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STAKEHOLDER PERCEPTIONS OF INHERENT BARRIERS TO THE POTENTIAL  
IMPLEMENTATION OF ULTRASOUND IN THE PREHOSPITAL SETTING BETWEEN  
THE SAUDI RED CRESCENT AUTHORITY AND THE NATIONAL GUARD  
HOSPITAL

A Dissertation

Submitted to the School of Education

Duquesne University

In partial fulfillment of the requirements for  
the degree of Doctor of Education

By

Maher Abdulrazzaq H Alsulami

December 2020

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Maher Abdulrazzaq H Alsulami

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Maher Abdulrazzaq H Alsulami

Approved October 27, 2020

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## ABSTRACT

# STAKEHOLDER PERCEPTIONS OF INHERENT BARRIERS TO THE POTENTIAL IMPLEMENTATION OF ULTRASOUND IN THE PREHOSPITAL SETTING BETWEEN THE SAUDI RED CRESCENT AUTHORITY AND THE NATIONAL GUARD HOSPITAL

By

Maher Abdulrazzaq H Alsulami

December 2020

Dissertation supervised by Connie M. Moss, Ed.D.

This exploratory study was designed to illuminate both the obstacles and the opportunities inherent in the current medical emergency systems within the kingdom of Saudi Arabia in relation to the possible inclusion of ultrasound machines to assist both Saudi Red Crescent Authority professionals and emergency physicians in the hospital. The research explored the issue of implementing the ultrasound from the perspective of multiple institutions: The Saudi Red Crescent Authority and the National Guard Hospital. The research explored multiple healthcare professionals within both organizations including paramedics, EMTs, emergency doctors and Saudi Red Crescent station administrators. The purpose of this qualitative method study was focused on exploring the possibility to implement the ultrasound device in the ambulance by looking to the potential barriers that the

Saudi Red Crescent might face in the implementation process and putting forth an action plan to overcome these barriers.

The study was guided by the following research question: *What do relevant stakeholders perceive as barriers to the potential introduction and effective use of prehospital ultrasound in the Saudi Red Crescent Authority?* Twenty-four paramedics and EMTs as well as four station administrators from four different Saudi Red Crescent stations in Riyadh city, Kingdom of Saudi Arabia were included in study. The participants also included two emergency doctors within the National Guard Hospital. Paramedics and EMTs participants completed a survey via the survey monkey platform. In addition, the four stations administrators and the two emergency doctors were interviewed in person by the researcher.

The researcher used a general interpretive process of close reading to develop themes from the qualitative data. The thematic coding revealed that the majority of the participants across all stakeholders agreed that cost, education and training were considered to be the main barriers of implementing the ultrasound in the Saudi Red Crescent Authority.

The study concludes with an educational action plan based both on the findings and the application of the theoretical framework.

## DEDICATION

This dissertation is dedicated to my father, Abdulrazzaq, my mother, Jamilah, my brothers, Bander, Waleed, Abdulwali, Rakan, Abdulwahab, and my sisters, Mona, and Bedor. Thank you for your support and guidance through this journey, I would not have done this without your help and support. To my late brother, Abdulwahed, your memory is still living with me forever and this memory has kept me going through difficult times more than anyone can imagine. Your encouragement, personality, vision, traits have inspired me in so many ways. Thank you for being in my life.

To my chair, Dr. Connie Moss, I cannot thank you enough for all the things that you did to teach and inspire me during the past three years. Since I have met you, I knew that we are going to be a great partner and that I am going to learn from you a lot. You listened to my struggles and offered solutions. Thank you, my love.

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Special acknowledgmet to my dissertation committee: Dr. Amy Olson and Dr. Joseph Decrosta who dedicated their time for the sake of this work. Thank you for your encouragement, guidance and feedback. Your insights and expertise helped and inspired me.



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## **Chapter 1: Moving from a Problem to a Problem of Practice**

This study examines a proposed initiative to incorporate prehospital ultrasound within the current structure of the Saudi Red Crescent Authority (SRCA). The Saudi Red Crescent Authority (SRCA) is a government entity of the Kingdom of Saudi Arabia. Its mission is to provide excellent emergency services across Saudi Arabia. SRCA has medical equipment, trained staff, and other facilities necessary to handle emergency incidents. Al Mutairi et al. (2016) stated that as of 2015 SRCA had close to 1058 ambulances across the entire country in order to handle various emergencies with staff around 6754 including administrators and EMS technicians. The study also stated that the SRCA's operations are funded either from the government or from private contributions. In 2009, the budget of the Saudi Red Crescent was 373 Million US dollars, and it increased in 2010 to 433 Million US dollars (Al Mutairi et al., 2016).

SRCA operates within a unique cultural, political, topographical and cultural context that contribute to the barriers to and the supports for advancements in emergency medical treatment options. SRCA ambulances, like those in other countries noted in the following literature review, are not currently equipped with ultrasound machines. "Ultrasound is a form of medical imaging that is portable, non-invasive, painless, and does not expose the patient to ionizing radiation. With proper training and education, prehospital providers can use ultrasound to obtain immediate anatomical, diagnostic, and functional information on their patients" (Taylor, McLaughlin, McRae, Lang, & Anton, 2014). The study explores the needs, issues, and barriers associated with such an initiative within the unique contexts of Saudi Arabia. And, while there are financial, policy, and religious issues that will come into play, this study focuses on the perceptions and learning needs of three sets of stakeholders: SRCA station administrators, the paramedics and

EMTs who will potentially use the ultrasound equipment as a team in the ambulance, and the emergency room physicians at the National Guard Hospital who will receive the patients transported by the ambulance. These physicians have both clinical and administrative duties in the National Guard Hospital.

### **Nature of the Problem**

The Kingdom of Saudi Arabia is the largest country in the region and covers about 4/5 of the area of the Arabian Peninsula, or 2,149,690 square kilometers. It's hospitals universities, and emergency ambulance services continue to advance, but have not established systems for collaborating with each other. The researcher is familiar with these systems having served as a volunteer paramedic in SRCA from 2012 to 2014. He is currently on leave from King Saud bin Abdul-Aziz University for Health Sciences, where he serves as a teaching assistant in the Emergency Medical Service Program at the university. The researcher has witnessed first-hand obstacles of terrain, professional belief systems, politics, and situations of mistrust inherent within the ambulance team and between the ambulance personnel and hospital personnel. This exploratory study was designed to illuminate both the obstacles and the opportunities inherent in the current medical emergency systems within the kingdom in relation to the possible inclusion of ultrasound machines to assist both SRCA professionals and emergency physicians in the hospital.

### **The Goal of the Study**

The goal of the study is to produce an educational action plan based on the perceived needs, barriers, and reported self-confidence of specific stakeholders (paramedics, EMTs, emergency room physicians, and hospital emergency room administrators) in their own abilities

to successfully employ the ultrasound diagnostic tool and effectively interpret and efficiently use data collected as individuals and as a highly efficient medical team. It is hypothesized that issues of trust between physicians and members of the Red Crescent Authority will come in to play along with issues of trust within the ambulance team that involves paramedics and EMTs.

### **The Theoretical Frameworks of the Study**

The study will not only address the medical importance and the application of the ultrasound, it also has an important educational lens. The educational lens is later on explained in the action plan where it lays out a 3-year educational plan to teach the paramedics and the EMTs about the knowledge and skills of the ultrasound machines. In addition, the study incorporated social theories to examine the perceived barriers of implementing the ultrasound as well as creating an action plan. Also, it investigates issues of confidence, bias, trust and perceived confidence the study employs a theoretical framework that combines elements of self-efficacy, collective efficacy, self-regulation, and self-assessment to both examine social cognitive issues of individuals and groups and design an educational plan. The plan was created using data from the study to propose ways to address areas of specific knowledge, gaps in understanding and skill. In addition, the action plan was designed to increase the potential for increased self and collective efficacy among stakeholders to foster dispositions to monitor and adjust on the job performance as part of an intentional effort of collaborative inquiry and ongoing improvement.

## **Chapter 2: Review of Knowledge for Action**

The following review of actionable knowledge provides the context for the study, and reviews the theoretical and empirical literature related to the following research question: What do relevant stakeholders perceive as barriers to the potential introduction and effective use of prehospital ultrasound in the Saudi Red Crescent Authority?

This study examines a proposed initiative to incorporate prehospital ultrasound within the current structure of the Saudi Red Crescent Authority (SRCA). “Ultrasound is a form of medical imaging that is portable, non-invasive, painless, and does not expose the patient to ionizing radiation. With proper training and education, prehospital providers can use ultrasound to obtain immediate anatomical, diagnostic, and functional information on their patients” (Taylor et al., 2014). The study explores the needs, issues and barriers associated with such an initiative within the unique contexts of Saudi Arabia. The literature review begins by tracing the origins of the SRCA and the influence of Islam in crafting the Emergency Medical Services (EMS) in the Kingdom of Saudi Arabia.

The Saudi Red Crescent Authority is a government-based organization that is focused on emergency medical services in the prehospital setting to ensure medical and non-medical patients will be treated and transferred to the nearest hospital. To better understand the origins of the Saudi Red Crescent Authority (SRCA), it is important to understand the country and the religious context of Saudi Arabia and its impact on medical care in Saudi Arabia.

### **Kingdom of Saudi Arabia**

Saudi Arabia is a country in Asian continent. It is specifically located in the southwestern part of the continent. The kingdom is boarded by the countries of the United Arab Emirates,

Qatar, and the Arabian Gulf on the east. On the west, the country is bordered by the Red Sea. Oman and Yemen are found on the southern part of Saudi Arabia, while Kuwait, Jordan, and Iraq are found in the northern Region. The Kingdom of Saudi Arabia is the largest country in the region and covers about 4/5 of the area of the Arabian Peninsula, or 2,149,690 square kilometers. The population of the Kingdom was estimated to be around 34.14 million people in 2019 and ranks it as 41st in the world. Given the population and the total surface area of the country, the Kingdom has a population density of about 15.61 individuals per square kilometer. Riyadh, the capital of the Kingdom of Saudi Arabia and also the largest city in the kingdom, is populated by over 7 million people. As such, Riyadh accounts for 22% of the population of the entire Kingdom. What's more the population of Saudi Arabia has a growth rate of 1.49% according to the 2014 census. This is the 80th highest growth rate in the world. The population is divided by age groups with the 0 to 14 age group representing 32.4% of the Kingdom's population. The middle age group of 15 to 64 makes up 64.8% and the 65+ age group comprises only 2.8% of the total population. It is interesting to note that the current median age in Saudi Arabia is 27.5 years and life expectancy is 75.5 years. This life expectancy has increased due to improved drinking water and sanitation facility access. In addition, country currently spends 4.7% of its GDP on health care resulting in 2.57 physicians per 1,000 Saudi citizens and 2.7 hospital beds available per 1,000 residents. While approximately 9 million non-Saudi citizens currently live and work in the country, the Kingdom of Saudi Arabia does not provide residency for foreigners. Foreigners are only given visas for a specific period of time and must leave when the visa expires or is not renewed (World Population Review, 2019).

The country plays an important economic role in oil production and produces more than 10 million barrels of oil per day that it shares with the rest of the world. In the recent past, the

government of Saudi Arabia paid great attention to the healthcare sector and education. The kingdom has 29 public and 12 private universities.

Saudi Arabia was founded by King Abdul-Aziz bin Abdulrahman Al Saud in 1932 with Riyadh city as its capital. Islamic laws are used for legislation. The country does not have a written constitution. The king performs the responsibility of the executive, judiciary, and legislative power. He also acts as the prime minister and supervises the activities of all the ministers.

For administrative purposes, the kingdom is sub-divided into a total of 13 administrative units. Each unit is divided further into governorates. Regional governors who are appointed by the king are given the task of administrating the Emirates. These governors use several councils to carry out functions involving finances, education, health, and agriculture. Saudi Arabia has a distinctive and significant religious identity with the cities of Makkah and Medina city serving as the two-sacred cities in the kingdom and occupying an important place in the heart of the Muslim world.

