectively communicate information verbally and non-verbally to patients, colleagues and others (ITEM 1)	9.12	1.18	9.43	.82
Be able to demonstrate English Language proficiency to an adequate level for appropriate professional communication (ITEM 41)	-	-	9.07	.96
Be able to maintain good coping skills to deal with stressful situations (ITEM 20)	8.94	.87	9.21	.56
Be able to demonstrate a high level of understanding for practice standards and protocols (ITEM 35)	8.94	1.00	9.21	.67
Be able to conduct themselves to a high professional behavioural standard (ITEM 19)	8.88	1.41	9.43	.61
Have the theoretical knowledge of key concepts in the EMS profession (ITEM 7)	8.82	1.82	9.14	.99
Be responsible for the quality of patient care (ITEM 18)	8.82	1.46	9.57	.73
Be able to maintain the appropriate personal characteristics of being	8.82	1.10	9.50	.50

trustworthy and accountable (ITEM 26)				
Be able to problem-solve, by assessing professional issues and calling upon the required experience and knowledge to resolve them (ITEM 10)	8.76	1.35	9.29	.59
Be able to maintain situational awareness at all times, whilst working in unpredictable situations (ITEM 11)	8.76	1.39	9.21	.77
Be able to maintain appropriate patient interaction and welfare of patients (ITEM 16)	8.76	1.11	9.29	.88
Be able to work as autonomous professionals with high levels of personal professional judgement (ITEM 28)	8.76	1.11	9.29	.70
Be able to work with different equipment and technology within the scope of practice (ITEM 32)	8.76	1.63	9.43	.62
Be able to maintain accurate and comprehensible record keeping within the scope of practice (ITEM 33)	8.76	1.52	9.14	.74
Be committed to a process of continuous lifelong learning and professional development (ITEM 21)	8.65	2.08	8.86	.83
Be able to reflect on their own experience and practice as professionals (ITEM 15)	8.59	1.19	9.29	.59

Be able to maintain an appropriate level of training through different professional courses (ITEM 30)	8.59	1.14	8.93	.88
Understand the need to maintain an appropriate level of physical and mental fitness (ITEM 31)	8.59	1.42	9.14	.64
Be able to manage personal emotions and those of patients and relatives (ITEM 12)	8.53	1.29	9.00	.76
Be able to provide mentoring and education when training others (ITEM 14)	8.53	1.88	8.64	1.11
Be able to provide care according to evidence-based practice (ITEM 17)	8.53	1.68	9.36	.72
Be able to work in different transportation modes (ITEM 29)	8.53	1.04	8.64	1.23
Be able to practice with appropriate Islamic values (ITEM 38)	8.53	2.23	9.29	1.33
Be able to maintain involvement with public and community health (ITEM 39)	8.41	1.42	8.64	.89
Be able to effectively practice in Umrah and Hajj (ITEM 40)	8.41	2.40	8.50	1.76
Be able to conduct an appropriate level of professional quality management (ITEM 34)	8.35	1.78	8.93	.80
Be able to demonstrate leadership skills (ITEM 5)	8.29	1.67	8.64	.89

Be able to provide health and social advocacy responsibly (ITEM 13)	8.24	1.31	8.86	.74
Be able to demonstrate an understanding of new technologies for clinical practice (ITEM 37)	8.24	1.93	8.86	.64
Be able to effectively supervise students and colleagues (ITEM 6)	8.18	1.76	8.21	1.21
Be information literate, by having the capacity to search and apply information (ITEM 4)	8.12	1.97	8.79	.56
Be flexible in learning from different sources including guidance from other colleagues (ITEM 27)	7.94	1.89	8.79	.77
Be able to prepare for and manage disasters and terrorist incidents (ITEM 36)	7.88	2.35	8.79	1.21

Discussion

The findings demonstrate that the Delphi technique is an effective methodology for establishing consensus in the development of EMS core competencies. Within health sector research, there is evidence of the Delphi method's usefulness since expert knowledge in the different disciplines is held by a group of recognised field experts. (7) Moreover, educational research has sometimes depended on the use of the Delphi method, especially for curriculum outcome development. In the context of conducting the current study, the method has proved useful in overcoming the major disadvantages of nominal group techniques, including senior expert dominance, geographical distance and difficulty in reaching consensus. (22)

Complete consensus was obtained in this study and all results were shown to be stable between rounds. The choice of consensus percentage was decided upon prior to data collection, as it was expected that all items would be considered important for the newly established Saudi EMS educational system. (1) As the core competency statements were extracted, clustered and duplicates removed from previously published literature reviews, (1, 13) the initial Delphi round for item generation was removed. Therefore, the study concentrated on the following two Delphi rounds to achieve item consensus.

The expert participants overall ratings were high. However, five core competency statements emerged as the most important for Saudi EMS, namely legal and ethical practice, safety procedures, respect and non-discrimination, decision making and critical thinking and clinical practice. These results both converge and diverge from previous research in other EMS industries. When looking at the first concept of legal and ethical practice, an obvious similarity is with attributes from Australian graduates. (23) However, in the UK study by Kilner (24) the same law and ethics concept was ranked only 30th in mean rank for paramedics. The importance of law and ethics can be seen in the study by O'Brien (25) and the UK Health and Care Professions Council (26) which established an entire dimension for ethical and legal responsibilities, consisting of four and eight statements, respectively. Legal and ethical EMS practice in Saudi represents the most important core competency, especially considering the nascent nature of the profession and the need to establish the associated legal structures.

Safety procedures were the second most important core competency for Saudi EMS. Obviously, safety is the first step in any interaction between paramedics both before and after arrival at a scene. Although not highly rated by UK paramedics, (24) or adequately researched within the field of EMS, safety remains a mandatory tenant of any professional EMS governing association. (26-29)

Respect and non-discrimination were also important concepts for Saudi EMS in a country with a multi-cultural population, especially during Hajj and Umrah. According to Spencer (30), ‘health outcomes deteriorate when health professionals do not provide care that is culturally appropriate’. The concept not only affects patient interaction, but also other team members in their dealings with one another. (31) As the workforce in Saudi Arabia is multi-national, educational curricula should accommodate the need for training and simulation which represent societal needs.

Decision-making and critical thinking was rated as the fourth most important core competency. This result was anticipated, as a previously conducted international literature review identified the same concept as the fourth most studied or endorsed core competency by eight different publications and professional EMS associations. (13) Moreover, in the context of pre-hospital care, making critical decisions involves considerable cognitive and mental skills. (24) In addition, the clinical duties of paramedics include many factors such as working in an exposed pre-hospital environment and, in particular, managing cases which the paramedic has never dealt with before. (32) Overall, making critical decisions in the context of Saudi EMS is more holistic than simply providing clinical care. (33) Therefore, educational curricula and simulation should involve other facets of pre-hospital care such as the police, civil defence and trauma centres.

Competence in clinical practice is central to being a pre-hospital care provider and is considered a critical facet of all EMS providers. (34) Moreover, the importance of clinical competence in paramedic practice is highly rated. (23, 24) Unlike other core competencies, clinical practice is well established in educational curricula, (24) especially when conducted with appropriate internships. (25, 32) There is, however, a need for all other important core competencies to be accommodated in EMS curricula and training.

Following the findings of this Delphi study, it is recommended that future research involves a national study of Saudi Arabian EMS in which a larger sample size is statistically modelled. This would generate a competency framework model which best portrays the specific needs of EMS in Saudi and other countries.

While the Delphi methodology is an accepted research technique that has been practiced for more than 50 years, (35) the methodology has been criticised for its limitations, primarily difficulties in generalising the results to the larger population. Small sample size is a common factor in Delphi studies. (36) Due to the nature of Delphi studies, timing and logistical restraints, patient perspectives were not included in this study.

Conclusion

This is the first study that represents the views of key experts and stakeholders in Saudi EMS with the aim of reaching consensus on a core competency framework. The Delphi study achieved the required recommendations for majority, consensus, stability and response rate. The findings represent core competencies expected for paramedics in Saudi Arabia. However, the study results do not offer a definitive blueprint for the formation of EMS curricula. Further research and statistical modelling based on larger samples is recommended, to develop a complete core competency model for adoption into university curricula.

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Conflict of interest

None

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Appendix H: National study of Emergency Medical Services core competencies: an exploratory factor analysis

National study of Emergency Medical Services core competencies: an exploratory factor analysis

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Abstract

Introduction

Emergency Medical Services (EMS) educational standards in Saudi Arabia have developed at an unprecedented rate and the rapid pace of development has resulted in a considerable disparity of educational approaches. Therefore, an empirically-based core competency framework should be developed. The aim was to utilise Exploratory Factor Analysis (EFA) in the reduction and generation of a theoretical Saudi competency model.

Methods

A purposive sample was utilised in a national quantitative cross-sectional study design of Saudi Red Crescent Authority (SRCA) health care workers. The instrument comprised 41 core competency items rated on a Likert scale. EFA alpha factoring with oblique promax rotation was applied to the 41 items.

Results

A total of 450 EMS health care providers participated in the study, of whom 422 (93.8%) were male and 28 (6.2%) female. Of the participants, 230 (60%) were aged 29-39 years and 244 (54.2%) had 5-9 years of experience. An EFA of instrument items generated five factors: Professionalism, Preparedness, Communication, Clinical and Personal with an eigenvalue >1, representing 67.5% of total variance. Only variables that had a loading value >.40 were utilised in the factor solution.

Conclusion

The EFA model Saudi ParamEdic Competency Scale (SPECS) has been identified, with 27 core competency items and five overarching factors. The model has considerable similarities to other medical competency frameworks. However, some aspects are specifically unique to

the Saudi EMS context. The SPECS model provides an academic blueprint that can be used by paramedic educational programs to ensure empirical alignment with the needs of the industry and community.

Keywords:

allied health personnel; attributes; competence; EMS; paramedic; Saudi Arabia

Introduction

The history of modern Emergency Medical Services (EMS) in Saudi Arabia dates back 85 years but the educational evolution of Saudi EMS has progressed at a rapid pace over the past decade (1). In countries like the US, EMS education has stagnated from the initial development of EMS certification and progress at tertiary-level has not kept up with other countries (2). In a joint statement, three prominent national EMS associations have called for the implementation of an associate degree requirement for all future paramedics (2). In Saudi Arabia, however, EMS education has evolved into the realm of tertiary education and only Bachelor degree programs are offered throughout the country (1). As demonstrated by other medical disciplines, the introduction of university educational standards can improve outcomes and research output (3). University-level education is also important for the development of professionally ethical, reliable and effective paramedics (4).