### **The Religious Context of Saudi Arabia**

There is no certified census of religion in the Kingdom of Saudi Arabia but there is evidence that the country is 93% Muslim (Pew Research Center, 2019). Saudi Arabia is home to two of the Islam's holiest cities: Mecca, where the Prophet Muhammad was born, and Medina, where the Prophet is buried. The country is home to the Grand and the Prophet's mosque that are referred to as the two holiest places of worship for Muslim people across the world. The Grand Mosque is located in Mecca while the Prophet Mohammed Mosque is located in Medina, two cities in Saudi Arabia. The mosques and their locations are central to the Islamic faith because of their religious significance, the mosques attract the Muslims who are required to visit at least

once in their lifetime. With nearly two billion Muslims in the world, Saudi Arabia has a history of providing services for millions of pilgrims each year as they make their way to the mosque. The Grand Mosque hosts the two major pilgrimages: Umrah and Hajj. Hajj is an annual visit of the Muslim faithful who are required to undertake the pilgrimage based on their ability. The holy trip to the Grand Mosque is undertaken during the last month of the Islamic calendar. During the pilgrimage believers perform certain rites that include the Ihram which is used for purifying oneself. Then, believers perform the ritual Tawaf in which a person walks around the Kaaba in a counterclockwise direction seven times. The Kaaba is considered the most sacred place for the Muslims. In addition, pilgrims are required to track seven times in the middle of the mountains of Al-Safa and Al-Marwah. Other rites include undertaking a vigil in mount Arafat, stoning the devil, and the rite of animal sacrifice which is performed during the tenth day of the pilgrimage. In contrast, Umrah is a pilgrimage that is undertaken by the Muslim faithful in any other time of the year. Unlike the Hajj, Umrah is not mandatory and it is not one of the Islamic pillars.

### **The Origin of the Saudi Red Crescent Authority (SRCA)**

Recognizing that Saudi Arabia was the pilgrimage destination for the Muslims all over the world, the leaders of the country saw the need to establish an emergency medical services by creating a charity organization that will focus on treating the pilgrims and transfer them to the hospital. The creation of the emergency medical services in the country was purposefully intended to facilitate the pilgrims visiting the country's two holy mosques.

In 1934, the National Ambulance Health Association (NAHA) was created, and the first ambulatory service center was established at the gate of the Grand Mosque in Mecca. The association was responsible to treat the injured, sick hajjis and transfer them to the only hospital in Mecca for first aid services. The function of the ambulance services was at first handled by the

Public Health Ambulance Authority which was responsible to offer emergency services to the pilgrims visiting Mecca and Medina cities. However, the formation of the NAHA coincided with the Saudi-Yemen War of 1934. Given the demands of the hajj and the need to provide emergency services to the military personnel, the public health ambulance service was quickly overwhelmed.

Following the Saudi -Yemen war, the pre-hospital emergency services were once again limited to Mecca and Medina and were undertaken under the charitable and private initiatives supported by the Charitable Relief Society (AlShammari, Jennings, & Williams, 2017). The government of King Abdul-Aziz bin Abdurrahman Al-Faisal Al-Saud prioritized the safety of the visitors and contributed immensely to the establishment of the EMS in the Kingdom. The reason for the establishment of the EMS was the desire of the Saudi government to facilitate the pilgrimages of the elderly and those with ill health so they could take part in the hajj in equal measure with pilgrims of good health (SRCA, n.d). After the Second World War, the income of the private and charitable organizations in Saudi Arabia was drastically reduced. In particular, the reduced donation resulting from the poor economy curtailed the ambulatory service provision by the Charitable Relief Society (CRS). As a result, it fell to the government to provide most of the emergency services. Because of the curtailed economy and the increased role of the government. In 1963, King Faisal issued a royal decree that converted the Charitable Relief Society (CRS) from a charitable and private organization to a public institution. This institution was given the name of Saudi Red Crescent Association. In 2008, the institution was renamed by a royal decree as the Saudi Red Crescent Authority (AlShammari et al., 2017). The Saudi Red Crescent is a government entity where they fund their operations either from the government or from private contributions. In 2009, the budget of the Saudi Red Crescent was 373 Million US



dollars, and it increased in 2010 to 433 Million US dollars. The increase in the cost was because of the operating expenses (Al Mutairi et al., 2016)

SRCA was established based on the principles of the Geneva Agreements and the rules of the Red Cross and Red Crescent Conventions. In 1949, The Geneva agreement was established and adopted by all nations around the world. The purpose of the agreement is to rescue the victims of armed conflict and preserve the safety of medical personnel without intervening in the conflict. In 2005, an additional agreement was set to ensure the safety of prisoners, civilians, medical personnel and wounded military personnel (Red Cross, 2011). The Saudi Red Crescent Authority is a public institution with a wide range of missions and roles. The main mission of the body is to provide highly effective and efficient prehospital emergency services to the citizens of the country, the expatriates, and the pilgrims. To fulfill its mission of providing excellent emergency services, the SRCA has the medical equipment, trained staff, and other facilities necessary to handle emergency incidents. For example, in 2018 SRCA has close to 2000 ambulances across the entire country to handle any sort of emergency along with paramedic's staff who are able to stabilize the emergency victims before they are taken to the hospital.

A second objective of the SRCA is to create health awareness amongst the people in Saudi Arabia. To address this objective, the SRCA establishes awareness through the training it offers to its employees and the general public. Apart from the training, the SRCA sensitizes the people through other means including its website, newsletters, and the use of general media. Through its website, the authority shares awareness images and videos which provide useful and relevant information on how different emergencies are addressed. For example, in their official website, they provide pictorial awareness information on the correct way to handle an emergency

after a car accident. The website also contains several videos on responding to heart attacks, chemical poisoning, airway obstruction, and epilepsy amongst many other relevant videos. In addition to offering information on its website, the SRCA convenes several events, meetings, and seminars which are purposefully utilized to train the staff or interested members of the public on medical emergency services. Additionally, the SRCA disseminates information to the public through the use of frequent newsletters. Finally, awareness creation is achieved through targeted collaboration with the media to cover the national and international news of the SRCA services (Hamam, Bagis, AlJohani, & Tashkandi, 2015).

Furthermore, the SRCA takes part in the activities of relief provisions both in Saudi Arabia and also outside the country. In fact, the authority has a role in the humanitarian and relief services they offer in areas where their aid is required. For example, the SRCA has been taking part in distributing donated foods and other materials in Syria (Arab News, 2012). Similarly, it has an established agreement with the United Nations Refugee Agency (UNHCR) with the main aim of strengthening joint implementation of the humanitarian projects (Genderen, 2007).

Importantly, the SRCA is specifically dedicated to providing EMS that are in accordance with the Islamic faith, teachings, values, and statutes. For example, female victims who are practicing the Islamic faith may not wish to be handled by a male medical or EMS personnel who are not family members in accordance with the Muslim faith. In such instances, the SRCA ensures that its staff is well informed in the manner in which they are required to observe the Islamic values and beliefs when offering emergency services to females. SRCA serves its mission through its psychological support unit that provides psychological services to both Saudi Arabians and also foreigners in the country (Alzahrani, Bakhamis, & Al-Surimi, 2017).

The two holy mosques in Mecca and Medina rely heavily on the services offered by the Saudi Red Crescent Authority (SRCA) to handle the emergencies that naturally arise from such a massive group of people. For example, in August 2018, the SRCA prepared for the Hajj with close to 3000 staff and 100 emergency centers. The SRCA offered emergency services in the Grand Mosque and all the other sacred sites where the pilgrims visited in the course of their stay in Saudi Arabia. In addition, close to twenty emergency centers were set up in Medina to serve the pilgrims who visited the Prophet's Mosque (Arab News, 2018).

According to Ganjeh and Einollahi (2015) at least 2,431 died in Mina during the Hajj season and 400 were missing due to overcrowd. There was a debate in whether the Saudi authorities were not prepared to handle Mina disaster in terms of crowd routing and emergency services. Keith Still a professor at Manchester University explained that the cause behind Mina incident was due to progressive crowd collapse, heat stroke and dehydration. The article recommended more investigation to be conducted due to lack of public transparency of the incident. It also, recommend better crowd routing, evacuation and treatment of the injured must be implemented which reflect a lack of the Saudi Red crescent effective intervention (Ganjeh & Einollahi, 2015).

### **Saudi Red Crescent Authority Statistics**

The Saudi Red Crescent Authority provides useful data and information about their personnel and their emergency capabilities including first aid centers and ambulances fleet as well as number of cases that were managed by the Red Crescent across the kingdom regions. These data are displayed in two websites: The General Authority for Statistics and the Saudi Open Data Portal.

Figure 2.1 reveals the number of ambulances and first aid centers that the Saudi Red Crescent Authority had across the kingdom from the period of 2011 to 2015. The figure also reveals that in 2011, the Saudi Red Crescent had 1572 emergency vehicles compared to 1965 in 2015—an increase of 393 vehicles. Moreover, The Saudi Red Crescent Center had 284 emergency centers in 2011 compared to 384 in 2015 (Saudi Red Crescent Authority, 2017).

Figure 2,2 explain the number of cases that were offered first aid treatment and carried out by the Saudi Red Crescent ambulances across the kingdom regions. In Mecca city there were 78953 emergency cases that were handled by the Red Crescent where Madinah city had 30629 emergency cases in 2015. The data displayed in figure 2.2 suggest that the EMS cases handled by the SRCA have been increasing on yearly basis (“Cases Offered First Aid,”2016).

To fulfill its mandates and achieve its objectives, the SRCA employs staff in excess of 8000 healthcare professionals including physicians, healthcare assistant, administrators, pharmacists, paramedics and EMTs. As depicted in figure 2.3, a breakdown of all numbers of healthcare professionals working in the Saudi Red Crescent Authority from 2011 to 2015 (“Personnel in SRCA,”2016).

Figure 2.4 explain the total services that were offered by the Saudi Red Crescent around the kingdom and were dependent on the service type. The figure is divided by the year that these cases occurred starting from 2009 to 2013. In 2009, there are 179070 patients that were transferred to the hospital where 28011 patients refused treatment. In 2013, 234792 patients were transferred to the hospital where 47254 patients refused treatment (“Services offered by SRCA,” 2016). In the Saudi Red Crescent Authority, women cannot officially work as paramedics, yet they volunteer to take care of the pilgrims visiting Medina and Mecca and offers basic

emergency medical services. According to the Saudi Gazette, Medina alone have 1150 women volunteers every year (Al-Sharif, 2018).

*Figure 2.1 Saudi Red Crescent Authority (SRCA)'s First Aid Centers & Ambulances 2011 -2015*

Years	No. of Ambulances and Service Vehicles	NO. of First Aid Centers
1432 (2011)	1572	284
1433 (2012)	1663	297
1434 (2013)	1463	328
1435 (2014)	1963	360
1436 (2015)	1965	384

*Note Adapted from "Saudi Red Crescent Authority (SRCA)'s First Aid Centers & Ambulances" by Saudi Red Crescent Authority., (2016, December,18) retrieved from <https://www.stats.gov.sa/en/3380>*

*Figure 2.2 Cases Offered First Aid and Carried by SRCA Ambulances by Region 2011 - 2015*

Region	1436 (2015)	1435 (2014)	1434 (2013)	1433 (2012)	1432 (2011)
Riyadh	53851	49813	49447	47634	42642
Makkah	78953	76812	67650	61987	58467
Madinah	30629	24366	23435	22681	22623
Al-Qassim	15664	12993	13125	12388	11230
Eastern	33753	31991	29483	26977	25577
Aseer	19130	17036	15925	15475	14289
Tabouk	10011	8890	9137	8478	7962

Hael	6446	5650	5360	4803	4663
Northern Borders	3529	3335	2768	2550	2501
Jazan	11351	8572	7398	7247	7347
Najran	3862	3178	3105	3195	2863
Al- Baaha	5793	5200	4525	4270	3859
Al- Jowf	4306	4301	3434	2953	3160
Total	277278	252137	234792	220638	207183

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*Note. Adapted from "Cases Offered First Aid and Carried by SRCA Ambulances by Region", by Saudi Red Crescent Authority., (2016, December18). Retrieved from <https://www.stats.gov.sa/en/3374>*

Figure 2.3 Personnel in the Saudi Red Crescent Authority by Profession 2011 -2015

Total	Profession						Years
	Laborers and Office attendants	Health Asst	Pharmacists& Assistants	Physicians	Administrators	Technicians & Specialist	
4775	825	750	4	86	618	2492	1432
5906	653	754	3	86	850	3560	1433
6158	751	738	3	86	847	3733	1434
6787	731	653	3	161	856	4383	1435
8028	717	767	2	62	972	5508	1436

Note. Adapted from "Personnel in the Saudi Red Crescent Authority by Profession", by Saudi Red Crescent Authority., (2016, December 18). Retrieved from <https://www.stats.gov.sa/en/3377>

Figure 2.4 Total Services in the Kingdom Classified by the Type of Service 1430 - 1434 A.H. (2009-2011)

Years	Carried Cases	Refuse Treatment	Non-Rescue Cases	Treated at Location	Not Reach the Scene	Other Causes	Total
1430 AH (2009)	179070	28011	6300	15782	1528	20901	251592
1431 AH (2010)	200409	36593	5150	15025	1312	21321	279810
1432 AH (2011)	207183	42390	4415	14077	1225	22337	291627
1433 AH (2012)	220638	51019	6176	18073	1378	22243	319527
1434 AH (2013)	234792	47254	6240	25969	1596	18480	334331

Note. Adapted from "SRCA Total Services in the Kingdom Classified by the Type of Service", by Saudi Red Crescent Authority., (2016, May 27). Retrieved from <https://data.gov.sa/Data/en/dataset/services-offered-by-srca-classified-by-the-type-of-service>

## **Trauma in Saudi Arabia**

Traffic accidents are considered to be the third cause of mortality in Saudi Arabia due to the speeds that are common. Road traffic accidents cost the kingdom more than 7 billion dollars each year or more than 16% of the country's health services budget (Alghnam et al., 2017). As it depicted in Figure 2.5, the Ministry of Interior- General Directorate of Traffic reported that in 2015, more than 518795 accidents both inside and outside the city were recorded in Saudi Arabia (Traffic Accidents Site by Region, 2016). In addition, a report from the interior ministry of Saudi Arabia indicate that by August of 2018 a total of 7000 people had died as a result of road crashes. That is an average of 20 people killed on the road on daily basis. The data also show that 30% of the accidents occur in cities while the rest take place in the rural areas (Lemon, 2017). According to Al-Naami, Arafah, and Al-Ibrahim (2010), the population of Saudi Arabia is not only undergoing tremendous growth but also that growth is accompanied by most families getting access to motor vehicles. Thus, the number of vehicles on the road has sharply increased. At the same time, inexperienced and young drivers have become more frequent on the roads. For that reason, road crash accidents traumas in Saudi Arabia has been on the rise. And, the researchers pointed out that road traffic accidents have terrific socioeconomic and psychological impacts on the victims who survive as well as on their family members. The economic cost of road accident traumas is hard to estimate as it entails rehabilitation costs, medical expenses, and even the productivity lost by the victim (Al-Naami, Arafah, & Al-Ibrahim, 2010).



Figure 2.5 Traffic Accidents Site by Region for Year 1436 A.H. (2015)

Region	Total	Outside the City		Inside the City	
		p.c .	No. Of Accidents	p.c .	No. of Accidents
Makkah	126537	22.28%	23930	24.94%	102607
Madinah	19058	6.44%	6921	2.95%	12137
Al-Qasim	24273	9.29%	9978	3.47%	14295
Eastern	88065	18.42%	19785	16.60%	68280
Aseer	32163	12.44%	13357	4.57%	18806
Tabouk	20638	3.46%	3714	4.11%	16924
Hael	8415	2.83%	3037	1.31%	5378
Northern Borders	13076	1.69%	1816	2.74%	11260
Jazan	22229	11.67%	12529	2.36%	9700
Najran	3220	1.15%	1231	0.48%	1989
Al-Baaha	4166	1.01%	1087	0.75%	3079
Al-Jowf	9387	1.32%	1419	1.94%	7968
Total	518795	100%	107398	100%	411397

Note. Adapted from "Traffic Accidents Site by Region", by Ministry of Interior-General Directorate of Traffic., (2016, December 26). Retrieved from <https://www.stats.gov.sa/en/3465>

Accordingly, the traumas and casualties produced by driving accidents in the country are exacerbated by prolonged ambulance response time (ART) to certain portions of the Kingdom. Alnemer et al, (2016) indicate that the ambulance response time in Saudi Arabia averages 13 minutes which exceeds the international standard of eight minutes. Because of this prolonged ambulance response time, the general public often choose to transport trauma victims in their private vehicles rather than use the ambulance services. According to Alshahrani (2017), a retrospective study done in Saudi Arabia investigated the effect of private non-EMS versus emergency medical transportation on victims of traffic accidents in terms of mortality and length of hospital stay. The researcher used medical records to examine the 308 trauma patients from

2008 to 2012. Two hundred thirty-two out of 308 trauma patients were transferred by emergency medical providers and 76 through private non-EMS. The study concluded that there is no difference between the two groups in terms of mortality and length of stay in the hospital (Alshahrani, 2017). This finding reflects the dysfunction of the emergency medical services in Saudi Arabia in their assessment, intervention, and transportation of the trauma patients.

The Saudi Red Crescent Authority (SRCA) staff is undermined by the attacks directed at the emergency response workers. In this case, Alharthy et al. (2017) embarked on a research study to explore the workplace violence which the EMS workers experience. Out of the total of 370 EMS staff surveyed, 65% of them agreed that they had encountered violence when handling emergency situations. The survey results indicated that 80% of the attacks were perpetrated by the relatives of the victims followed by the patients themselves at 51%. The majority of the attacks (61%) were verbal assaults. These findings are supported by the results of a research study by El-Gilani, El-Wehady, and Amr (2010) which was conducted in Al-Hassa. The study concluded that 28% of the primary healthcare employees had faced violence from the victims or their family members in at least a single instance in the course of discharging their duties and responsibility. Though this research was not focused on the EMS workers, it points to a trend that the general healthcare workers in Saudi Arabia are being undermined by the attacks emanating from the victims or their family members (El-Gilany, El-Wehady, & Amr, 2010). These attacks raise a very disturbing question about the possible link between insufficient emergency medical services and the increased number of attacks against emergency workers.

## **The Evolution of Emergency Medical Services**

Emergency medical services is a structured system that is responsible to treat and transport medical and non- medical patients to the hospital. In 1794, Baron Dominique and Jean Larrey noted during the French revolution that injured soldiers dies in the battlefield if they did not receive medical intervention consequently, they organized a system where medical personnel intervene and transfer the soldier to the hospital (Pozner, Zane, Nelson, & Levine, 2004). This idea that emerged from Baron and Jean helped create a well-organized system that is now considered to be the first vital contact to the patients outside the hospital. Manish (2006) stated that the development of the emergency medical services in the United States, started to grow quickly. between 1960 and 1973 due to medical, historic and social powers. Many emergency medical services were invented and were trained by the Red Cross and the American Heart Association in order to use pharmaceutical therapies, cardiopulmonary resuscitation, defibrillation and cardioversion (Shah, 2006). Prehospital care refers to the emergency service given to patients before they arrive at the hospital or healthcare facility for comprehensive medical attention. In essence, prehospital care offers first and resuscitation aid that may stabilize victims before they are taken to the hospital. In view of that. An effective prehospital system will assist emergency providers to deliver efficient and effective intervention to patients in the prehospital setting. One of the roles the SRCA offering is prehospital care to the victims. According to the job descriptions posted by the SRCA to recruit EMS staff, experience in prehospital care is needed (Ems1.com, 2009). In essence, the SRCA prioritizes the prehospital care as the major part of the emergency services. On the other hand, part of the prehospital setting may include the location where the victims are placed just after they are rescued by the EMS. In particular, an effective prehospital setting is one that places the victims in an

environment with limited risk factors. It follows then that the environment of the ambulance used to ferry victims to the hospital is crucial part of the prehospital setting. Thus, it is important that ambulances possess the capability of providing an appropriate environment for the victim (Pepe & Stewart, 1986).

### **History and Current Application of Ultrasound in the Pre-Hospital Setting**

“Ultrasound is a form of medical imaging that is portable, non-invasive and does not expose the patient to ionizing radiation. Healthcare providers who use the ultrasound are able to obtain immediate anatomical, diagnostic, and functional information on their patients” (Taylor et al, 2014). Medical ultrasound is the term used to refer to the diagnostic imaging technique that is based on the use of ultrasound waves and is performed by ultrasound machines. The technique involves creating an image of internal body organs and structure such as muscles, blood vessels, tendons, and joints. The main aim of doing this is to identify the source of a certain disease or exclude pathology in the specific organ or structure (Taylor, et al., 2014).

Ultrasound is sound waves have frequencies higher than what human beings can perceive. Ultrasonic images are formed when echoes of ultrasound pulses are reflected from different tissues. The most type of image that is formed is the 2-D Cross-sectional B- mode image. In some instances, the 3-D images can also be formed to display motion in a tissue, blood flow, or anatomy of as structure. Pierre Curie, a French physicist, discovered that ultrasound could be generated for an industry in 1880. An American called Floyd Firestone built on this discovery and started to use ultrasound to detect internal defect in metal castings in 1940. The first attempt to echo human body organs was done in 1941 by Theo Dussik. Dr. Ludwig was the

first person to apply ultrasound for medical purposes in the late 1940s. Subsequent developments have improved the technology to make it simple and better (Tsung, 2015).

Ultrasound imaging is a preferred method in many cases because it provides real-time images to any existing pathology inside the human body. Ultrasound machines are portable, cheap, and does not use harmful ionizing radiation like other imaging machines. However, its success depends on patient's cooperation and the presence of a skilled operator.

Ultrasound has a wide range of applications in the area of anesthesiology, cardiology, pulmonology, and obstetrics. In emergency medicine, ultrasound use to assess pericardium tamponade and hemoperitoneum in case of trauma. It can also be utilized in differentiating the abdominal pain caused by kidney and gallbladder stones among other uses.

In the United States, emergency departments have used the ultrasound in their practices including the practices of non-radiologist personnel. Physicians around the world use a bedside ultrasound in order to uncover clinical questions that make patient diagnosis more accurate in time sensitive emergency cases. Moreover, physicians and non-physicians in the United States and Europe use ultrasound equipment in their emergency rooms. The massive growth in the use of the ultrasound in the emergency department has come about because of advances in the technology that made these devices more portable, accurate and lightweight (El Sayed & Zaghrini, 2013).

Rippey and Royse (2009) examined the history of the ultrasound in major trauma and its application in the pre-hospital setting. The researchers found that technology helped bring the ultrasound equipment outside the emergency room due to increasingly small, portable devices and more affordable ultrasound machines. In 1980, Germany became the first country to study and use the ultrasound in the trauma assessment. These studies were ignored by the United

States, Britain, and Australia due to the language barrier. In 1990, a huge increase of interest into the use of ultrasound machines to reveal solid organ injury in trauma such as haemoperitoneum and haemopericardium (Nelson, Melnick, & Li, 2011). Even with this increased interest, the use of ultrasounds was hampered by limitations such as problems that occurred when the ultrasound was used by poorly trained and inexperienced operators as well as conditions of specific patients, such as obesity that interfered with the ability of the machines to produce an accurate image.

In 1995, Rozycki invented Focused Assessment with Sonography for Trauma (FAST). The purpose of this ultrasound exam is to identify if patients are suffering from abdominal bleeding. In addition, Extended Focused Assessment with Sonography for Trauma (EFAST) is an ultrasound exam that checks for any bleeding in the chest as well as the heart. Rippey and Royse (2009) could find no conclusive evidence that the use of the ultrasound improved patient survival. They supported this conclusion by identifying factors that contributed to the accuracy of the ultrasound imaging which are inclusion criteria, equipment, techniques used and the experience of the operator. For example, an experienced operator can conduct an accurate FAST exam in less than 3 minutes. The researchers highlighted the importance of training paramedics to perform the ultrasound but questioned the exact amount of training required since there were no conclusive findings to suggest what type and length of training produced operators who could dependably produce accurate and speedy readings.

Another study examined the factors that prevented the use of the ultrasound outside the radiology department such as cost, bulk, and steep learning curves. But the research pointed out that with technology advances, lightweight portable ultrasounds are possible to deploy outside the hospital. The main purpose of deploying the ultrasound in the prehospital setting is to increase diagnostic accuracy. The study concluded that using a lightweight portable ultrasound in

the prehospital setting shows great potential for increasing clinical assessment for medical professionals in the field. It also recommended that further research is necessary to determine the benefit of using the prehospital ultrasound in medical illness (Nelson et al., 2011). Also, prehospital ultrasound increases the accuracy of diagnosis which is a very important factor in patient care in the pre-hospital setting.