The fast pace of change within Saudi EMS and the establishing of new EMS Bachelor programs, however, has resulted in considerable educational disparities in Saudi Arabia (1). There are concerns that inconsistencies between university programs can produce variations in how graduates communicate with and manage patients, which is problematic in pre-hospital contexts where paramedic guidelines and medical oversight are fundamentally restrictive in managing medical ambiguity (5). Delivering safe and effective care depends on competency in making critical decisions about the incident scene, the available equipment, safety concerns, the patient’s condition and other complex characteristics of pre-hospital care (5).

Core competency inconsistencies between university programs can result in an adverse mismatch between educational output and industry competency necessities specific to Saudi Arabia (1). As such, empirically identifying the correct core competencies and applying them to EMS educational programs will facilitate the progression of competent EMS graduates into the workforce and thus the improvement of overall patient care. The overall aim of this study was to utilise the exploratory nature of the EFA test to provide data reduction and generate a theoretical model regarding the underlying processes.

Methods

Study design

This was a national quantitative cross-sectional survey study of Saudi Red Crescent Authority (SRCA) health care workers.

Setting

The SRCA is the national Saudi Arabian pre-hospital care provider and its remit extends across the entire country (1). As a centralised pre-hospital care system, it includes EMS health policies, policy development and other organisational governance in the SRCA (1). However, number of medical staff members, type of health care provider and types of crews utilised are different in each SRCA station. Geographical locations are diverse, ranging from rural regions to metropolitan and industrial locations. The study instrument was distributed to participants through the SRCA email system using the internet-based Qualtrics. In addition, data were collected from 42 SRCA EMS stations in the Central and Eastern regions of Saudi Arabia.

Participants

A purposive sampling technique was utilised for the study and the target population was health care professionals working for the SRCA. The inclusion and exclusion criteria were: i) the capacity to read and write in the English language; ii) minimum age of 18 years old; iii) minimum qualification of a health care certificate; and iv) currently working for the SRCA as a health care provider, in any capacity including managerial, training or clinical.

The targeted sample population was large to achieve reliable factor analysis and the study was carefully designed to accommodate different perspectives (6). To ensure a representative sample, the survey was electronically disseminated within all 13 regions in Saudi Arabia and the paper form of the survey was also distributed in two of the most populated regions of the country. The study included all health care professionals contributing to the field of EMS, at all levels of qualification.

Instrumentation

The purpose of the study was to generate an EMS instrument representing a theoretical competency framework for Saudi EMS. The first section of the survey contained seven demographic questions regarding gender, age, qualification, experience, medical discipline, professional role and nationality. The second section included 41 core competency statements rated on a 1-10 Likert scale where 1 represents ‘Not important at all’ and 10 represents ‘Extremely important’.

The core competencies instrument was developed using a combination of international standards and local Saudi requirements and comprised 33 international core competency items extracted from a systematic scoping review (7), and seven core competency items from a review of Saudi universities and colleges (1). A face and content validity study was also performed on the 40-item instrument which led to an additional item being added following a consensus study involving Saudi EMS experts and all Saudi universities offering the degree.

Procedures

The participants were presented with a paper-form explanatory statement prior to completing the questionnaire. Emailed invitations, entitled ‘EMS Research Participants Invitation’, also contained an explanatory statement and a Qualtrics software link to the study. The survey was forwarded to all SRCA email accounts and the voluntary participation of all health care providers in SRCA requested. Respondents were informed of the purpose of the study, the voluntary nature of their participation and of the procedures to ensure their anonymity in all published outputs. Although electronic data collection has the major advantages of flexibility and rapid data collection, one typical disadvantage is the low response rate (8). Therefore, an additional round of paper-form research data collection was conducted concurrently with the electronic form.

Data analysis

The data were analysed by an EFA using alpha factoring with an oblique promax rotation method. This has been recognised as a more appropriate psychometric testing procedure and maximises the alpha reliability of each extracted factor (9, 10). In oblique rotation, the recommended practice is to report both the factor pattern matrix and the factor structure matrix, which will be adhered to in this study (11). While both the pattern and structure matrices will be reported, only the oblique method pattern matrix was utilised for the interpretation of EFA analysis (12). The national study data were stored and analysed using IBM SPSS Statistics Version 23. The information generated was then randomly split approximately 50/50 through SPSS and the first half of the data was used to conduct the EFA for this study. The second half will be used in future research to perform confirmatory factor analysis via structural equation modelling to confirm the SPECS theoretical model.

Ethics

Consent was implied when the paper questionnaire was completed, or when participants opened the Qualtrics email link and they completed the survey electronically. Approval from the Monash University Human Research Ethics Committee was granted on 28-2-2017, and the study ascribed project number 8072. In addition, the Saudi Red Crescent Authority granted approval on 18-5-1438 Hijra, equivalent to 15-2-2017, project number 81211.

Results

Of the 1260 surveys distributed, 909 surveys were returned generating a response rate of 72.14%. In addition, the online survey provided 104 responses, thus yielding a grand total of 1013 responses. Of these, 86 had one or more missing values and were removed from the analyses. Consequently, a total of 927 surveys had a complete data set which was then split and 450 were used in the current study. As presented in Table 1, a diverse range of qualifications, expertise and disciplines was found among the expert participants. Of the 450 participants, only 28 (6.2%) were female, indicating the male dominance of the EMS sector. Most of the participants were aged 29-39 (60%), with a mid-range of experience between 5-9 years (54.2%). The majority held a diploma degree (76.4%) and were paramedics (64.4%). More than three-quarters were Saudi (86.2%) and were well distributed in their professional roles, as presented in Table 1.

Table 1. Study demographics

	Category	**Frequency**	**Percent**
Gender	Male	422	93.8
	Female	28	6.2

	Total	450	100.0
Age groups	18-28	109	24.2
	29-39	270	60.0
	40-49	61	13.6
	50 or above	10	2.2
	Total	450	100.0
Highest qualification	Certificate	29	6.4
	Diploma	344	76.4
	Bachelor’s degree	55	12.2
	Master’s degree	16	3.6
	PhD	6	1.3
	Total	450	100.0
Years of EMS experience	1-4	148	32.9
	5-9	244	54.2
	10 or more	58	12.9
	Total	450	100.0
Primary medical discipline	Paramedic	290	64.4
	Nurse	123	27.3

	Physician	36	8.0
	Public health	1	.2
	Total	450	100.0
Main professional role	Administrative/Leadership	69	15.3
	Education/Academic	153	34.0
	Clinical/Patient care	228	50.7
	Total	450	100.0
Nationality	Saudi	388	86.2
	Egyptian	28	6.2
	Jordanian	18	4.0
	Syrian	7	1.6
	Indian	5	1.1
	Sudanese	2	.4
	Pakistani	1	.2
	Filipino	1	.2
	Total	450	100.0

The EFA was first initiated by generating a correlation matrix, which produced a considerably large number of strong correlations. The Kaiser-Meyer-Olkin Measure for the data set was .96

and the Bartlett test of sphericity significance measure was $p \leq 0.000$. Therefore, the data are considered suitable for the EFA statistical procedure (12-14). The 41 items generated five factors with an eigenvalue >1, representing 67.5% of total variance. An examination of the scree plot also confirmed a solution made up of five factors. All variables that had a loading value of .40 or less were deleted (15), cross-loading variables were also deleted and weak loading variables inconsistent with a given factor were also removed. In total, 14 items were deleted during three rotation EFA iterations. The resulting EFA model was therefore cleaner with less complex variable loadings, presenting a more parsimonious and clearly defined factor structure. The final five-factor solution for the EFA was assigned with appropriate conceptual SPECS factor names.

- Factor 1: Professionalism
- Factor 2: Preparedness
- Factor 3: Communication
- Factor 4: Clinical
- Factor 5: Personal.

Factor 1 was given the name ‘Professionalism’ and comprised nine items which loaded in the range between a high of 0.79 and a low of 0.48. The factor retained an explained variance of 49.1% and the highest loading item was ‘Be flexible in learning from different sources including guidance from other colleagues’. The eight other items represented the ability to work as an autonomous professional, trustworthiness, maintenance of safety procedures, accommodating different transportation modes, a commitment to lifelong learning and professional development, providing care based on evidence-based practice, practicing within the legal and ethical boundaries and maintaining good coping skills with stressful situations.

Factor 2 was given the name ‘Preparedness’, with the factor made up of six items which loaded in the range between a high of 0.78 and a low of 0.46. The factor retained an explained variance of 5.6% and the highest loading item was ‘Be able to demonstrate an understanding of new technologies for clinical practice’. The five other items represented appropriate Islamic values, community outreach, practice in Hajj, the ability to manage disasters and terrorist incidents and proficiency in the English language.

Factor 3 was given the name ‘Communication’ and comprised five items which loaded in the range between a high of 0.84 and a low of 0.58. The factor retained an explained variance of 4.7% and the highest loading item was ‘Be able to practice with respect and non-discriminatory manner’. The four other items represented information literacy, teamwork, communicate verbally and non-verbally and leadership skills.

Factor 4 was given the name ‘Clinical’ and consisted of four items which loaded in the range between a high of 0.88 and a low of 0.47. The factor retained an explained variance of 4.1% and the highest loading item was ‘Be able to provide appropriate and effective clinical care’. The three other items represented decision making, theoretical knowledge and the ability to problem solve.

Factor 5 was given the name ‘Personal’ and comprised three items which loaded in the range between a high of 0.69 and a low of 0.43. The factor retained an explained variance of 3.7% and the highest loading item was ‘Be able to maintain an appropriate level of training through different professional courses’. The other two items represented the understanding of physical and mental fitness and the ability to manage personal emotions.

The solution is presented with the factor pattern matrix, structure matrix and communalities coefficients in Table 2. Since the communalities coefficients indicate a relation between the variables with <.3 and do not equal or exceed the value of 1, the final EFA does not indicate problems with the solution such as the wrong number of factors or too little data (12).