### **Paramedics' Capability of Obtaining Pre-Hospital Ultrasound Imaging**

“A Paramedic is a health professional who provides rapid response, emergency medical assessment, treatment, and care in the out-of-hospital environment” (Paramedicine Role Descriptions, n.d.). A study was conducted to examine the use of the prehospital ultrasound by paramedics in the field in order to determine if the paramedics were effective in obtaining the ultrasound imaging correctly. It also, examined paramedics' ability to determine cardiac activity by using the ultrasound. The researchers selected a sample of paramedics who had no ultrasound experience. These paramedics were selected to participate in a 3-hour session on prehospital ultrasound that included hands on experience with the machine followed up further experiences for paramedics to use the ultrasound in the prehospital setting and learning to save the scan for further investigations. 89% of paramedics who participated in the study were able to obtain cardiac images by using the ultrasound and 100% were able to distinguish between cardiac activity and standstill. The researchers concluded that the paramedics were effective on using the ultrasound to obtain cardiac images despite minimum training. They were able to correctly diagnose and interpret cardiac activity on cardiac arrest patients. Based on their findings, the researchers recommend a large-scale clinical trial to determine the effectiveness of using the ultrasound to diagnose patients with cardiac complains (Rooney et al., 2016).

Heegaard et al. (2010) examined if paramedics could effectively interpret the ultrasound images of patients with abdominal bleeding (FAST) and abdominal aortic exam after a 6-hour training program. The main objective of this study was to determine if paramedics from busy emergency departments could effectively perform ultrasounds in the ambulance. Two emergency medical agencies participated in the ultrasound training where paramedics collected the ultrasound images. Consequently, these scans were reviewed by the emergency sonographer physicians (OPs). This observational study examined the use of prehospital ultrasound and its role in clinical decision-making process. The field study was conducted in two emergency departments in Minneapolis and Minnesota. 40 paramedics participated in the study and were trained by using lecture, pre-post written examination and Objective Structured Clinical Examination (OSCE) format. The study began in January 1, 2008 and concluded on year later in January 1, 2009. During that year, a total of 104 patients received ultrasound intervention. Additionally, during that year, refresher courses for the paramedics were conducted on two separate occasions after 3 and 8 months from the beginning of the study to ensure effective information retention of ultrasound (US) knowledge. During the study, 20 abdominal aortic exams were performed in the field and came back negative and 84 Focused Assessment Sonography in Trauma (FAST) exams were conducted by paramedics that resulted in 6 positive exams, 70 negative and 8 inadequate exams. The researchers concluded that paramedics could achieve a high level of accuracy in performing the abdominal aortic (AA) FAST examination in the ambulance.



## **Prehospital Ultrasound Versus Survival Rate**

Many studies have been done to determine the effect of using prehospital ultrasound on the potential for increased survival rates among trauma patients. Byhahn, Bingold, Zwissler, Maier, and Walcher (2008) examined the use of prehospital ultrasound on a pregnant woman who suffered stabbing wounds and was found in an unstable condition. The use of the ultrasound helped to diagnose the patient with pericardial tamponade after she suffered a cardiac arrest on the scene. Cardiac tamponade is the leading cause of mortality in blunt and penetrating trauma and is very difficult to diagnose it in the prehospital setting without diagnostic tools such as ultrasounds. The point of using the ultrasound in the prehospital setting is to diagnose any abdominal bleeding that could be missed if paramedics relied only on the clinical findings. This study pointed out that if paramedics only relied on the clinical findings such as distended neck vein which was not obvious due to her hemorrhagic shock, they will not be able to diagnose the patient. The pregnant patient survived her wounds without neurological deficit, but her baby died due to prematurity. The study concluded that the handheld, portable ultrasound was able to effectively diagnose the patient in a timely manner and was able to uncover the main cause for her cardiac arrest.

Gillman, Ball, Panebianco, Al-Kadi, and Kirkpatrick (2009) reviewed exciting medical literature about the ultrasound and its role in the assessment of trauma patients. They report that traumatic injuries are the leading cause of death in most developed countries. The researchers suggest that the introduction of the Focused Assessment Sonography in Trauma (FAST) ultrasound technique has advanced to a higher level and the care of trauma patients has improved. Most importantly, the researchers discovered that there is a 'golden hour' for all trauma patients where the damages are recognized and treated at the early stages preventing

unnecessary deaths of patients. The authors call upon the EPs to conduct prompt assessments on trauma patients for the purpose of identifying the presence of peritoneal or pericardial fluid. As a result, they believe the ultrasound should not just be understood as a diagnostic test but also a physical exam. In this context, researchers explored the advantages and disadvantages of incorporating resuscitative ultrasound to all assessments of trauma patients. The study concludes that traumatic injuries are a global burden to all countries and that the ultrasound offers invaluable information that adds additional knowledge to the physical examination of patients.

Rudolph, Sørensen, Svane, Hesselfeldt, and Steinmetz (2014) did a systemic review to determine if utilizing pre-hospital ultrasound improved the medical outcomes of patients suffering from non-traumatic conditions. This study was stimulated by the fact that there has been great advancement in technology that has made prehospital ultrasound examinations readily available. In fact, there has been an increase in the usage of ultrasound imaging away from the hospital. Therefore, the researchers sought to investigate if the increased use of prehospital ultrasound translated into improved clinical outcomes. After using various search engines such as Medline, Cochrane, ISI Web, and EMBASE, the investigators were able to locate about 10 studies that were relevant. The researchers discovered, however, that all the studies ranged from descriptive studies, non-randomized, and case series. They found that the studies had a high risk of bias and thus could not be used to draw a significant conclusion. Therefore, they were unable to effectively conclude whether prehospital ultrasound improved the clinical outcomes of patients suffering from non-traumatic conditions. They did, however, find constant reports that indicated that prehospital ultrasound improved patient management in the areas of diagnosis, treatment, as well as referrals

Chin et al. (2013) also conducted a pilot test to investigate the practicability of using an on-site ultrasound assessment in emergency situations. The researchers wanted to determine if care providers were able to identify images of life-threatening diseases by using Prehospital Assessment with Ultrasound for Emergency (PAUSE). The researchers created this protocol in order to effectively diagnose patients in a timely manner. Twenty paramedics who did not have initial training on ultrasonography were enrolled in the program. They were trained on basic ultrasonography in order to detect conditions such as pneumothorax, differences in cardiac activity, and pericardial effusion. They were then tested on their ability to differentiate normal and abnormal findings. After analyzing the results, the researchers noted that most of the paramedics were able to use the protocol correctly. Therefore, they concluded that prehospital ultrasound may become a good tool for detecting life-threatening conditions and thus can improve the way such patients are diagnosed and managed. By extrapolation, then, prehospital ultrasound may significantly improve clinical outcomes. However, the implied prerequisite in this study is the effective training of the paramedics to ensure that they are able to detect life-threatening conditions using ultrasound.

Press et al. (2014) tried to determine the accuracy of detecting life-threatening conditions among the paramedics via prehospital ultrasound. The aim of this research was to determine both the accuracy and potential utility of prehospital ultrasound. Their study participants were helicopter emergency medical service providers. The study involved a 7-month period during which 293 patients were assessed using ultrasound before arriving at a health facility. The findings of the prehospital results were compared with those of Computed Tomography (CT) of patients performed after they arrive at a healthcare facility. The specificity and sensitivity of hemoperitoneum was 49% as compared to that of pneumothorax that stood at 18.7%. Therefore,

the researchers concluded that the prehospital ultrasound yielded a moderate accuracy in identifying the correct condition. They also concluded that the likelihood of carrying out the correct intervention was also moderate. There are important limitations of the study to consider. First, the study did not assess some variables such as the experience of the paramedics working with the ultrasound machines. And more importantly, the researchers did not know if the participants had gone through a proper training program and evaluation to assess their level of understanding in using ultrasonography. Nevertheless, the study demonstrated some significant improvements in patient care due to prehospital ultrasound.

Laursen et al. (2016) carried out a pilot test to establish the time spent with, and feasibility and accuracy of using ultrasonography to diagnose cardiogenic pulmonary edema. The study was done retrospectively. Only patients who were above 18 years old and who presented a pre-admission respiration rate of more than 30 breaths per minute and oxygen saturation of less than 90% were included in the study. These patients also had prehospital emergency care activated. Three physicians carried out an audit to determine if the patient was suffering from cardiogenic pulmonary edema after admission. As a result, 40 patients were included in the study. The researchers found a 100% feasibility score of prehospital ultrasounds and a median time of 3 minutes. They also established a sensitivity score of 94.4% and a specificity of 77.3%. These results indicate that prehospital ultrasound can be a great assessment tool for identifying and excluding cases of pulmonary edema of cardiac origin. Therefore, the investigators concluded that prehospital ultrasound was fast and significantly practical, especially for people suffering from respiratory distress. They concluded, therefore, that prehospital lung ultrasound has great potential for ruling out cardiopulmonary edema. What's more, the study demonstrated that prehospital ultrasound can be a great tool in emergency medicine. However, the researchers

strongly suggested that more studies that involve a large sample should be done to test their findings.

A systemic review of current research reports to assess the role that prehospital in improving how critically ill patients are managed was conducted by Botker, Jacobsen, Rudolph, and Knudsen (2018). The main goals of the research were to assess the feasibility of prehospital ultrasound, the education of the providers, and the changes in patient management that were induced by this approach of care. The research team was able to identify more than 3000 articles that relevant to the subject of their study. However, only 27 studies met the criteria for inclusion. Among all the studies, only one of evaluated patient outcomes after the use of prehospital ultrasound. Only four studies demonstrated that prehospital ultrasound was feasible and affected the management of patients. Two studies revealed noteworthy viability of this ultrasound modality in patients with breathing difficulties. Another two studies demonstrated that a few hours of teaching were enough for the paramedics acquiring basic interpretation skills. From this review, the researchers noted that prehospital ultrasound was feasible and led to significant changes in the management of the patients with breathing difficulties, trauma, and cardiac arrest. However, they were unable to identify whether these changes translated into improved outcomes. In addition, they noted that expertise in prehospital ultrasound skills required extensive training that called for good theoretical knowledge, experience, and hands-on teaching.

The use of ultrasound as a useful prehospital diagnostic tool has been supported by literature across a variety of contexts. A case study by Everett, Laselle, and Kendell (2010), indicated that the body hardening training that is common for American soldiers was potentially dangerous and could lead to hemoperitoneum. They also found that, luckily, the use of ultrasound was able to assess any adverse events following body hardening exercises, causing

the researchers to conclude that it was a useful tool that led to prompt diagnosis and management of the condition. This led them to also conclude that prehospital ultrasound is an important tool for identifying cases of splenic injury due to trauma.

Jørgensen, Jensen, and Dirks (2010) performed a systemic review to establish if abdominal and thorax prehospital ultrasound increases the survival rate among trauma patients. According to these researchers, rapid prehospital assessment influences the initial life support interventions, as well as the promptness of care. They noted that most pieces of the literature demonstrated that prehospital ultrasound is a feasible procedure and concluded that this approach was highly reliable in detecting cases of hemopericardium and hemoperitoneum in comparison to the using physical assessment, as well as hemodynamic changes findings. However, they noticed that there were no studies that indicated that prehospital ultrasonography can lead to improvement in the treatment of trauma to the abdomen and thorax and recommended a large-scale clinical trial to answer the objective of this study.

Some researchers have investigated the changing efficacy of the ultrasound over the years. Nelson and Sanghvi (2016) noted that the use of ultrasound has significantly evolved in the last few years. They noted that in the past, the ultrasound was reserved for certain specialties. The current durability and portability of ultrasound machines, however, have increased its range of uses. In their review, the researchers also noticed that prehospital ultrasound improves diagnostic capacity and thus allows some beneficial interventions to be initiated in the field. The investigators concluded that in life-threatening conditions, ultrasound is the only realistic imaging technique that can direct diagnosis and thus aid in establishing the need for urgent referral of patients to healthcare facilities. Currently, ultrasound has been integrated into telemedicine. Body images can be obtained using ultrasound even in remote areas and are

transmitted electronically to a healthcare provider who can interpret them. More uses of prehospital ultrasound will be developed as technology advancements continue into the future.

This increased quality of outcomes, however, rests squarely on proper training with the machine itself. Bhat et al. (2015) demonstrated that after appropriate training, a majority of emergency service providers were able to correctly identify pneumothorax, pericardial perfusion, and cardiac still in an ultrasound image (a pre-test score of 65.8%, 90.5% post-test, and 93.1%, one week after the test). These findings indicate that is feasible to train paramedics to correctly to identify life-threatening conditions using on-site ultrasonography.

### **In Hospital and Prehospital Ultrasound application: Differences and Existing Barriers**

Different factors influence the use of ultrasound in the hospital and prehospital setting. A prehospital setting, by nature, is characterized by an endless combination of environmental factors that could affect the utility and the quality of the results of using the ultrasound. These environmental factors include and are not limited to noise, limited workspace, resources and rapid transport mode; all of which can serve as barriers to implementing prehospital ultrasound. Ultrasound in both setting has the same medical indication of use, but the settings differ in their diagnostic approaches. In the prehospital setting, the need for a focused diagnosis is mandatory in order to begin immediate treatment especially in triage where it is important to prioritize patients with severe injuries. In contrast, the need for a precise diagnosis is crucial in the hospital setting since triage is already has been done. Commonly, the prehospital setting is mainly focused on fast transportation of patients and therefore presenting what could be a huge barrier to implementing any diagnostic tool such as ultrasound (Rudolph, Sørensen, Svane, Hesselheldt, & Steinmetz, 2014).

Additionally, the mode of transportation can be a barrier in implementing the prehospital ultrasound. Emergency medical services require a specific type of transportation mode depending on the condition of the patient. These modes are described in various terms such as “*load and go*”, “*treat then transfer*” “*stay and play*” and finally “*scoop and run*”. *Stay and play* is where paramedics stabilize the patient at the scene and then transport. *Scoop and run*, on the other hand, is a transportation strategy where paramedics load the patient and transport the patient to the hospital without proper intervention. These methods vary by country. For example, in Europe, the *stay and play* strategy is well established in contrast, the *load and go* strategy is widely used in the United States. Both approaches have their positive and negative impacts. Patients suffering from traumatic brain injury have a 23% mortality rate when endotracheal intubation is done at the scene compared to a 50% mortality rate when the patient must wait for the endotracheal intubation to happen in the hospital. This is because hypoxia can cause neurological damages, and this is reduced among traumatic brain injury patients with the stay and play approach. Consequently, effective intervention on the scene is not only appropriate, but also highly desirable in some cases. On the other hand, using the stay and play approach could impact what is commonly known as the “golden hour”, a well-known part of the trauma and emergency service lexicon (Crowley, 1975). In his article, Crowley stated, “the first hour after injury will largely determine a critically-injured person’s chances for survival”. As a rule of thumb, then This trauma patients are treated on the scene for 10 minutes and then transported to the nearest hospital for definitive treatment. Some emergency medical services use both methods where they do limited interventions on the scene “stay and play” and accomplish the necessary medical procedures in the ambulance “load and go” (Beuran et al., 2012).



According to Taylor et al. (2014) pre-hospital ultrasound implementation is not widely used in North America. This finding resulted from a cross-sectional survey that the researchers distributed to EMS directors both in the United States and Canada to investigate the current application of pre-hospital ultrasound in North America. The survey was distributed via the mailing list of the National Association of EMS Physicians. Seven hundred fifty-five surveys were delivered, and 255 were returned yielding an overall response rate of 30%. The reported findings included that 4.1% of EMS systems are currently using a pre-hospital ultrasound; 21.7% are considering incorporating the ultrasound in the future; and, 78.3 % are not considering the implementation of pre-hospital ultrasound. The study concluded that the reasons pre-hospital ultrasound use in North America is rare could be explained by barriers such as the cost of the machines, training operators, and the limited evidence of improved outcomes. The researchers noted that one of the barriers to implementing ultrasound in the pre-hospital setting is the lack of evidence of improved outcomes. This finding could be explained by the fact that in North America, paramedics are widely working in the pre-hospital, while in Europe, prehospital physicians are mainly working in the ambulances. Therefore, there is low utilization of prehospital ultrasound in North America. Figure 2.6 shows medical directors' perceptions about the barriers of implementing the prehospital ultrasound in North America.

Figure 2.6 Barriers to Implementing Ultrasound Perceived by EMS Medical Directors (n= 198)

<b>Barrier</b>	<b>Number/% of respondents</b>
<b>Equipment cost</b>	177 (89.4%)
<b>Training cost</b>	146 (73.7%)
<b>Challenges in training</b>	106 (53.5%)
<b>Transport times</b>	95 (48.0%)
<b>Concerns about delaying time for definitive care</b>	90 (45.5%)
<b>Ultrasound is beyond the scope of practice of providers</b>	76 (38.4%)
<b>Lack of evidence</b>	76 (38.4%)
<b>Regulatory factors</b>	29 (14.6%)
<b>Approval by EMS administration</b>	25 (12.6%)
<b>Buy-in by other EMS medical directors</b>	21 (10.6%)

*Note. Adapted from "Use of prehospital ultrasound in North America: a survey of emergency medical services medical directors", Taylor, J., et al, 2014, BMC Emergency Medicine, 14, P. 3.*

Sajid et al. (2020) explored the perception of the medical personnel about using the ultrasound machines in the prehospital setting in the kingdom of Saudi Arabia. The study was conducted on the emergency department at The National Guard Hospital and involved nurses, paramedics, surgeons, EMS students within the hospital and King Saud bin Abdul-Aziz university in Health sciences in Alahsa city. By using the snowball sampling method, the study had an overall 130 participants only 80 participants answered the survey with a response rate of 61.5%. The participants have different education specialties which are (1 surgeon, 3 emergency

doctors, 4 paramedics, 3 EMTs, 37 nurses, 23 EMS students, 9 EMS intern). The study revealed that 41% of the participants have no prior knowledge about prehospital ultrasound. Moreover, 70% of the participants are interested taking courses or workshops in the prehospital setting which reveals a high level of interest in acquiring the skills and the knowledge of the ultrasound. The study also revealed that 43% of the participants think that the cost of the machines can be a barrier in implementing the ultrasound. The study concluded that there is a high level of interest from the participants to learn the knowledge and the skills of the ultrasound machines. The study identified that low level of training, and the cost associated with the machines can be a barrier to the implementation of such a device in the prehospital setting.

### **Saudi Red Crescent Authority: Configurations and Ambulance Team Compositions**

The Saudi Red Crescent Authority has two types of ambulance team configurations: A Basic life support unit, and an Advance life support unite. The basic life support unit consists of two emergency medical technicians whereas the advanced life support units have one paramedic and one EMT basic. The Saudi Red Crescent has a specific set of codes for each emergency call and hospital facility. For example, code number 2 is for fire and code 14 is for King Khalid Hospital. The SRCA Central Radio Communication Room (CRCR) is responsible for receiving emergency calls and sending the appropriate ambulance team (either basic or advanced) based on the incident type. SRCA gets incoming calls from different methods either from people dialing the free emergency 911 line, or sometimes patients will go directly to the ambulance stations. In addition, the firefighter and police CRCR can directly contact the Saudi Red Crescent if they encounter a medical case in their daily work (Almutairi et al., 2016).

## **Context for Stakeholders Included in the Study**

This section examines the various stakeholders in Saudi Arabia who would be instrumental to any initiative to increase the use of ultrasound in the prehospital setting as well as those who would have a stake in creating, implementing, and monitoring quality education initiatives for prehospital teams.

### **Ministry of Health (MOH) in Saudi Arabia.**

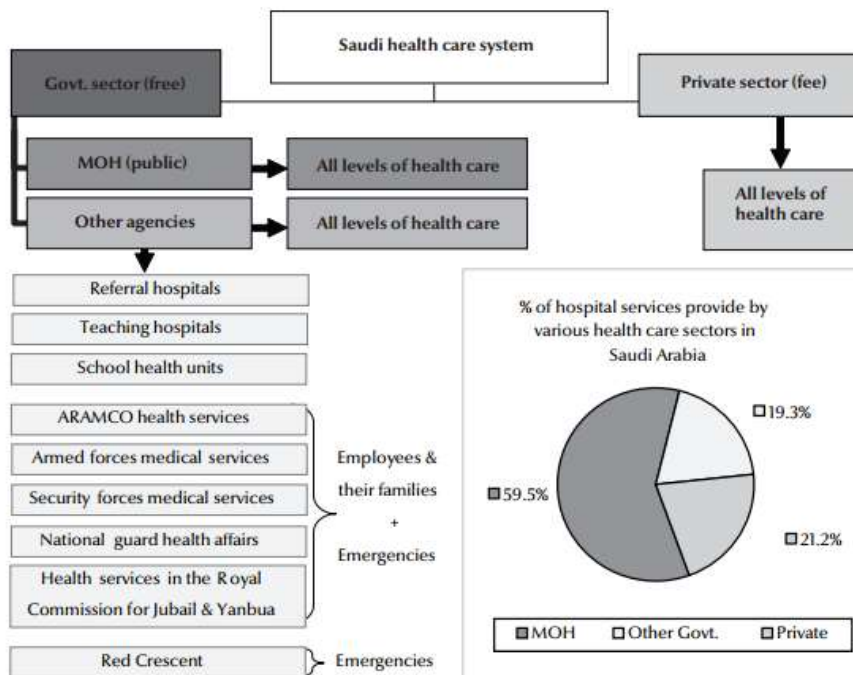
All citizens of the Kingdom of Saudi Arabia are entitled to free healthcare services. It is the responsibility, then, of The Ministry of Health (MOH) (2013) to coordinate those health services to ensure that the highest quality of care is achieved. Its mission is to participate in the provision of all levels of care services and enhance public health. It also prevents diseases, in addition to regulating the private, as well as public health care sectors. The Ministry of Health also supports health research and academic training and creates an environment that promotes investment in the health sector. The MOH provides about 60% of health services to its public facilities and dispensaries. All the citizens of the country are entitled to free healthcare services.

The origin of the MOH in the Kingdom can be traced back to 1925 when the department of public health was established. This department was responsible for creating, as well as enforcing health regulations, Later, a public health council was formed to address the increased needs in healthcare services. These two institutions were joined together to form a ministry in 1950. Currently, the MOH is the principle planner, as well as the provider of health services. The Ministry is allocated slightly above 7% of the country's budget to fund its services.

The MOH in Saudi Arabia employs about 38,825 doctors, 82,948 nurses, and many pharmacists, as well as technicians. In total, it owns about 35,000 hospitals beds. It operates

thousands of hospitals, clinic, dispensaries, and mobile clinics. Agencies under the MOH are divided into either private or public. On the public side, they include referral hospitals, school health units, teaching hospitals, national guard health affairs among others as shown on the figure below (Almalki, Fitzgerald, & Clark, 2011). Figure 2.7 illustrates this organization.

Figure 2.7 The Saudi Health Care System



Note. Reprinted from "Health care system in Saudi Arabia: an overview", by Almalki, M. Fitzgerald, G. Clark, M., 2011, Eastern Mediterranean Health Journal, 17, P.786.

### National Guard Hospital (NGH)

The National Guard Hospital (NGH) is a medical complex that is based in Saudi Arabia. It is comprised of a group of medical cities that are scattered across the country. The National

Guard Hospital was founded in 1983 as a specialist hospital under the National Guard Health Affairs. Each hospital has more than 2,000 beds. These facilities are found in cities such as Al-Ahsa, Jeddah, Riyadh, and Dammam. The largest facility under this program is the medical center that is located in Riyadh. This facility is the only one in the world that has achieved a 100% success rate in the separation of conjoined twins. National Guard Hospital deals with specialized medical and surgical cases for both adults and children. It deals with surgical procedures such as cochlear implants and organ transplant among others (Ministry of National Guard Affairs, n.d.).

National Guard Hospital receives its allocation of finances from the government through the Ministry of Health. These finances are managed by the Financial Affairs Division. This unit manages both cash inflow and outflow by ensuring that financial transactions are done efficiently and accurately. It also oversees the preparation and implementation of the budget and generates timely financial reports. This facility also employs a large number of specialist doctors, nurses, pharmacists, and other technicians. The main agencies of the hospital include administrative services that deal with financial, legal, religious protocol, recruitment, and logistic issues; technical support services that deal with engineering, e-health, communication, and environmental issues; development and control services that handle planning, infection control, and internal audits, as well as security and safety services that deal with military police and fire protection issues (Ministry of National Guard Affairs, n.d.).