Table 2. Factor pattern and structure matrix for the final EFA five-factor solution

	Factor Pattern matrix coefficients					Factor Structure matrix coefficients					
Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	h^2
Be flexible in learning from different sources including guidance from other colleagues (ITEM 27)	**.791**	-.184	.050	.037	.056	.749	.475	.548	.544	.400	.575
Be able to work as autonomous professionals with high levels of personal professional judgement (ITEM 28)	**.753**	.106	-.102	-.033	.127	.798	.634	.549	.555	.508	.658
Be able to maintain the appropriate personal characteristics of being trustworthy and accountable (ITEM 26)	**.735**	-.027	.107	-.150	.122	.749	.554	.578	.481	.465	.582
Be able to maintain appropriate and effective safety procedures (ITEM 23)	**.717**	.071	-.013	.075	-.094	.764	.573	.552	.571	.343	.592
Be able to work in different transportation modes (ITEM 29)	**.664**	.055	-.008	-.048	.044	.687	.525	.495	.469	.389	.475
Be committed to a process of continuous lifelong learning and professional development (ITEM 21)	**.606**	.193	-.125	.139	.057	.782	.663	.557	.627	.481	.647

Be able to provide care according to evidence-based practice (ITEM 17)	**.583**	-.110	.253	.091	-.060	.718	.499	.629	.574	.344	.554
Be able to practice within the legal and ethical boundaries of the profession (ITEM 22)	**.576**	.010	-.090	.199	.102	.712	.544	.511	.601	.453	.535
Be able to maintain good coping skills to deal with stressful situations (ITEM 20)	**.482**	.087	.043	.122	.132	.730	.612	.592	.606	.508	.572
Be able to demonstrate an understanding of new technologies for clinical practice (ITEM 37)	-.194	**.776**	-.084	.152	.173	.503	.770	.476	.509	.544	.632
Be able to practice with appropriate Islamic values (ITEM 38)	-.042	**.742**	-.067	.124	.042	.555	.766	.496	.517	.466	.596
Be able to maintain involvement with public and community health (ITEM 39)	.217	**.727**	-.007	-.105	-.086	.618	.767	.518	.440	.384	.608
Be able to effectively practice in Umrah and Hajj (ITEM 40)	.173	**.718**	.117	-.110	-.106	.644	.794	.592	.471	.395	.657
Be able to prepare for and manage disasters and terrorist incidents (ITEM 36)	-.137	**.612**	.080	-.053	.320	.490	.716	.510	.424	.611	.586
Be able to demonstrate English language proficiency to an adequate level for appropriate professional communication (ITEM 41)	.195	**.457**	.280	-.056	-.120	.625	.681	.626	.484	.350	.539
Be able to practice with respect and non-discriminatory manner (ITEM 2)	-.102	-.036	**.838**	.115	.043	.577	.538	.838	.593	.436	.710

Be information literate, by having the capacity to search and apply information (ITEM 4)	.145	.008	**.776**	-.037	-.038	.662	.582	.842	.563	.405	.718
Be able to work as part of a team in a collaborative and professional approach (ITEM 3)	.015	-.077	**.775**	.040	.113	.602	.535	.817	.567	.477	.677
Be able to effectively communicate information verbally and non-verbally to patients, colleagues and others (ITEM 1)	-.085	.067	**.596**	.157	.094	.550	.548	.729	.574	.456	.558
Be able to demonstrate leadership skills (ITEM 5)	.104	.234	**.581**	-.108	-.007	.610	.624	.736	.485	.413	.581
Be able to provide appropriate and effective clinical care (ITEM 8)	-.045	-.048	.052	**.884**	.019	.592	.497	.580	.867	.413	.755
Be able to conduct appropriate decision making and critical thinking (ITEM 9)	.118	.135	-.008	**.702**	-.088	.660	.588	.585	.820	.378	.695
Have the theoretical knowledge of key concepts in the EMS profession (ITEM 7)	.110	-.105	.094	**.591**	.140	.590	.471	.560	.733	.462	.565
Be able to problem-solve, by assessing professional issues and calling upon the required experience and knowledge to resolve them (ITEM 10)	.270	.129	.148	**.468**	-.273	.659	.549	.600	.704	.233	.603
Be able to maintain an appropriate level of training through different professional courses (ITEM 30)	.097	-.041	.059	-.083	**.694**	.407	.411	.388	.327	.710	.511

Understand the need to maintain an appropriate level of physical and mental fitness (ITEM 31)	.162	.117	.015	.048	**.562**	.580	.591	.516	.509	.741	.612
Be able to manage personal emotions and those of patients and relatives (ITEM 12)	.084	.160	.097	.062	**.433**	.534	.566	.516	.485	.643	.493

Note: The factor pattern matrix coefficients were the loadings utilised to interpret the EFA results. The table is based on post rotation for alpha factoring extraction method and promax with Kaiser Normalisation rotation method, rotation converged in 7 iterations. Bold numbers indicate which factor the item loaded under. h^2 = communality coefficient.

The reliability test was performed using Cronbach's coefficient alpha, as this is researchers' preferred method for assessing internal consistency (15). This study utilises the recommendation of Hair (16), whereby the minimum threshold to establish acceptable factor reliability is a value equal to or greater than .70. All five EFA factors had a value greater than .80 except for factor five which achieved a value of .76 as presented in Table 3.

Table 3. Reliability measure for the EFA factors

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Cronbach alpha	.919	.883	.893	.869	.766
Number of items	9	6	5	4	3

Discussion

Internationally, the EMS educational standards have changed rapidly into a pre-employment tertiary model (17). Such changes have been coupled with advances in a range of clinical treatments and the provision of high-quality community healthcare (17). Yet, the issue of an educational core competencies framework for Saudi EMS has not been properly addressed (1). Therefore, the SPECS model has been created to fit the needs of the Saudi EMS industry and community expectations. The SPECS model was designed to help accommodate an empirically-based core competency standard and its development has been appropriately sourced from international EMS literature and subjected to validation and consensus building methods. The EFA-generated SPECS model will be discussed in relation to other similar competency frameworks.

The number of factors generated for the SPECS model was different from other EMS studies that have used a factor analysis approach. The first EFA study performed by Kilner (18) generated only three factors for paramedics in the UK, while a pilot EFA study by Williams (19) resulted in 10 factors for Australian paramedics. However, the Australian Paramedic Graduate Attribute scale (PGAS) confirmed seven of the initial 10 factors (20). In a Canadian study by Tavares (21), six paramedic roles were identified using a mixed-methods literature review and interviews. Thus, in an international context, the appropriate number of factors representing an EMS core competency framework has not yet been identified or agreed upon. However, the finding of five competency factors in the national EFA study may offer the appropriate middle ground in the current range identified by the literature. Three factors do not offer enough discrimination while 10 provide too many factors for classification and clarity. For example, the Health Professions Council of South Africa (HPCSA) identified six factors as representative of a competent health care practitioner (22).

Professionalism is the first-listed and largest factor in the SPECS. The EFA analysis by Kilner (18) produced a similar result where core professional skills represented the largest factor for ambulance paramedics. However, in the study by Williams (19) Professionalism was ranked as the fourth factor, with similar core competencies split over other factors. Nevertheless, similarities in core competencies between the SPECS and other studies were identified, those being accountability (19), ethical practice (19, 21), evidence-based practice (19, 21), lifelong learning and self-development (18).

The second largest factor in SPECS was Preparedness. This factor represents the unique Saudi-based outlook on EMS which differs from other countries or studies. Concerns with disaster management in conjunction with terrorist incidents do not feature in other EMS studies, emergency nursing practice standards or physician competency frameworks (17-19, 21, 23, 24). Other unique Preparedness core competencies include practice in Hajj and Umrah, maintaining appropriate Islamic values and English language proficiency, all of which are specifically important in the conduct of a multi-ethnic and multi-lingual Islamic Hajj (25). The only similarity that can be identified is community health and involvement, which is represented as a distinct dimension by Tavares (21) in EMS and the Canadian Physician Competency Framework (23).

In contrast to Preparedness, the Communication factor is internationally recognised and is by far the most researched or recommended core competency in EMS (7). In addition, research addressing EMS competency development identifies communication as a core competency (18, 19, 21), and within medicine and emergency nursing communication is also a distinctive factor (23). Teamwork and leadership are either recognised as core competencies or distinct factors (18, 19, 23). The term ‘information literacy’ as a core competency was not identified in EMS research or emergency nursing practice standards (18, 19, 21, 24). However, the exact term with an associated description was recommended in the Canadian Physician Competency Framework, as part of the Scholar role (23).

Clinical care conducted by EMS providers is the essential cornerstone of the profession. Clinical skills and the associated theoretical knowledge are referred to across EMS competency research but different terms are used (18, 19, 21); for example, decision-making and critical thinking, both important aspects of clinical care (19, 23). Other EMS research, however, categorises decision making under a different factor to clinical skills (18, 21).

Personal was the final and smallest factor in the SPECS EFA model. While no exact equivalent factor can be identified in EMS research or emergency nursing practice standards (18, 19, 21, 24), the HPCSA has important similarities, especially in the combination of commitment for increased emphasis on personal health, well-being and career development of health practitioners (22). In addition, paramedics are not only exposed to physical harm but also to traumatic events such as mass casualty incidents, brutal rape or child victims of violence which may lead to post-traumatic stress disorder (PTSD) (26). Therefore, a holistic paramedic well-being view should be encouraged and accommodated, as poor well-being is associated with poor patient safety outcomes including medical errors (27).

As previously mentioned, this EFA study is part of a larger project aimed at developing a Saudi Arabian EMS core competency framework. Therefore, the next recommended step is to utilise a large sample in confirming the generated SPECS EFA model, through structural equation modelling. This will validate a SPECS model which best portrays the specific needs of EMS in Saudi Arabia.

Limitations

It is acknowledged that while the EFA was based on an appropriately large national sample, the EFA model cannot be fully validated until it has been subjected to confirmatory factor analysis. Therefore, the current SPECS model may not represent the final version for implementation.