### **Relevant Stakeholders**

For the purposes of this investigation, having context for the stakeholders who will participate in the study is crucial in order to address the research question: *What are the existing barriers regarding the potential use of prehospital ultrasound in the Saudi Red Crescent?* The

study sought to address that question in the context of the interactions between the National Guard Hospital and the Saudi Red Crescent Authority. The key personnel in each are therefore identified as the stakeholders and described in turn noting their relationship to the study and to each other.

## **Stakeholders within the National Guard Hospital**

### **Emergency Physicians**

The Emergency Physicians are certified doctors who mainly work in the emergency department at the National Guard Hospital. Their primary duties are focused on treating ill patients in the emergency rooms. The emergency physician must undergo extensive training in patient care and must be proficient in diagnosing patients, ordering medical tests, performing follow-up visits and establishing treatment plans. Their role is to stabilize patients with critical conditions and then transfer them to the relevant medical department (Emergency Physician: Job Description and Educational Requirements, n.d.).

Emergency physicians are deeply involved in the prehospital setting through medical direction to the SARC paramedics on the scene. “Medical direction is a system of physician-directed quality assurance that provides professional and public accountability for medical care provided in the prehospital setting” (Medical Direction, n.d.).

### **Emergency Department Administrators:**

The Emergency department administrators are the ones who oversee the emergency department through creation, implementation, and execution of hospital policy and procedures. Moreover, they are responsible for providing high-quality medical care and the recruitment of highly skilled physicians and staff evaluation (Department of Emergency Medicine, 2014). The

National Guard Hospital has two different emergency departments: the emergency room and the emergency medical services. Emergency Medical Services is a division within the National Guard Hospital that is responsible for coordinating between the hospital and the SRCA in terms of managing incoming patients and their legibility in the National Guard Hospital. The administrators of the emergency department are the key to this study that examines their perspective about prehospital ultrasound and the existing barriers that currently prohibit the use of prehospital ultrasound inside the emergency department at the National Guard Hospital.

### **Stakeholders within the Saudi Red Crescent Authority (SRCA)**

#### **Saudi Red Crescent Administrators**

From my experience as a volunteer paramedic, administrators at the Saudi Red Crescent Authority are overseeing the overall management of prehospital setting such as policy creation, implementation and enforcement. They are many departments within the SRCA, and each has a specific role in the management of the ambulance team such as paramedics and Emergency Medical Technician (EMT).

#### **Saudi Red Crescent Emergency Medical Technician (EMT) and Paramedics**

Unitek EMT (2013) explains the different level of Emergency Medical Providers in the prehospital setting. There are three Emergency Medical Technician (EMT) certificates which are EMT-basic, EMT- intermediate and Paramedics. EMT-basic is the entry level of emergency medical technician. Besides, EMT- intermediate is the second step of prehospital providers with more than 200 hours of training. Paramedics are considered the highest level of emergency medical technician with extensive training over a period of two years. Emergency medical



providers are the essential part of our study where we will examine their perspective about the existing barriers in using the ultrasound in the ambulance.

### **King Saud bin Abdul-Aziz University of Health Sciences (KSAU-HS)**

The King Saud bin Abdul-Aziz University of Health Sciences (KSAU-HS) is the earliest government-owned university in the Middle East, and specifically in Saudi Arabia, to offer specialized health services. Its headquarters in Riyadh, which is the capital city of Saudi Arabia. The university has two campuses; one in Al-Ahsa and the other in Jeddah.

King Abdul-Aziz University was established in the year 2015. Advanced medical facilities at King Abdul-Aziz cities led to the idea of establishing the university. The main campus of the university is located in Riyadh with two additional campuses located in Al-Ahsa and Jeddah. The main campus has several colleges that include colleges of medicine, pharmacy, dentistry, and applied medical sciences among many others. Jeddah has colleges of nursing, applied health sciences, medicine, and others. Colleges in Al-Ahsa include that of applied medical sciences, nursing, and that of sciences and health professionals. The KSAU-HS university receives funds from the Ministry of Education. Other research funds come from King Abdullah International Medical Research.

Emergency medical services programs at King Abdul-Aziz University fall under the College of Applied Medical Sciences. It is the first Bachelor of Science program that was established to train paramedics according to international standards. The mission of the KSAU-HS is to fill the gap of emergency healthcare personnel and also promote a world-class model program of emergency medical services. A problem-based learning model is used as the method of teaching in this area (King Saud Bin Abdul-Aziz University of Health Sciences, n.d.).

## **Saudi Commission for Health Specialties (SCHS)**

Saudi Commission for Health Specialties (SCHS) is another important stakeholder in the health sector in the Kingdom. It is a professional body that is mandated to regulate health-care related practices in the country. In addition, the SCHS is involved in the accreditation of healthcare practices at various levels in Saudi Arabia.

The SCHS was established through a royal decree in June 1992 for the main purpose of setting standards of health practice in the country. The leadership of Saudi Arabia was concerned about the increased number of healthcare facilities and professionals. They concluded that a failure to regulate healthcare practices would lead to poor quality training and substandard professionals. The headquarters of the SCHS are located in Saudi Arabia's capital of Riyadh, and also operates several branches that are spread across the Kingdom.

Presently, the SCHS supports and has approved more than 35 training programs in the area of healthcare. The SCHS administers licensure exams to various medical specialists. Only those people who excel in these exams are given licenses to practice in the country. The SCHS gets its funds from the subscriptions paid by the healthcare professionals that are required of them to be listed and retained in the commission's register. Facilities that require accreditation also pay some charges to the commission. Other finances come from accreditation of training programs in various institutions (Saudi Commission for Health Specialties, n.d).

## **Theoretical Framework: Understanding the Barriers Inherent in Current Conditions and Relevant Stakeholders**

Researchers who investigate what it takes to lead improvement within complex organizations point to the importance of learning in the setting where the work currently takes place. In other words, the best learning is learning in context. In fact, learning within the context

in which changes for improvement will take place has been shown to be the approach with the greatest potential payoff (i.e., Elmore, 2000; Fullan, 2000). This is because this type of learning is inherently more specific (customized to the situation) and recognizes that organizational improvement is a social enterprise. It involves a group, or in the case of advancing the use of ultrasound in the prehospital setting, several intersecting groups. Learning in context helps to develop leadership and improve the organization(s) as the stakeholders prepare for, implement, and monitor and improve the improvement process. Such learning changes the individual and the context simultaneously (Von Krogh, Ichijo, & Nonaka, 2000). Learning in context is based on the premise that "what is gained as a group must be shared as a group" (Pascale, Millemann, & Gioja, 2000, p. 264).

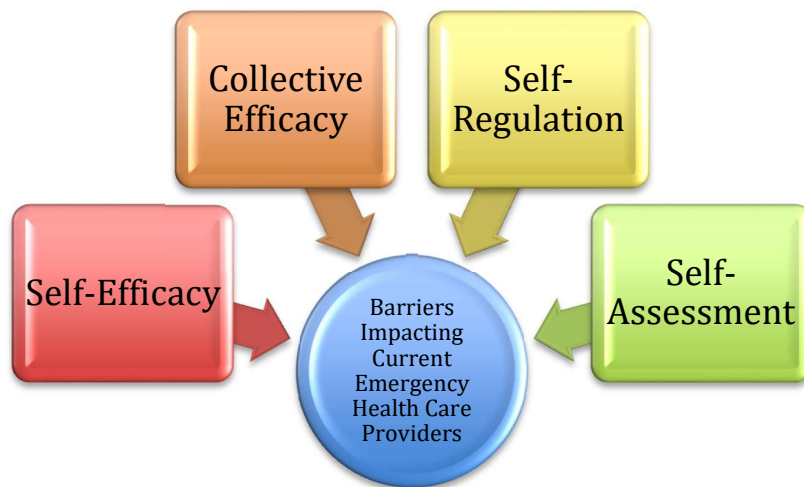
In fact, improvement initiatives rise and fall on the beliefs and commitments of the people involved in and impacted by the improvement process. Organizational or systems improvement requires learning and behavioral change at all levels. In the fast-paced society of the 21<sup>st</sup> century change is everywhere and so is resistance to those changes. As Fullan (2000) commented on the very personal reactions that people have even the most important improvements:

If you ask people to brainstorm words to describe change, they come up with a mixture of negative and positive terms. On the one side, *fear, anxiety, loss, danger, panic*; on the other, *exhilaration, risk-taking, excitement, improvements, energizing*. For better or for worse, change arouses emotions, and when emotions intensify, leadership is key (p. 1).

For these reasons related to the nature of the improvement proposed in this study, the theoretical framework that will guide it involves theories that help to examine and explain the inherent beliefs and confidence levels of individuals and groups. Specifically, this study proposes to

examine the perceptions of stakeholders using the theoretical perspectives of self-efficacy, collective efficacy, self-assessment, and self-regulation (See Figure 2.8).

*Figure 2.8 Theoretical Framework*



Each theory offers a valuable lens through which to examine certain aspects of learning and belief, and work in combination with each other to illuminate areas of need, propose areas for growth and provide a way to enhance and monitor individual and team growth.

Each theory is described in turn noting its connection to the medical field in general and specifically to the proposed improvement initiative program focused on implementing ultrasound in the prehospital setting between the National Guard Hospital and the Saudi Red Crescent in Saudi Arabia.

### **Self-efficacy: Examining Why Believing in One’s Self Matters**

“Perceived self-efficacy is defined as people’s beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives. Self-efficacy beliefs determine how people feel, think, motivate themselves and behave” (Bandura,

1994). Specifically, self-efficacy theory refers to a set of guidelines and approaches that tend to explain the overall human behavior towards a given situation. This theory focuses on the explanation of the abilities of an individual from a personal perspective to accomplish a set of goals and objectives. This theoretical perspective was presented first by Albert Bandura (1977) and his other works offer a set of explanations aimed at outlining concepts related to self-efficacy (i.e., Bandura & Adams, 1977). According to Bandura (2000), self-efficacy theory refers to the ultimate personal judgement on the best strategies that an individual can implement aimed at dealing with a given prospective situation. In this case, one can confirm that this theory focuses on explaining the ultimate course of actions that an individual can take that would, in the end, help to achieve the set goals in the long run. Individuals involved in new or different approaches, procedures, or roles within their current context, often see a decrease in confidence and negative perceptions that they can be successful. Moods, emotional state, physical reactions, and stress levels can all impact how a person feels about their personal abilities in a particular situation. "[I]t is not the sheer intensity of emotional and physical reactions that is important but rather how they are perceived and interpreted" (Bandura, 1997, p. 108).

However, Bandura (1997) claims that the success of the people who exhibit self-efficacy may differ from one party to the other, the difference, in this case, comes from the understanding that people tend to show differing abilities when dealing with obstacles that may arise in the course of actions when trying to accomplish a set of goals. People who may exhibit high self-efficacy levels as per Bandura may achieve their goals with ease as compared to those who exhibit lower levels of self-efficacy. From another perspective, this theory claims that psychological changes that may arise usually come from the alterations of the sense of personal mastery of the affected parties. In this case, therefore, an individual with high-level self-efficacy

may stand at a better position to achieve a set of goals based on their capabilities. Many of the stakeholders in this initiative, but especially the paramedics and the EMTs in the Saudi Red Crescent will be tasked with implementing not only the mechanics of the ultrasound in the field, but also making the life or death decision about taking the time to do the prehospital diagnosis rather than simply loading the patient quickly for transport to the National Guard Hospital.

Bandura (1997) continues to say that the self-efficacy theory plays a critical role in defining the overall behavior that people may exhibit when undertaking various tasks. For example, a person may present a given set of activities based on his or her personal belief of accomplishment. If a paramedic does not believe in his ability to quickly and accurately perform an ultrasound, he is less likely to use it regardless of its potential to ultimately save the patient's life. In a very real sense, therefore, self-efficacy theory helps to define the behavior of an individual not based on the skills or knowledge but on the person's underlying inner beliefs of regarding the individual's ability to accomplish goals or a specific set tasks in real life. An individual with high-level self-efficacy will approach difficult tasks with a strong believe in the individual's ability to master it rather than view it as a task to be avoided. Self-efficacy theory, then, will help to explain the complex perceptions and commitments of the stakeholders involved in and impacted by this investigation.