Conclusion

The theoretical SPECS competency model was identified, consisting of the most influential factors associated with EMS core competencies in Saudi Arabia. The SPECS model has many similarities to EMS and other medical competency frameworks but the SPECS model maintains aspects that are appropriate and specific to Saudi Arabian EMS. The model represents an important advance towards a more standardised and empirically-based EMS educational system. Therefore, with further research, the SPECS model represents an academic blueprint to facilitate the empirical alignment of paramedic educational programs with the needs of the Saudi Arabian EMS industry.

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Conflict of interest

None.

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Appendix I: National study of Emergency Medical Services core competencies: a confirmatory factor analysis

National study of Emergency Medical Services core competencies: a confirmatory factor analysis

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Abstract

Introduction

Internationally, the development of Emergency Medical Services (EMS) educational standards from a post-employment to pre-employment model has gained considerable momentum. In Saudi Arabia specifically, the evolution to university-based EMS degrees has proceeded swiftly. However, the fast pace of development has contributed to considerable disparities in educational approaches between university programs. Therefore, the development of an empirically-based core competency framework is of considerable importance. The aim of this paper is to utilise Confirmatory Factor Analysis (CFA) through Structural Equation Modelling (SEM) to confirm the theoretically developed Saudi ParamEdic Competency Scale (SPECS) model.

Methods

A national cross-sectional study design with purposive sampling technique was utilised with Saudi Red Crescent Authority (SRCA) health care providers. The SPECS instrument included 41 core competency items measured on a self-reported Likert scale. The maximum likelihood method was used with all the one factor congeneric and complete CFA models.

Results

In total, 477 EMS health care professionals contributed to the study of whom 444 (93.1%) were male and 33 (6.9%) female. Of the participants, 282 (59.1%) were aged 29-39 years and 264 (55.3%) had 5-9 years' experience. A CFA of the SPECS model confirmed five congeneric factors within the adequate fit measurement indices: Professionalism, Preparedness, Communication, Clinical and Personal. There was one higher order factor titled Paramedic Competency.

Conclusion

The CFA results support the SPECS as a reliable, valid, unidimensional and psychometrically sound model for operationalisation into Saudi university curricula. The confirmed model is made up of 27 items with five factors and an overarching latent higher order construct. The SPECS model represents an empirically developed blueprint for adoption into Saudi Arabian university programs.

Keywords:

allied health personnel; attributes; competence; EMS; paramedic; Saudi Arabia

Introduction

The Emergency Medical Services (EMS) represent the first point of patient contact in emergency conditions and the vital role that EMS plays in the overall health care system is therefore of considerable importance. While EMS in Saudi Arabia has a long history dating back to 1934, the universal and centralised provision of pre-hospital care was only initiated in 1963, through the Saudi Red Crescent Association (SRCA) (1).

Initially, the Saudi Arabian EMS educational approach was based on a post-employment training model (1) that offered limited first aid training and basic provision of care prior to patient transport (2). However, over the last decade the country has witnessed a fast pace of evolution and since 2012 the minimum EMS educational qualification offered has been a university level Bachelor degree (1). In terms of the expected level of educational qualification, this requirement surpasses countries like the US, Canada and UK (3).

The introduction of Bachelor degree programs for EMS is important, especially when compared to different medical disciplines, as they are seen to improve outcomes and research output (4). University level education can also be a source of progress for a professionally effective, reliable and ethical paramedic (5). However, with the establishment of many university programs, which were based on either local or international programs, considerable educational disparities have developed (1). This inconsistency between university programs can create an adverse mismatch between industry competency needs and actual educational output for paramedics. Therefore, the empirical identification of a Saudi competency framework and its alignment into EMS university programs will enable the development of a competent EMS workforce, thereby improving patient care. The overall aim of this paper was to use Confirmatory Factor Analysis (CFA) through Structural Equation Modelling (SEM) in order to determine if the hypothesised theoretical SPECS model structure fits the available data. The theoretical SPECS model was developed through an Exploratory Factor Analysis (EFA) and a different sample data set.

Methods

Study design

The study adopted a CFA statistical method in analysing a national quantitative cross-sectional survey design of SRCA health care professionals.

Setting

In Saudi Arabia the SRCA is the centralised national pre-hospital care provider, and its remit extends across the whole country (1). This centralised pre-hospital care system includes EMS organisational policy development, health policies and other organisational governance operationalised by the SRCA (1). Nevertheless, the types of crews being utilised, including the number of EMS providers and the type of medical provider, are different for each SRCA pre-hospital station. Even station locations are geographically diverse, ranging from metropolitan to rural regions and industrial sites. Distribution of the study instrument was carried out using the SRCA email system and utilised the internet-based Qualtrics. In addition, the study was also distributed to 42 SRCA EMS stations in the Eastern and Central regions of Saudi Arabia.

Participants

The study utilised a purposive sample technique and the population encompassed all health care providers working in SRCA. The exclusion and inclusion criteria were as follows: i) a minimum age of 18 years old; ii) the capacity to read and write in the English language; iii) currently working for the SRCA as a health care provider, in any capacity including management, training or clinical; or iv) a minimum qualification of a health care certificate.

The study was attentively designed to retain different perspectives and the sample population sought was large to attain reliable factor analysis (6). Moreover, to achieve a representative sample, the study was electronically disseminated within all 13 regions of Saudi Arabia. The paper form survey was also distributed in the Central and Eastern regions which are some of the most populated areas in Saudi Arabia. The study included all levels of qualification and all medical disciplines contributing to the field of EMS.

Instrumentation

The aim of the national study was to confirm an EMS instrument named the Saudi ParamEdic Competency Scale (SPECS). The first part of the instrument was made up of seven demographic questions which were gender, age, qualification, experience, medical discipline, professional role and nationality. The second part was made up of 41 core competency items that were rated on a 1-10 Likert scale, where 10 represents 'Extremely important' and 1 represents 'Not important at all'.

The SPECS instrument was established using a combination of local Saudi-based requirements and international standards, and included seven core competency statements from a review of Saudi universities and colleges (1) and 33 international core competency statements acquired from a systematic scoping review of the literature (2). Following a face and content validity study of the 40 extracted items and a Delphi consensus study involving Saudi EMS experts and all Saudi universities offering an EMS Bachelor degree, an additional item was added. The instrument was analysed using Exploratory Factor Analysis for item reduction and model generation, resulting in 27 items and five factors titled 'Professionalism', 'Preparedness', 'Communication', 'Clinical' and 'Personal'.

Procedures

The study participants were presented with an explanatory statement before completing the questionnaire. Invitations sent via email were entitled 'EMS Research Participants Invitation' and contained a Qualtrics software link to the study and an explanatory statement. The survey was sent to all SRCA staff email accounts and contained information regarding procedures to assure anonymity in all published outputs, the voluntary nature of participation and the purpose of the study. Even though electronic collection of data has the advantages of speed and flexibility, a typical disadvantage is the expected low response rate (7). Therefore, a paper-based data collection round was conducted concurrently with the electronic form.

Data analysis

The purpose of the CFA was to view how well the proposed factors and variables explained the data (8) and the procedure was performed to determine if the hypothesised theoretical structure fitted the available empirical data (9). In keeping with the highly desirable approach proposed by Jöreskog (10), the hypothesised model was developed via exploratory methods, and then statistically confirmed with a different data set. Data analysis also followed Hair et al.'s Hair (11) recommendation for validating the results by splitting the data in half and confirming the findings with confirmatory statistical analysis. Therefore, the data were initially randomly split to approximately 50% through SPSS; one half was used to conduct the EFA and the other half was used to perform the CFA for this study.

The data was stored and analysed using IBM SPSS Statistics Version 23 and the AMOS 25 statistical package, respectively. The maximum likelihood method is considered superior to other estimation methods in medium to large samples of less than 2500 and was therefore the method of choice for this study (12, 13). The $\chi 2$ is aimed to be non-significant, which indicates the model to be a good illustration of the relations between the observed variables, namely their variance and covariance. However, as the $\chi 2$ test is sensitive to large sample sizes (13-15), the $\chi 2$ will be presented with the ratio of $\chi 2$ to the degrees of freedom (CMIN/DF), where a model with a value of CMIN/DF < 5.0 is acceptable for model fit (11, 14, 16).

As a SEM measurement index, the root mean square error of approximation (RMSEA) indication of a model fit is generally considered to be $\leq$.08 (11). In addition, the standardised root mean square residual (SRMR) can be utilised via an AMOS software plugin, with a good fitting model value of $\leq$.08 (17). The Bentler-Bonett normed fit index (NFI) is regarded as an incremental fit index, the NFI has other similarly scaled indexes such as the Bentler (18) comparative fit index (CFI) and the Bentler-Bonett non-normed fit index (NNFI), otherwise called the Tucker-Lewis Index (TLI) (11, 13, 16). All the aforementioned incremental measurement indices are recommended to have a value of $\geq$.90 for a good fitting model (11-13).

The testing of the theorised SPECS model involved a congeneric approach, where each factor and the associated observed variables were tested separately before the entire model was combined for analysis (12). As the observed variables were accounted for by their correlation and association with an underlying latent factor, by the same rationale, since all EFA factors (sometimes called latent variables in SEM) were strongly correlated with each other, there is a strong indication that a higher order underlying construct was the cause for this correlation (12). Moreover, hierarchical higher order analysis can be a more accurate presentation of reality than first order factor analyses alone (19). Therefore, the CFA was utilised to test the final model fit using a higher order factor categorised as ‘Paramedic Competency’.

Ethics

The consent of participants was implied when the questionnaire was filled out or when the Qualtrics email link was opened and the survey electronically completed. Approval from the

Monash University Human Research Ethics Committee was granted on 28-2-2017, and the research was ascribed project number 8072. The SRCA granted approval on 18-5-1438 Hijra, equivalent to 15-2-2017, and assigned project number 81211.

Results

Of a total 1260 surveys distributed, 909 surveys were returned (a response rate of 72.14%) and the online survey produced 104 responses, generating a total of 1013 responses. Of these, 86 were list-wise removed from the analyses as they had one or more missing values. Accordingly, a total of 927 participants had a complete data set which was randomly split and only 477 were used in this study. As presented in Table 1, a diverse range of disciplines, expertise and qualifications were found among the expert participants. Of the 477 participants, only 33 (6.9%) were female which reflects male dominance of the EMS sector in Saudi Arabia. Most of the participants were aged 29-39 (59.1%), with a mid-range of experience between 5-9 years (55.3%). The majority held a diploma degree (76.1%) and were paramedics (61.8%). More than three-quarters were Saudi (84.7%) nationals and the participants were well distributed in their professional roles (see Table 1).

Table 1. Study demographics

	Category	**Frequency**	**Percent**
Gender	Male	444	93.1
	Female	33	6.9
	Total	477	100.0
Age groups	18-28	121	25.4

	29-39	282	59.1
	40-49	61	12.8
	50 or above	13	2.7
	Total	477	100.0
Highest qualification	Certificate	39	8.2
	Diploma	363	76.1
	Bachelor’s degree	59	12.4
	Master’s degree	8	1.7
	PhD	8	1.7
	Total	477	100.0
Years of EMS experience	1-4	167	35.0
	5-9	264	55.3
	10 or more	46	9.6
	Total	477	100.0
Primary medical discipline	Paramedic	295	61.8
	Nurse	134	28.1
	Physician	47	9.9
	Pharmacist	1	.2

	Total	477	100.0
Main professional role	Administrative/leadership	81	17.0
	Education/academic	175	36.7
	Clinical/patient care	221	46.3
	Total	477	100.0
Nationality	Saudi	404	84.7
	Egyptian	25	5.2
	Jordanian	23	4.8
	Syrian	14	2.9
	Indian	6	1.3
	Sudanese	3	.6
	Pakistani	2	.4
	Total	477	100.0

The first CFA SEM model was for the factor ‘Professionalism’, in which the congeneric model was measured using nine observed variables, one latent variable and nine error estimates. The results of the first CFA model presented an adequate SEM model fit within the acceptable fit indices ranges. The model fit results were presented as $\chi 2$ value of 127.80 (df = 27, p = .00), CMIN/DF 4.73, RMSEA .08, NFI .96, TLI .95, CFI .96 and a SRMR of .02.

The second CFA SEM model was for the factor 'Preparedness', in which the congeneric model was measured using six observed variables, one latent variable and six error estimates. The results of the second CFA model presented an inadequate SEM model fit. The modification indices were inspected and one potential covariance in the model was found between e14 to e10. This indicated a link between e14 'Be able to prepare for and manage disasters and terrorist incidents' and e10 'Be able to demonstrate an understanding of new technologies for clinical practice'. After accounting for the single covariance, the results of the second CFA model presented an adequate SEM model fit within the acceptable fit indices ranges. The model fit results were presented as $\chi 2$ value of 15.97 (df = 8, p = .04), CMIN/DF 1.99, RMSEA .04, NFI .99, TLI .99, CFI .99 and a SRMR of .01.

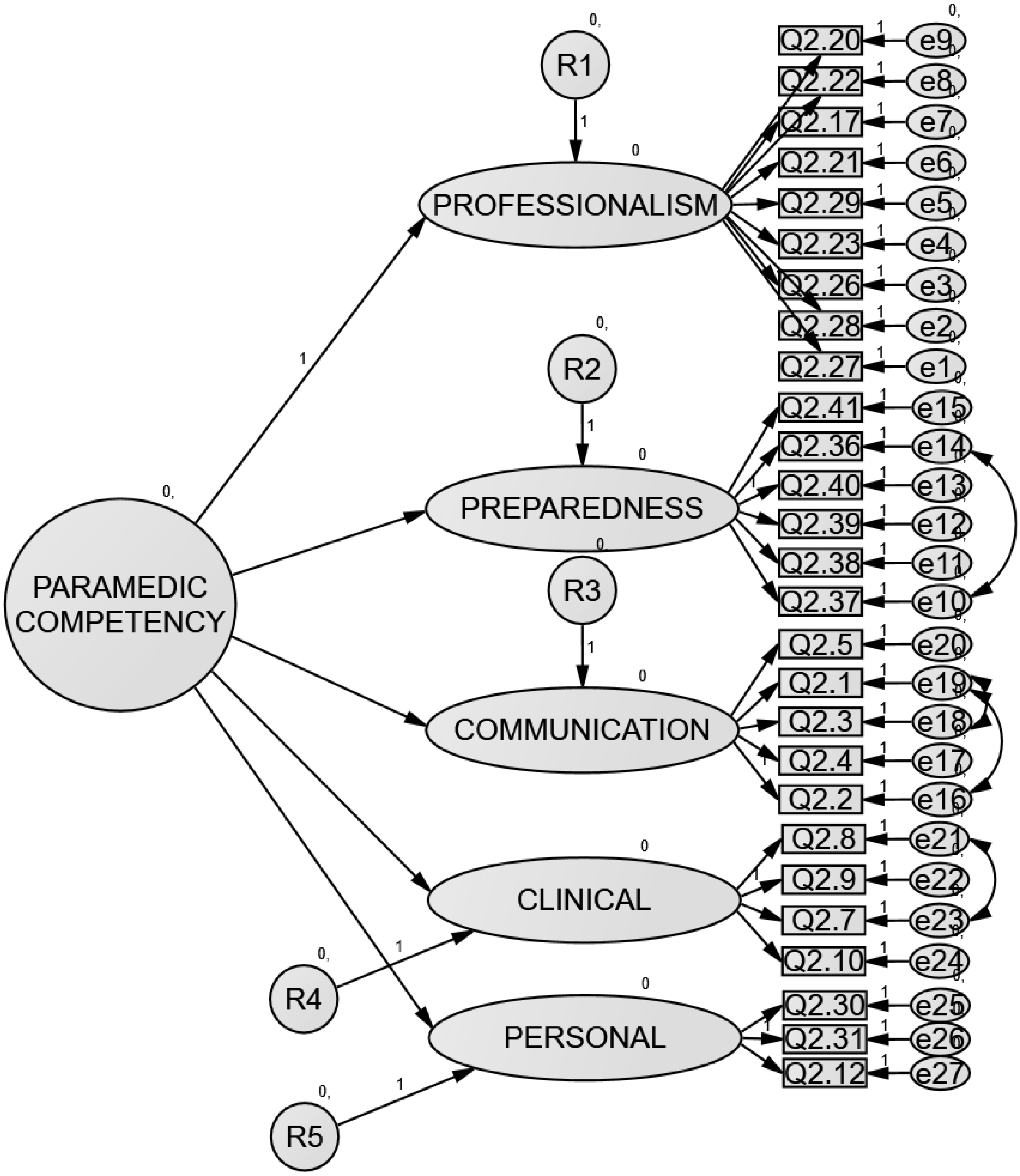
The third CFA SEM model was for the factor 'Communication', in which the congeneric model was measured using five observed variables, one latent variable and five error estimates. The results of the third CFA model presented an inadequate SEM model fit. The modification indices were inspected and two potential covariances in the model were found between e19 to e18 and e19 to e16, thereby indicating a link between e19 'Be able to effectively communicate information verbally and non-verbally to patients, colleagues and others' and both e16 'Be able to practice with respect and non-discriminatory manner' and e18 'Be able to work as part of a team in a collaborative and professional approach'. After accounting for the two covariances in the model, the results of the third CFA model presented an adequate SEM model fit within the acceptable fit indices ranges. The model fit results were presented as $\chi 2$ value of 9.26 (df = 3, p = .02), CMIN/DF 3.08, RMSEA .06, NFI .99, TLI .98, CFI .99 and a SRMR of .01.

The fourth CFA SEM model was for the factor 'Clinical, in which the congeneric model was measured using four observed variables, one latent variable and four error estimates. The results of the fourth CFA model presented an inadequate SEM model fit. The modification indices were inspected and one potential covariance in the model was found between e21 to e23. This indicated a link between e21 ‘Be able to provide appropriate and effective clinical care’ and e23 ‘Be able to maintain appropriate and effective safety procedures’. After accounting for the single covariance in the model, the results of the fourth CFA model presented an adequate SEM model fit within the acceptable fit indices ranges. The model fit results were presented as $\chi 2$ value of 2.85 (df = 1, p = .09), CMIN/DF 2.85, RMSEA .06, NFI .99, TLI .98, CFI .99 and a SRMR of .00.

The fifth CFA SEM model was for the factor ‘Personal’, in which the congeneric model was measured using three observed variables, one latent variable and three error estimates. As this model is made up of only three observed variables, another loading was also fixed with the value of one. The results of the fifth CFA model presented an adequate SEM model fit within the acceptable fit indices ranges. The model fit results were presented as $\chi 2$ value of 2.34 (df = 1, p = .12), CMIN/DF 2.34, RMSEA .05, NFI .99, TLI .99, CFI .99 and a SRMR of .00.

For the final SEM model in this study, ‘Competency’ presents an abstract second order factor, sometimes also referred to as a higher order factor (see Figure 1). The model in this case is represented by an overarching inclusive higher order factor ‘Competency’ which has five latent variables, namely ‘Professionalism’, ‘Preparedness’, ‘Communication’, ‘Clinical’ and ‘Personal’. The first order latent variables are represented with 27 observed variables split in nine, six, five, four and three observed variables, respectively. The final model contains 32 error estimates divided between five for each of the first order latent variables and 27 for the observed variables. As per the modification indices from the previous congeneric model, four covariances were accounted for which are between e14 to e10, e19 to e18, e19 to e16 and e21 to e23. The results of the final CFA model presented an adequate SEM model fit within the acceptable fit indices ranges. The model fit results were presented as $\chi 2$ value of 959.88 (df = 315, p = .00), CMIN/DF 3.04, RMSEA .06, NFI .91, TLI .93, CFI .94 and a SRMR of .03.

Figure 1. Confirmed SPECS model



Note: The bidirectional arrows between the 'e' indicates a covariance between items under each factor.

The reliability and validity of the scale have also been supported. The internal consistency reliability measured using Cronbach alpha was >.85 for all factors, as presented in Table 2. In addition, the item reliability was also tested using the squared multiple correlation. The conventional cut off point for the squared multiple correlation is any value below $\geq$.5, which has been achieved by all the observed variables (20).

The unidimensionality of the scale has also been achieved, as all factor loadings are above the loading value of .5 and all are positively loaded (21-23). Furthermore, the convergent validity has been supported, as the minimum standardised regression weight for each observed variable has achieved a value of $\geq$.7 (20).