To further explain his theory, Bandura describes the four primary sources of efficacy. They include verbal persuasion, psychological arousal, mastery, and vicarious experiences (Bandura,1994). Each is briefly described to note its degree of impact on perceived self-efficacy.

**Verbal Persuasion** refers to the capabilities that words from one individual may have on the level of self-efficacy of another. For instance, offering words of encouragement may raise the beliefs of an individual into performing a given task.

**Psychological Arousal** refers to the psychological health aspects of the affected individuals when it comes to performing the associated tasks. Specifically, psychological arousal helps to explain a person who exhibits anxiety regarding the task. That is because psychological aspect may impact a person's beliefs in the person's own capability to perform a certain task.

**Vicarious Experiences** refer to the skills and beliefs that people absorb from observing successful role models. In this case, the role model must exhibit the required levels of self-efficacy as seen or heard in expressions of the beliefs that the model towards succeeding in undertaking the day to day tasks (Bandura, 1977). It will be important for those leading the initiative and the training in the mechanics, process, and discernment involved in implementing the ultrasound in the prehospital setting to demonstrate high levels of expertise and confidence.

**Mastery Experiences** refer to the successes or failures of a task that an individual achieved in the past. An individual's previous experience in successfully completing a specific task is the most important source of self-efficacy. A successful experience increases the perceived self-efficacy, in contrast, an unsuccessful it weakens it (Bandura, 1994). By learning and working in context to master the challenge at hand, individuals learn to increasingly achieve the set goal or solution based on the application of the inner skills and knowledge. Being able to monitor and develop specific skills and knowledge in the context of the proposed improvement initiative will therefore play a critical role in defining the abilities of each stakeholder to exhibit levels of mastery that will strengthen positive perceptions of self-efficacy. And, to do that, each stakeholder must learn the processes of self-assessment and self-regulation discussed later in this section.

These concepts play a crucial part in the process in that they form the foundation for understanding the building blocks of the self-efficacy theory. Through these building blocks, Bandura claims that one can be in a position to understand the working of the underlying theory.

The primary reason behind the creation of the self-efficacy theory comes from the desire to explain and understand the motivation that pushes an individual into accomplishing a given set of goals. For instance, Bandura through the method explored some of the issues and factors that in the end help people to achieve a set of goals. In this case, Bandura focused on determining the inner motivation driving the success of a given individual towards succeeding in accomplishing a task. Through the theory, Bandura concluded that the success of an individual in achieving a set of goals and functions comes from the perception rather than the knowledge, skills and or experiences that one may exhibit. Through this theory, Bandura allows the audience to explore and apply the underlying concepts in a wide range of areas in the attempt to explain the factors behind the success of the targeted individuals (Bandura, 1977).

For instance, one can apply the concepts of self-efficacy to explain the potential factors that drive the medical teams towards accomplishing a given goal in their different lines of work. The ultimate success of the improvement initiative, in a very real sense, revolves around creating conditions of learning that advance positive perceptions of self-efficacy for all stakeholders.

### **Collective efficacy theory: Why Believing in Each Other's Effectiveness Matters**

“Collective efficacy is a shared belief, resulting from the common exposure of group members to external and internal stimuli, such as group performance” (Watson, Chemers & Preiser, 2001). Collective efficacy theory, originally noted by Albert Bandura (1997) as “a group’s shared belief in the conjoint capabilities to organize and execute the courses of action



required to produce given levels of attainment” (p.478), has undergone several changes and developments over the past two decades in an attempt to establish a set of concepts revolving around the working and application of the framework within a successful group. Collective efficacy theory helps to explain the general role of social, neighborhood, and collective efforts focused on accomplishing a set of community or shared goals (Watson, Chemers & Preiser, 2001). In general, collective efficacy theory focuses on the definition of the ultimate approaches that individuals working together may use to achieve a set of goals from a community perspective.

### **Self-Efficacy and Collective efficacy**

Self-efficacy and collective efficacy use different approaches and sets of concepts. For instance, the self-efficacy theory defines the inherent abilities of an individual as the ultimate foundation and motivation towards the accomplishment of a given goal in the selected areas of application. This statement implies that the personal beliefs of an individual play a critical role in defining the abilities of an individual in accomplishing a given goal. On the other hand, collective efficacy theory defines the abilities and tasks that a given group of people may take in an attempt to achieve a set of goals. This theory acknowledges the importance of the ability and expertise of individuals within the group in activating the confidence of members of the group in each other and strengthening their ties one another to create and pursue a shared set of goals to benefit the larger population (Watson, Chemers & Preiser, 2001).

### **Self-Efficacy and Collective Efficacy Application in the Medical Field**

In the healthcare sector, health care professionals involved in the medical fields need to exhibit high levels of efficacy from both self and collective perspectives to achieve the desired

goals. Healthcare professionals such as nurses, paramedics and physicians handling cardiopulmonary resuscitation may exhibit different behaviors that may either support or discourage them from performing important tasks. Navalpotro-Pascual, Blanco-Blanco and Torre-Puente (2019) investigated the behaviors that rescuers endure during cardiopulmonary resuscitation and the factors that often impact their ability to perform cardiopulmonary resuscitation (CPR). The researchers found that self-efficacy in the medical field was not simply enhanced and measured through simulation with a manikin. It is in recognizing the important aspects of psychological arousal and mastery experiences embedded in Bandura's theory (1997) that needs to be considered in the training medical personnel and recognizing the psychological state of the rescuers during CPR that could hinder their ability to advance effective intervention. The study explored the aspects that lead to better handling of CPR. The researchers divided the conditions into two main categories: personal factors and situational factors. Personal factors involved knowledge that consists of prior knowledge, protocols, and practical training. Rescuers are well trained and have an extensive knowledge about basic life support including CPR but rescuers report that they fear their lack of experience will hamper their ability to execute CPR. Given that fact, the researchers recommend continuous training and learning experiences since cardiopulmonary resuscitation does not happen regularly. Thoughts and beliefs can also have a negative or a positive impact on perceptions of a medical professional's ability to successfully perform CPR. Rescuers must believe in their ability of perform CPR during in a real-life incident of cardiopulmonary resuscitation. This positive belief can have a positive impact on the rescuer's confidence. Clearly, emotions can play a huge role in the healthcare professional's capability in performing the difficult task of CPR. Rescuers may exhibit negative emotions such as stress and

fear and that can have a major impact of their self-efficacy as well as their ability to intervene in a life or death situation.

By applying self-efficacy theory, one can conclude that the factors that may hinder these parties from conducting such tasks may revolve around the personal as well as the situational factors. One can also conclude that self-efficacy beliefs can affect the overall perception as well as the acquisition of the skills medical professionals require in performing their tasks. Likewise, collective efficacy theory, helps leaders understand that specific groups of professionals require assistance from and confidence in other members of their group to better perform such tasks as they confidently collaborate to achieve a common goal. In a very real way, collective efficacy theory defines the behavior of the medical teams in seeking assistance and collaboration in their attempt to successfully undertake specific tasks with fidelity and accuracy. It is not enough for the paramedics in the ambulance to acquire the right skills and knowledge to perform the specific tasks on patients. Just as importantly, leaders must acknowledge the motivation of the paramedics, realizing that it comes from the internal perception or beliefs that they hold regarding how well they can perform those tasks regardless of the arising situations. From a collective efficacy perspective, collaboration among and between the relevant stakeholders in the prehospital setting will be crucial. For example, the paramedics and EMTs of the Saudi Red Crescent and the emergency room doctors at the National Guard Hospital must work together with confidence in each other to create the ultimate foundation for achieving the common goal of saving the life of the patients by working together to support the use of prehospital ultrasound.

## **Self-Regulation Theory: Why Believing Individuals Can Monitor and Control What They Think, Say, and Do Matters**

Self-influence is greatly motivated via the exercising regulation oneself. According to Bandura (1991), there are three different fields of self-regulative mechanisms. Those fields consist of (1) how individuals monitors their own behaviors, the determinants of their behavior, and the effects of their behavior; (2) how individuals judge their behaviors while comparing them to their own standards and environmental circumstances; and, (3) the way the individuals view their own self-reflection. With a strong impact on the individual's thoughts, motivations, and their actions, self-regulation is a vital component and partner in increasing perceptions of positive self-efficacy for specific tasks. Self-regulation in Bandura's view also emphasizes moral conduct and the achievement and moral domains. Individuals evaluate themselves through standards of stability and utilize judgmental factors that are varied and complex in nature. According to the perspective of the social cognitive theory, social factors affect the operational methods of the self-regulative system (Bandura, 1986). For example, individuals who engage in physical exercise might be motivated to do so by reflecting on the complex amalgamation of biopsychosocial factors and the barriers in which they become engaged. Thus, those barriers have implications and may become deciding factors in individual decisions aimed at improving the well-being, quality, and longevity of the individual's life (Garrin, 2014).

The self-regulative process works when individuals form beliefs that manifest within themselves through consequences and prospective actions (Nabavi, 2012). Through the exercise of forethought, individuals can motivate themselves while guiding their own actions in a more anticipatory and proactive manner (Zimmerman, 2000). The present motivation of individuals can't be determined by future events that could occur. That is why it is crucial to develop the

sub-functions of self-regulatory processes in a mobilized and self-directed manner to individuals to change in their behaviors and motivation. With the self-monitoring of one's functions, individuals can influence their own motivations as well as their own actions while paying attention to their current performances aren't readily perceived (Nabavi, 2012).

Individuals tend to stay away from certain aspects of functioning that aren't important to them while adhering to the selective ones in which they have profound interest. Embedded in self-regulation is a self-diagnostic function that creates a systematic way for individuals to conduct self-observations, and in turn, these observations become important for self-diagnosis (Bandura, 1991). When individuals begin observing their own thoughts, the way in which their emotional reactions to situations and circumstances, and the nature of their own behaviors at the given time, their reactions begin what Kelley (1967) described as covariation, a form of attribution. Kelley's covariation model explains that people make causal inferences to explain why other people and themselves behave in a certain way. In this way it helps to explain how individuals use both social perception and self-perception in the self-regulation of behavior. In other words, the individuals begin noting their psychological importance concerning the social environment that has led them to behave in the manner in which they are behaving.

Some individuals learn that they can alter their behaviors by modifying certain aspects within their environment to increase their sense of well-being (Bandura, 1991).

Individuals can alter their habitual patterns by observing the accompanying and underlying effects. This increases their abilities to come to a greater understanding of how the way they think has a profound effect on their emotional state of being, the level of the motivation they have, and on their performance (Bandura, 1991). This self-knowledge provides the individual with self-measures and self-measuring processes by directing them towards more self-

regulatory control. When individuals look closer at their performances, they are inclined to beginning the process of setting goals for themselves. This is conducted through methods of improvement and evaluating self-reactions while monitoring one's efforts towards those goals that are intentionally being attained. According to Regehr and Eva (2006), a rationale for individual models of professionalism regarding self-regulation isn't based on their approach to daily practice but rather their ongoing monitoring and retrospective reflection of their daily performance.

### **Self-Assessment Theory: Why Learning to Compare One's Self to Success Criteria Matters**

Self-assessment is defined as the involvement of learning in the judging process of whether or not the standards for learning have are being identified and met. However, due to the conciseness of this definition self-assessment can become misleading due to the underappreciation of the complexities revolving around the self-construct. In a very real way, self-assessment functions as being both a mechanism for the identification of one's strengths and weaknesses as well as process that determines and considers complementary functions (Eva & Regehr, 2005).

Self-assessment theory is an ongoing process focused on how individuals perceive their progress to be, the way in which they self-judge themselves, and how they self-monitor their abilities. Such assessments can include personal judgments, educational capabilities, professional performance, personal characteristics, or a combination of two or more. Being a self-assessor can be beneficial to all who assesses themselves (Eva & Regehr, 2005). This can enable individuals to determine their potential, capabilities, and readiness for mastering knowledge and skills. These actions, however, have little impact on an individual's ability to improve toward specific

goals unless the individual compares the current state of ability to clearly described criteria for success. However, identifying and describing clear criteria is one of the most difficult things for professionals to do (Moss & Brookhart, 2019). For example, a paramedic could set a goal to become more competent at interpreting data from the ultrasound machine and could judge personal performance as excellent based on nothing more than a hunch. In order to self-assessment to contribute to meaningful growth, performance criteria must be described in terms that are appropriate to the to the context; defined in agreed upon, public terms; observable by someone other than the person performing; use specific criteria that describe specific aspects of a successful performance that are separate and distinguishable from one another; that use separate criteria to that together describe the whole of the performance that is the focus of the monitoring and improvement effort; and, that the criteria are arranged along a continuum of quality so that each criterion can be described over a range of performance levels (Moss & Brookhart, 2015).