Table 2. Reliability measure for the CFA factors

	Factor 1	**Factor 2**	**Factor 3**	**Factor 4**	**Factor 5**
Cronbach alpha	.94	.91	.89	.90	.87
Number of items	9	6	5	4	3

Discussion

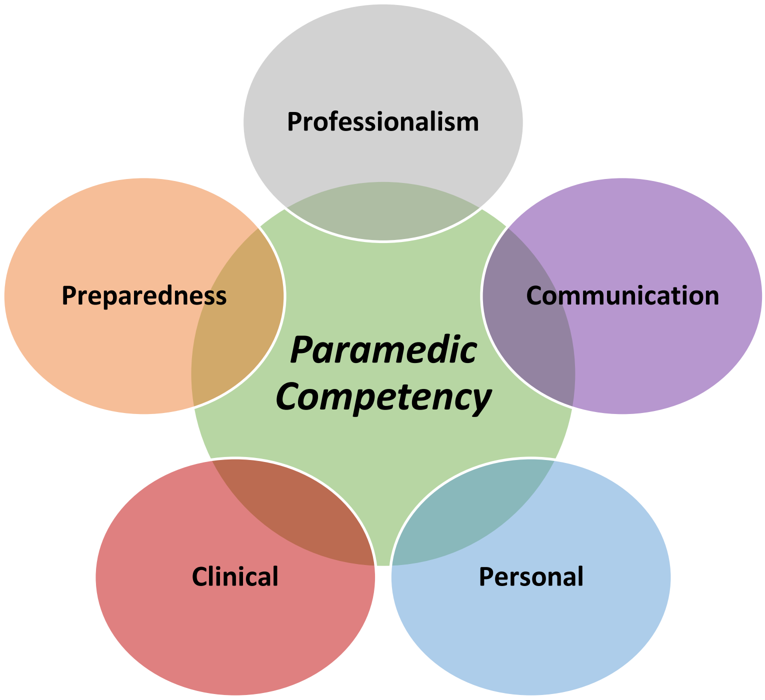
All the previously presented fit indices have met their respective commonly acceptable fit values and the results verify an acceptable fit for the SPECS model with regard to the national study data set. The CFA results for the SPECS model therefore represent a confirmed model. Construct validity has also been established as an adequately fitting model in CFA represents a confirmation of construct validity (20). The model's reliability has also been supported with strong Cronbach alpha factor coefficients. Item reliability was supported by tests that used the squared multiple correlation which indicated that the underlying factors roughly explain more than 50% of the variance in each observed variable.

Given the importance of developing empirical core competency frameworks for EMS health care providers, previous studies have explored different EMS competency frameworks by conducting an EFA (24-26). However, the current study is the first to confirm and validate a theoretical EFA model using CFA through SEM in the field of EMS. The CFA for the SPECS model represents the final empirical step in the development of a Saudi EMS competency framework. The SPECS model was composed of local and international core competency items and subjected to initial validation and expert consensus. Finally, the SPECS model was a product of this study's statistical exploratory generation, reduction and confirmation (13).

Generally, EMS competency framework standards are represented by long lists of items that are often based on vocational training or are direct adaptations from different organisations, rather than classified under specific empirically developed factors (27-29). However, internationally recognised competency standards from other health care disciplines are represented by six factors and an overarching concept such as 'Medical Expert' or 'Health Practitioner' (30, 31).

The SPECS model structure is similar to international medical norms, with core competency items grouped under specific factors and an overarching higher order concept representing paramedic competency (see Figure 2). However, as the model was developed for Saudi Arabian EMS, the actual factors are somewhat different. For example, the leadership factor was accommodated as an item under the SPECS model 'Preparedness' factor, emphasising the importance of the EMS leadership role in preparedness for disaster, terrorist incidents and Islamic Hajj.

Figure 2. SPECS representation



The SPECS model was represented by four covariances within three factors. Although the co-varying items seem natural, those such as item 8 'Be able to provide appropriate and effective clinical care' and item 7 'Have the theoretical knowledge of key concepts in the EMS profession', naturally link clinical skills with theoretical knowledge. Nevertheless, the communication factor represented the most interesting relationships with covariances identified between item 1 'Be able to effectively communicate information verbally and non-verbally to patients, colleagues and others' on the one hand and items 2 'Be able to practice with respect and non-discriminatory manner' and 3 'Be able to work as part of a team in a collaborative and professional approach' on the other.

The link between improved communication in item 1 and non-discrimination in item 2 is not well researched in EMS. However, the concept is important in the current multi-cultural context of Saudi society and specifically during the multi-lingual and multi-national Islamic Hajj (32). Such a link is highly recommended when looking at improving communication in the wider health care system (33). Even within the medical profession, the link between communication and non-discrimination is important and should be a source of learning and integration (34).

The association between item 1 communication and item 3 teamwork is very important in complex environments such as critical cases in the pre-hospital setting (35). Furthermore, communication is an essential component of team dynamics where breakdowns in communication can endanger the quality of care and patient safety (35, 36). Overall, interprofessional educational exercises or simulated wilderness exercises for paramedic students may be useful in researching and improving the link between communication and teamwork (37, 38).

As previously mentioned, this CFA study is part of a larger project aimed at developing a Saudi Arabian EMS core competency framework, which has now been realised. The next step in the research is to utilise the large sample in the national study data to explore how participants' professional profiles compare to the confirmed SPECS model factors. This will improve understanding of the current status and paradigms specific to Saudi EMS.

Limitations

It is acknowledged that although the SPECS model represents the first EMS competency framework to be confirmed with CFA through SEM, the current model cannot be compared to other CFA EMS models, as none have yet been developed. The self-reporting nature of the study is another limitation; this approach, however, was the only viable one as a large sample size was required for advanced statistical analysis.

Conclusion

The results of this study support the SPECS as a reliable, valid, unidimensional and psychometrically sound model for operationalisation into Saudi university curricula. The overall outcome of the national study data identified and confirmed 27 items represented by five factors and a higher order construct. The SPECS model offers all Saudi universities an EMS program blueprint to ensure curricula standardisation that will facilitate EMS university programs to maintain excellence in curriculum standards based on empirical input from the local and international EMS industry.

Acknowledgments

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Conflict of interest

None.

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Appendix J: National study of Saudi Arabian Emergency Medical Services professional profiles: an inferential analysis

National study of Saudi Arabian Emergency Medical Services professional profiles: an inferential analysis

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Abstract

Introduction

Internationally, Emergency Medical Services (EMS) are an essential access point to the health care system. Building an understanding of the professional, educational and demographic profiles of an EMS workforce is important. The aim of this study is to statistically test the professional profiles of EMS providers against the Saudi ParamEdic Competency Scale (SPECS) model factors.

Methods

Health care providers working for the Saudi Red Crescent Authority (SRCA) were surveyed using a cross-sectional study design with purposive sampling technique. The independent variables were tested against the five SPECS model factors 'Professionalism', 'Preparedness', 'Communication', 'Clinical' and 'Personal'.

Results

Of the 1260 surveys distributed, 909 surveys were returned (72.14% response rate). A total of 927 EMS health care professionals contributed to the study of whom 866 (93.4%) were male and 61 (6.6%) female. Of the participants, 552 (59.5%) were aged 29-39 years and 508 (54.8%) had 5-9 years' experience.

Conclusion

This is the first national study to explore and contextualise the diverse professional stakeholders in Saudi EMS. The study was able to employ the professional profiles of the participants in understanding the different perceptions of the SPECS model. We recommend that future research address the specific differences identified in the demographic, professional and educational aspects of this study.

Keywords:

allied health personnel; attributes; competence; EMS; paramedic; Saudi Arabia

Introduction

The Emergency Medical Services (EMS) are the first point of patient contact in pre-hospital emergency care and play a vital role in the overall health care system. While the demographic profiles of EMS patients have been subjected to different studies for epidemiological purposes (1), the importance of EMS providers' professional and demographic profiles is important for many reasons such as understanding of competency perception, benchmarking and development of research specific to the EMS industry. An example is the study by Fernandez (2), which estimated the probability of passing the national paramedic certification examination in the US and found that demographics, educational background, lead instructor qualification and national program accreditation were all significantly associated with success in the national certification exam.

Generally, there is a dearth of research investigating the professional and demographic profiles of the EMS workforce, especially in Saudi Arabia. The current EMS composition in Saudi is not clear with regards to gender, age, qualification, experience, medical discipline, professional role and nationality. Thus, by extension, EMS stakeholders' perception regarding the educational core competency framework requirements are also unclear.

Saudi Arabian society as a whole is young with approximately three-quarters of the population below the age of 40 (3). As expected in an Anglo-American EMS model, most of the EMS workforce are perceived to be paramedics (4). The EMS system is generally split between post-employment certificate holders with minimal education qualification (5), and a pre-employment model represented by Diploma, Bachelor, Masters and PhD holders (6). Although the majority of the population in the country are Saudi (3), only a third of the physicians in the Ministry of Health (MOH) are Saudi nationals. Also, other health care disciplines in the MOH are female dominated, for example, approximately three-quarters of nurses in the Saudi MOH are female (7).

Overall, the composition of Saudi EMS is expected to follow a similar pattern to other countries with a male dominated EMS profession, as the low representation of females in the EMS workforce is an international feature (8-12). One of the reasons for the preference of male over female paramedics is the physical strain involved in the work which leads to the hiring of perceived stronger male paramedics (9). However, females have been shown to be equal to males on certain aspects and are reported to even outperform them in specific psychological traits. For example, young female paramedics can tolerate working for 24 hours under the same conditions as males (11). Furthermore, female paramedics can be more empathetic to their patients, which can elevate the quality of patient care (13). The trend for increasing female paramedic education is changing in certain regions such as Victoria, Australia (14). There is an underlying need for the inclusion of female paramedics in EMS workforce training and clinical practice, specific to the requirements of the Saudi EMS industry (15). This study aims to statistically represent how the professional profiles of the national study participants compare against the confirmed Saudi ParamEdic Competency Scale (SPECS) model factors.

Methods

Study design

The study utilised a non-parametric statistical method in analysing a national cross-sectional survey design of health care professionals in the SRCA.

Setting

The SRCA represents a centralised national provider of public pre-hospital care, with responsibility across the whole of Saudi Arabia (16). The pre-hospital care system comprises health policies, EMS organisational policy development and other organisational governance utilised by the SRCA (16). However, SRCA EMS station crews vary in the number of providers, level of qualification and type of medical discipline. Even the geographical locations of EMS stations are diverse, ranging from rural to metropolitan regions and industrial sites. The study was distributed using the SRCA email system and utilised the Internet-based Qualtrics. Furthermore, the study instrument was distributed to 42 SRCA stations in the Central and Eastern regions of the country.

Participants

The research was conducted with a purposive sample technique and the study population encompassed all health care provider staff in the SRCA. The inclusion and exclusion conditions were: i) a minimum qualification of a health care certificate; ii) currently working for the SRCA as a health care provider in any capacity including training, management or clinical; iii) the capacity to read and write in the English language; or iv) a minimum age of 18 years old.

To achieve a representative population sample, the study was electronically distributed within all 13 regions of the country. Also, the paper form survey was administered in the highly populated Eastern and Central regions of Saudi Arabia. The research included all medical disciplines and all levels of qualification involved in the field of Saudi EMS.

Instrumentation

The professional profile element of the SPECS instrument represents the only aspect associated with this study and comprised seven demographic questions: gender, age, qualification, experience, medical discipline, professional role and nationality.

The SPECS model was established using a collection of national Saudi requirements and internationally recognised standards, and comprised seven core competency items from a review of Saudi Arabian universities and colleges (16) and 33 international core items generated from a systematic scoping review (17). After performing a face and content validity study of the extracted items and a Delphi method study involving key Saudi EMS experts and all Saudi universities offering an undergraduate EMS degree, an additional item was added. The model was first generated using Exploratory Factor Analysis for parsimony, resulting in 27 items and five factors entitled 'Professionalism', 'Preparedness', 'Communication', 'Clinical' and 'Personal'. The final SPECS model was then confirmed using structural equation modelling (SEM) and confirmatory factor analysis (CFA) with a different data set.

Procedures

The research participants were offered an explanatory statement before completing the questionnaire. The study email was entitled 'EMS Research Participants Invitation' and included an explanatory statement and a Qualtrics software link to the study. The message was sent to the email accounts of SRCA staff and included information regarding the purpose of the study, the voluntary nature of participation and procedures to assure anonymity. Although electronic data collection has the advantages of flexibility and speed, a distinctive disadvantage is the likely low response rate (18). Hence, a paper-based data collection procedure was administered in conjunction with the digital form.

Data analysis

The data was stored and analysed using the IBM SPSS Statistics Version 23 statistical package. The seven independent professional variables were tested against the five confirmed SPECS model factors. The inferential statistical analyses were performed via Kruskal-Wallis H tests with post hoc analysis and a Mann-Whitney U test. As the assumptions for parametric analysis were not met due to the size of some of the groups, data were not normally distributed, and it wasn't possible to apply a parametric data analysis technique (19, 20). To assess for any detected significance of relationship amongst the data variables, a p value of <.05 was set for this study. As the Kruskal-Wallis H test cannot detect which of the specific groups are statistically significantly different from each other, post hoc Dunn pairwise analysis with a Bonferroni adjustment to the alpha level was conducted for each significant factor (19, 21, 22). According to Pallant (19), the Mann-Whitney U test can be used after the Kruskal-Wallis H test to further analyse each significant relationship and identify the effect size. The Cohen (23) criterion was used to evaluate the effect size as small ($r \geq 0.1$), medium ($r \geq .03$) or large ($r \geq .5$).

Ethics

Consent was implied when the questionnaire was completed by study participants or when the email link was opened, and the survey electronically completed. Approval from the Monash University Human Research Ethics Committee was approved on 28-2-2017, and the research was assigned project number 8072. SRCA approval was granted on 18-5-1438 Hijra, equivalent to 15-2-2017, and ascribed project number 81211.

Results

In total, 1260 surveys were distributed of which 909 were returned, generating a response rate of 72.14%. The online survey generated 104 responses, producing a total of 1013 responses. Of these, 86 were list-wise deleted from the analyses as they contained one or more missing values. Thus, a total of 927 participants provided a complete data set which were utilised for this study. As presented in Table 1, a diverse range of expertise, disciplines and qualifications were identified among the participants. Of the 927 participants, only 61 (6.6%) were female which reflects male dominance of the EMS sector in Saudi Arabia. Most of the participants were aged 29-39 (59.5%), with a mid-range of experience between 5-9 years (54.8%). The majority held a diploma degree (76.3%) and were paramedics (63.1%). More than three-quarters were Saudi (85.4%) nationals and the participants were approximately well-distributed in their professional roles (see Table 1).

Table 1. Participants' profiles

	Category	Frequency	Percent
Gender	Male	866	93.4
	Female	61	6.6
	Total	927	100.0
Age groups	18-28	230	24.8
	29-39	552	59.5
	40-49	122	13.2
	50 or above	23	2.5
	Total	927	100.0
Highest qualification	Certificate	68	7.3
	Diploma	707	76.3
	Bachelor's degree	114	12.3
	Master's degree	24	2.6
	PhD	14	1.5

	Total	927	100.0
Years of EMS experience	1-4	315	34.0
	5-9	508	54.8
	10 or more	104	11.2
	Total	927	100.0
Primary medical discipline	Paramedic	585	63.1
	Nurse	257	27.7
	Physician	83	9.0
	Public health	1	.1
	Pharmacist	1	.1
	Total	927	100.0
Main professional role	Administrative/leadership	150	16.2
	Education/academic	328	35.4
	Clinical/patient care	449	48.4
	Total	927	100.0
Nationality	Saudi	792	85.4
	Egyptian	53	5.7
	Jordanian	41	4.4
	Syrian	21	2.3
	Indian	11	1.2
	Pakistani	3	.3
	Sudanese	5	.5

	Filipino	1	.1
	Total	927	100.0

The significant results of the study on the influence of professional profiles on SPECS model factors are presented in Tables 2-8. The non-parametric inferential analysis identified a total of 39 different significant relationships. Due to single participation of the Public Health and Pharmacist disciplines and their inability to combine with Paramedic, Nurse or Physician, the two participants were excluded from the analysis. Also, nationalities were merged into three groups: Arabs (Egyptian, Jordanian, Syrian and Sudanese), Non-Arabs (Indian, Pakistani and Filipino) and Saudi. The Mann-Whitney U test revealed a significant difference in terms of professionalism between male (n = 866) and female (n = 61) participants (p = .005). A significant difference was similarly found in terms of preparedness (p = .000), communication (p = .000) and clinical factors (p = .000) (see Table 2).

Table 2. Significant differences between gender groups

Construct	Factor 1		Factor 2		Factor 3		Factor 4	
Group	M	F	M	F	M	F	M	F
N	866	61	866	61	866	61	866	61
U	20783.50		18113.00		15451.50		18277.50	
z	-2.791		-4.12		-5.44		-4.04	
p	.005		.000		.000		.000	
r	.09		.13		.17		.13	
MR	470.50	371.71	473.58	327.93	476.66	284.30	473.39	330.63

The Mann-Whitney U tests revealed a significant difference in terms of communication for the 29-39 and 40-49 groups (U = 27021.5, p = .001), 18-28 and 49-50 groups (U = 9812, p = .000), 18-28 and 29-39 groups (U = 55089, p = .003) and 18-28 and 40-49 groups (U = 11489, p = .005) (see Table 3).

Table 3. Significant differences between age groups

Construct	Factor 3		Factor 3		Factor 3		Factor 4	
Group	29-39	40-49	18-28	40-49	18-28	29-39	18-28	40-49
N	552	122	230	122	230	552	230	122
U	27021.50		9812		55089		11489	
z	3.43		-4.66		-2.93		-2.81	
p	.001		.000		.003		.005	
r	.12		.25		.10		.15	
MR	349.55	282.99	194.84	141.93	427.98	376.30	187.55	155.67

Professionalism had two Mann-Whitney U tests that showed a significant difference: certificate and diploma (U = 17787.5, p = .000) and certificate and Bachelor's (U = 2637, p = .000). Preparedness had three tests that showed a significant difference: certificate and diploma (U = 16083, p = .000), certificate and Bachelor's (U = 2361.5, p = .000) and certificate and Master's (U = 494.5, p = .003). Communication had four tests that showed a significant difference: certificate and diploma (U = 16249, p = .000), certificate and Bachelor's (U = 2451.5, p = .000), certificate and Master's (U = 489, p = .003) and certificate and PhD (U = 245, p = .003). Clinical had two tests that showed a significant difference: certificate and diploma (U = 17132.5, p = .000) and certificate and Bachelor's (U = 2727.5, p = .001). Personal had three tests that showed a significant difference: certificate and diploma (U = 502.16, p = .000), certificate and Bachelor's (U = 2684, p = .000) and certificate and Master's (U = 468.5, p = .001) (see Table 4).

Table 4. Significant differences between educational groups

Construct	Comparison Number	Education	*N*	U	*z*	*p*	*r*	MR
Factor 1	1	Certificate	68	17787.5	-3.55	.000	.12	479.92
		Diploma	707					379.16
	2	Certificate	68	2637	-3.62	.000	.27	109.72
		Bachelor's	114					80.63
Factor 2	1	Certificate	68	16083	-4.53	.000	.16	504.99
		Diploma	707					376.75
	2	Certificate	68	2361.5	-4.45	.000	.32	113.77
		Bachelor's	114					78.21
	3	Certificate	68	494.5	-2.94	.003	.30	51.23
		Master's	24					33.10
Factor 3	1	Certificate	68	16249	-4.44	.000	.16	502.54
		Diploma	707					376.98
	2	Certificate	68	2451.5	-4.18	.000	.30	112.45
		Bachelor's	114					79.00
	3	Certificate	68	489	-2.99	.003	.31	51.31
		Master's	24					32.88
	4	Certificate	68	245	-2.98	.003	.37	44.90
		PhD	14					25.00
Factor 4	1	Certificate	68	17132.5	-3.94	.000	.14	489.55
		Diploma	707					378.23
	2	Certificate	68	2727.5	-3.40	.001	.26	108.39
		Bachelor's	114					81.43
Factor 5	1	Certificate	68	502.16	-4.45	.000	.16	502.16
		Diploma	707					377.02
	2	Certificate	68	2684	-3.55	.000	.26	109.03
		Bachelor's	114					81.04

	3	Certificate	68	468.5	-3.24	.001	.24	109.03
		Master's	24					81.04

The Mann-Whitney U tests revealed a significant difference in professionalism with 1-4 and 10 or more years' experience (U = 13792.5, p = .015), professionalism with 5-9 and 10 years or more (U = 22347, p = .013), communication with 1-4 and 10 years or more (U = 12953, p = .001), clinical with 1-4 and 10 years or more (U = 13801, p = .015) and clinical with 1-4 and 5-9 years (U = 68920, p = .001) (see Table 5).

Table 5. Significant differences between experience groups

Construct	Factor 1		Factor 1		Factor 3		Factor 4		Factor 4	
Group	1-4	10+	5-9	10+	1-4	10+	1-4	10+	1-4	5-9
N	315	104	508		315	104	315		315	508
U	13792.5		22347		12953		13801		68920	
z	-2.42		-2.48		-3.21		-2.43		-3.362	
p	.015		.013		.001		.015		.001	
r	.12		.10		.16		.12		.12	
MR	218.21	185.12	314.51	267.38	220.88	177.05	218.19	185.20	447.21	390.17

The Mann-Whitney U tests showed a significant difference in communication with paramedics and nurses (U = 66239.5, p = .006), communication with paramedics and physicians (U = 19778, p = .006) and clinical with paramedics and nurses (U = 64383, p = .001) (see Table 6).

Table 6. Significant differences between discipline groups

Construct	Factor 3		Factor 3		Factor 4	
Group	Paramedic	Nurse	Paramedic	Physician	Paramedic	Nurse
N	585	257	585	83	585	257
U	66239.5		19778		64383	

z	-2.76		-2.75		-3.34	
p	.006		.006		.001	
r	.10		.11		.12	
MR	436.77	386.74	342.19	280.29	439.94	379.52

The Mann-Whitney U tests revealed a significant difference in preparedness with administrative/leadership and education/academic (U = 20906, p = .008), communication with education/academic and clinical/patient care (U = 65915, p = .012), clinical with administrative/leadership and education/academic (U = 21129, p = .013), personal with administrative/leadership and education/academic (U = 19526.5, p = .000) and personal with administrative/leadership and clinical/patient care (U = 26866.5, p = .000) (see Table 7).

Table 7. Significant differences between professional groups

Construct	Factor 2		Factor 3		Factor 4		Factor 5		Factor 5	
Group	Admin	Edu	Edu	Clinical	Admin	Edu	Admin	Edu	Admin	Clinical
N	150	328	328	449	150	328	150	328	150	449
U	20906		65915		21129		19526.5		26866.5	
z	-2.65		-2.51		-2.49		-3.66		-3.75	
p	.008		.012		.013		.000		.000	
r	.09		.09		.11		.17		.15	
MR	264.12	228.24	365.46	406.20	262.64	228.92	273.32	224.03	345.39	284.84

The Mann-Whitney U tests revealed a significant difference among Saudis and Arabs in professionalism (U = 35935.5, p = .000), preparedness (U = 34442, p = .000), communication (U = 31758.5, p = .000) and clinical (U = 32847.5, p = .000) (see Table 8).

Table 8. Significant differences between nationality groups

Construct	Factor 1		Factor 2		Factor 3		Factor 4	
Group	Saudi	Arab	Saudi	Arab	Saudi	Arab	Saudi	Arab
N	792	120	792	120	792	120	792	120
U	35935.5		34442		31758.5		32847.5	
z	-4.32		-4.88		-5.89		-5.48	
p	.000		.000		.000		.000	
r	.14		.16		.19		.18	
MR	471.13	359.96	473.01	347.52	476.40	325.15	475.03	334.23

Note: The Arab group comprises Egyptian, Jordanian, Syrian and Sudanese nationalities. The Saudi group comprises the one nationality.

Discussion

The overall inferential analysis of the national study data represented an important first step in comprehending the different perceptions of professional stakeholders in Saudi EMS in relation to competency. All professional groups had a positive perspective towards the SPECS model with high agreement ratings. However, many significant differences were identified between different groups. Thus, an interpretation of analyses will be discussed in relation to the key differences in gender, age, qualification, experience, medical discipline and nationality of the participants.

In relation to gender, data collection was completed four days before a royal decree was issued on 26-9-2017 allowing women to drive (24). This provides valuable insight into the perceptions of female EMS providers prior to removal of the driving ban. The significant difference observed in perceptions of professionalism (p = .005) in this instance may be attributed to females not wanting to appear less competent, as they were unable to drive ambulances or other motor vehicles until this time. Therefore, females would have been at an obvious disadvantage to males who were able to perform the dual role of driver and clinical patient care provider. An example of the limited paramedic role as a result of female gender prior to the lifting of the driving ban, is the 10KSA female-only breast cancer awareness charity event held in Saudi Arabia (25). Of the eight paramedics covering the event, only two were female and their role was limited to performing station oversight for controlled narcotic and antiepileptic medications (25). In contrast, the six male paramedics were equipped with three ambulances to respond to patients (25).

Communication differences between genders is also subjective to the Saudi context and patient care. Issues pertaining to eye contact, touching and smiling are all important aspects of quality patient care (26) and, generally, the context of inter-gender communication is complex and multi-layered (27). Moreover, in clinical competency bases there may be limited differences in actual clinical skills between male and female paramedics (28). Nevertheless, there are social differences between men and women in the EMS profession that affect decision-making such as emotional intelligence and extraversion (sociable, assertive, talkative and active) (10, 12, 29). However, the influence of gender on risk preference in decision making is acknowledged to be low (10).

Regarding the differences between age groups in this study, the younger the age group, the higher the mean rank, indicating that younger graduates in general rate core competencies higher than older graduates. Some similarities can be drawn from medicine, where approximately one-fifth of graduates above the age of 30 self-reported an inadequate level of clinical competency, and only 6.2% and 11.9% of graduates aged 25-27 and 28-30 self-reported as inadequate (30). Surprisingly, a near exact opposite was identified by the expert evaluators who were supervising the medical graduates. More than 40% of the 25-27 and 28-30 younger medical graduate age groups were identified as inadequate (30), whilst only 9.7% of the older 30+ age group were identified as inadequate (30).

The statistical analysis indicated a clear split between the post-employment and pre-employment groups. The split between both groups is not only found in Saudi but also in Australia, where university paramedic students can be made to feel unwelcome by post-employment senior paramedics who may perceive them as a threat to their position (31). Generally, certificate holders are perceived to have a higher commitment to an employing EMS organisation (32). Such post-employment commitment can be the result of limited employment mobility in Saudi EMS, as the current Saudi Commission for Health Specialities (SCFHS) system is based on educational qualification (16). The post-employment training model has been phased out in Saudi Arabia, leading to a small percentage (7.3%) representing the certificate group in the study. Regarding the differences between experience groups, the theoretical model developed by Pfeffer (33) supports the results of the statistical analysis by indicating that similarity between age and experience (time of entry) of employees are contributing factors to an increase in integration, cohesion and frequency of communication (34). This is reflected in research which demonstrates that shared attitudes and experiences among employees within similar age groups leads to increased understanding and liking for one another (33). However, other studies have revealed that this can result in isolation between specific age groups characterised by conflict and power struggles (35) and higher rates of voluntary staff resignation, compared to circumstances where there is strong cohesion between different age groups (35). The findings from the current study demonstrate that the rating of communication competency can be affected by providers' age and experience.

In discussing the difference in importance of communication competency between disciplines, it is interesting to note that paramedics have a consistently higher mean rank when compared to physicians and nurses. Generally, paramedics report frustration with other disciplines in emergency departments (ED), where interactions with medical staff are typified by a lack of active listening, underappreciation, disinterest, distraction and, in some cases, not being believed when handing over patients (36, 37). Many solutions have been proposed by different publications, yet the majority agree that standardisation is the key to ensuring an improved handover and communication procedure (36-38).

Statistical analysis of the national study data identified significant differences between the Saudi and Arab nationality groups. The literature to explain these differences in a Saudi EMS context is non-existent and drawing on the scarce international EMS and medical research addressing the differences between immigrant and local health care providers is inappropriate, for two main reasons. First, the labour force in Saudi is made up of expatriate workers and not immigrants (39) and, second, Arabs are linguistically and for the most part religiously comparable to Saudis, with certain cultural and economic differences. Thus, the relationship between Arabs and Saudis cannot be compared, as an example, to relations between English locals and Chinese immigrants. To affirm the second point, in a study by Bozionelos (40) regarding nursing in Saudi Arabia, Saudis were specifically clustered under the Arab group, thereby indicating similarity. However, other Saudi Arabian research addressing either health or demographics specifies Saudis and Arabs as distinct groups (39, 41, 42). Therefore, the difference between Saudis and Arabs is neither well specified nor adequately researched.

This inferential analysis study was part of a larger project aimed at developing a Saudi Arabian EMS core competency framework, which has now been realised. We recommend that researchers interested in investigating EMS, especially in a Saudi context, empirically explore gender, age, qualification, experience, medical discipline, professional role and nationality in relation to EMS competency and practice.

Limitations

It is acknowledged that although this is the first large study to contribute to an understanding of the professional profiles of Saudi EMS, the findings cannot be compared to other similar studies as none have yet been published. The self-reporting nature of the study is another limitation; this approach, however, was the only viable one as a large sample size was important for the statistical analysis.

Conclusion

This study represents the initial step in contextualising the professional stakeholders in Saudi EMS. The perception of an EMS competency framework specifically designed for academic curricula has also been observed from the different perspectives of diverse groups. Thus, the research was able to utilise the large sample in the national study data to explore how participants' professional profiles compare to the confirmed SPECS model factors. This is expected to improve understanding of the current status and paradigms specific to Saudi EMS. Finally, the most noticeable disadvantage of EMS internationally and locally is a lack of research addressing professional, demographic and educational aspects of the profession.

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Conflict of interest

None.

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