Through self-assessment against specific criteria for success, an individual can become more self-aware of their own beliefs and misconceptions. Self-assessment also helps to reinforce current levels of knowledge, skills, values, and behaviors and in doing so can increase self-esteem while influencing motivation through strengthening self-efficacy and providing a pathway to change. Self-assessment is also a vital component in everyday life that can help establish lifelong learning for students, professionals, and educators alike (Eva & Regehr, 2005).

### **Self-assessment in Healthcare Professions**

There is an interest in formal self-assessment and its potential for improving healthcare services. Daily, significant numbers of healthcare workers function without supervision, working in a very real sense as solo agents. Because regular supervision is not possible across complex

health systems and in many rural areas served by ambulances and ambulance teams, there is a need for a mechanism by which workers could assess themselves as an effective means of improving the quality of care. In this way, self-assessment has the potential to reinforce medical standards and to increase worker accountability (Bose, Oliveras, & Edson, 2001)

The ability to self-assess was once assumed to be inherent, particularly to health professionals but beginning in the 1990's, a number of authors, in and outside the field of health, began to advance the concept that self-assessment skills that must be learned (Falchikov & Boud 1989). Currently, the literature on learning and assessment stresses that all learners benefit from systematic practice in the judgment of their own work against shared criteria for mastery and feedback on the ability where they are, where they need to go, and what steps they can take to close the gap between their current state and mastery (Moss & Brookhart, 2019).

Self-assessment operates as a mechanism to gauge one's strength and weakness (Eva & Regehr, 2005). In a healthcare setting, a health professional may determine areas of vulnerability for a specific task such as ultrasound testing, and therefore, avoid doing the task based on their limited competence with those particular skills. Likewise, a healthcare professional might consider recruiting someone to perform the task who is more competent than at this specific task. Recognizing one's weakness can also be a valuable tool for an individual to set a learning target to overcome his or her limited competence (Moss & Brookhart, 2019). For example, a paramedic can know the knowledge about the application of ultrasound, and it is benefits but might not know how to use it on the patients in terms of clinical skills. Paramedics can self-assess their weakness and recognizing their less competency in doing the clinical abilities of ultrasound. Self-assessing their weakness will allow health professionals sets a new learning target to enhance their ability to conduct ultrasound skills.



### **Chapter 3: Methods and Design for Action**

The methods employed in the study were designed to address the following research question: *What do relevant stakeholders perceive as barriers to the potential introduction and effective use of prehospital ultrasound in the Saudi Red Crescent Authority?*

#### **Methodology and Method of Data Analysis**

The study examined each stakeholder's perceptions of barriers to the potential implementation of ultrasound in the prehospital setting between the Saudi Red Crescent Authority and the National Guard Hospital in the Kingdom of Saudi Arabia.

The study employed qualitative methods to analyze data. Data from open-ended survey and interview items were analyzed through the general interpretive process of close reading to analyze the responses from each stakeholder. The close reading process involves identifying patterns of thinking and acting in order to discover regularities and uncover anomalies (Miles, Huberman, & Saldana 2014). Because of the nature of the text, this involved thematic coding categories that were analyzable by writing propositions about meaning. The researcher took several passes through the data to test the trustworthiness of information. The researcher identified the emerging themes (Gibbs, 2007) culled through constant comparative analysis to examine the similarities and differences contained in the responses to produce a comprehensive account of the findings.

Data from selected response items, were analyzed using frequency counts to report information from each question. The researcher then compared the responses by various demographic groups such as certificate held, length of service and experiences of transporting

trauma patients to the National Guard Hospital, to see if there are patterns of responses common to demographic groups.

## **Procedures**

### **Selection and Recruitment of Participants**

The study examined two groups of stakeholders associated with the prehospital setting, the Saudi Red Crescent Authority and the National Guard Hospital). Therefore, it required two types of recruitment strategies. The sampling method was used to ensure a clear road to gather data from administrators and paramedics in order to provide important insights about the current barriers to the potential implementation of prehospital ultrasound.

### **Recruitment of Paramedics and EMTs**

**Selection of Potential Paramedic and EMT Participants.** The researcher identified four Red Crescent stations with the closest proximity to the National Guard Hospital in Riyadh city. Each station is staffed by a total of 8 to 12 paramedics and EMTs. Half of them work the day shift and half of them work the night shift. For the purpose of this study, the researcher recruited participation from day shift paramedics and EMTs at each station. Since they are four to six paramedics and EMTs who work the day shift at each station, the result is a sample size of twenty-four paramedics and EMTs (n=24). In addition, since it is customary for paramedics and EMTs to change their shift every two days (two days working during the day followed by two days working during the evening), the researcher had no knowledge of who will be present for the day shift on the date of the research visit to each paramedic station. The research visits took place on four consecutive days.

**Informed Consent Process for Paramedics and EMTs.** At each station, the researcher explained the purpose of the study as well as the process of informed consent. The researcher assured the potential participants that their responses would be held anonymous and their names would not be connected to the study. The researcher asked for the email addresses of the potential participants and used those addresses to distribute a link to the online survey. The researcher explained that the participants would be able to read a detailed description of the informed consent statement (See Appendix A) prior to choosing to complete the survey.

The researcher shared the link to the survey at each station on the day of the researcher's visit. Each of the four visits took place on four consecutive days and followed the same procedure. The survey remained open for 15 days from the date of the last of the four visits. The researcher sent a reminder email to all potential participants every five days during the 15-day period of time that followed the final visit.

#### **Selection and Recruitment Process Red Crescent Authority Administrators**

The researcher conducted face-to-face interviews with administrators of the Saudi Red Crescent Authority. One administrator is on duty at each Saudi Red Crescent Station during the day shift resulting in a potential participant size of four ( $n = 4$ ) administrators. On the day of the research visit to each of the four Saudi Red Crescent stations selected for the study, the researcher invited the administrator to participate in the face-to-face interview.

**Informed Consent Process for Saudi Red Crescent Administrators.** At each station, the researcher explained the purpose of the study and provided the administrator with an informed consent statement for the administrator to read and sign (See Appendix B). The researcher assured the potential participants that their responses will be held confidential and

their names will not be connected to the study. The researcher also informed the administrators that their face-to-face interview would be recorded and requested a private room from the administrator for use during the interview. The researcher assured each administrator that all identifiers would be removed from the taped interview before it was transcribed and that following transcription, all interview recordings would be destroyed.

The interviews were semi- structured and guided by a set of interview questions that paralleled the survey questions given to the EMTs and paramedics. During each interview, the researcher asked follow up questions, as necessary, to probe for more information (See Appendix C).

## **Selection and Recruitment of National Guard Hospital Emergency Department Physicians**

### **Direct Recruitment of Physicians at the National Guard Hospital**

The researcher identified two emergency physicians who work with the National Guard Hospital and who have had frequent contact with the Saudi Red Crescent Authority. Emergency Physician One has experience working in the hospital and has clinical and administrative duties. Emergency Physician Two currently performs administrative duties in addition to his clinical work in the Emergency Department.

The researcher conducted face-to-face interview with these two physicians to determine their current perception about the existing barriers of a potential implementation of prehospital ultrasound. Both emergency doctors are well recognized in their field and have extensive experience with the emergency medical services in Saudi Arabia. Since the researcher has a personal relationship with the selected emergency physicians, specific measures were taken to ensure that the participants did not feel obligated or pressured to participate in the interview and

that they fully understood that their participation was completely voluntary. Considering that the two selected physicians are well known within the emergency medical services community in Saudi Arabia, certain measures were taken to ensure that their personal information was protected, identifying factors were kept confidential, and any identifying information did not appear in the descriptions of the data analysis in Chapter Four of this dissertation. The researcher de-identified the physicians' names and any other information including location and affiliations that could be used together to identify the physicians. Each physician is described in turn noting his expertise and experience relevant to the current study and omitting any identifying information.

### **Emergency Physicians One**

Emergency Physician One had previously served as an emergency department physician, a medical director, and as the distinguished director of the Emergency Medical Services division at one of the National Guard Hospital branches in Saudi Arabia. It is important to note that the National Guard Hospital in Saudi Arabia has four branches: Jeddah City, Medina, Riyadh City, and Dammam. Each of those branches operate under the same policies and procedures and have the same relationship with the Saudi Red Crescent Authority. With more than 17 years of experience at the hospital, Emergency Physician One has held many important positions both in the National Guard Hospital and the Saudi Commission for Health Specialties. He also served as the clinical supervisor of paramedic students for a portion of their yearlong internship. During the paramedics' supervised training, the paramedic students learn the skills, knowledge, policies and protocols involved in serving the medical needs of those who come to Mecca each year during the Hajj Mission. The Hajj Mission is a religious requirement for the Islam faithful who must visit Mecca on an annual basis. Typically, the Hajj Mission sees 3 million believers make

the pilgrimage each year, swelling the normal local population of 5.188 million (according to the United Nations Statistics Division, 2010) by over 50% thus presenting additional multifaceted sets of factors for medical personnel.

### **Emergency Physicians Two**

Emergency Physician Two is currently serving as the chairman of the Emergency Medicine Department in one of the National Guard Hospital branches in Saudi Arabia. Emergency Physician Two is a North American board-certified fellow in Emergency Medicine and critical care. In addition to his clinical duties he also serves in important educational roles in the emergency medical service program that are currently offered by one of the universities in Saudi Arabia. He was chosen because he has the potential to offer particular insights that might be especially useful to the goals of the study to gain a better understanding of the perceived barriers to implementation of the ultrasound in the prehospital setting and used to propose a three-year action plan for the education of paramedics relevant to the effective use of ultrasound in the prehospital setting.

### **Data Collection Instruments**

The study employed two separate instruments for the face-to-face interviews and online surveys. The questions from both instruments were designed to examine and reveal each group of participants' perceptions of the potential barriers to an initiative to equip Saudi Red Crescent Authority ambulances with ultrasound to help in the diagnosis of trauma patients in the prehospital setting.

The first instrument (See Appendix C) contained a set of interview questions used during the face-to-face data collection sessions with the two identified emergency physicians and the four

administrators at the Saudi Red Crescent Authority. The questions guided each face-to-face interview focused on gathering stakeholders' perceptions of potential barriers to the implementation of ultrasound in the prehospital setting involving the partnership between the Saudi Red Crescent Authority and the National Guard Hospital Emergency Department.

A second set of somewhat parallel questions (See Appendix D) were distributed via the online survey to paramedics and EMTs in the four stations of the Saudi Red Crescent Authority located in Riyadh City. Each of the four stations where participants were recruited are within close proximity with the National Guard Hospital. The online survey was housed on Survey Monkey platform. The platform is highly secure and highly anonymous and employs industry best-practice methods to keep data safe. No identifying data were connected to the responses collected by the researcher.

The questions that appeared in Arabic in the online survey (See Appendix D) and the questions used to conduct the interviews in Arabic with the physicians and administrators were translated into Arabic by the researcher. The translations were verified by Ahmed Abdelwahab, Ph.D., an adjunct professor at Robert Morris University who is fluent in both Arabic and English and also a trained academic who is familiar with concepts of research design and data collection protocols.

## Chapter 4: Description of Findings

This chapter reports the findings from the analyses of the data collected to inform the following research question that guided the study:

*What do relevant stakeholders perceive as barriers to the potential introduction and effective use of prehospital ultrasound in the Saudi Red Crescent Authority?*

The data were gathered from three groups of participants, each data set is described in turn. Findings from the Surveys of the Paramedics and the EMTs

**Description of the participants.** Twenty-four paramedics and EMTs participated in the survey. The researcher distributed the survey (See Appendix D) by sending a link to the participants via email that took them to the survey housed on the Survey Monkey platform. In the online survey, a consent form (See Appendix A) appeared on the first page of the survey. Participants were advised that by clicking the “I Agree Button” they would indicate their acceptance of the conditions of the study. Once they clicked, the paramedics and the EMTs were able to view the rest of the survey.

### **Comparative Analysis of the Demographic Data**

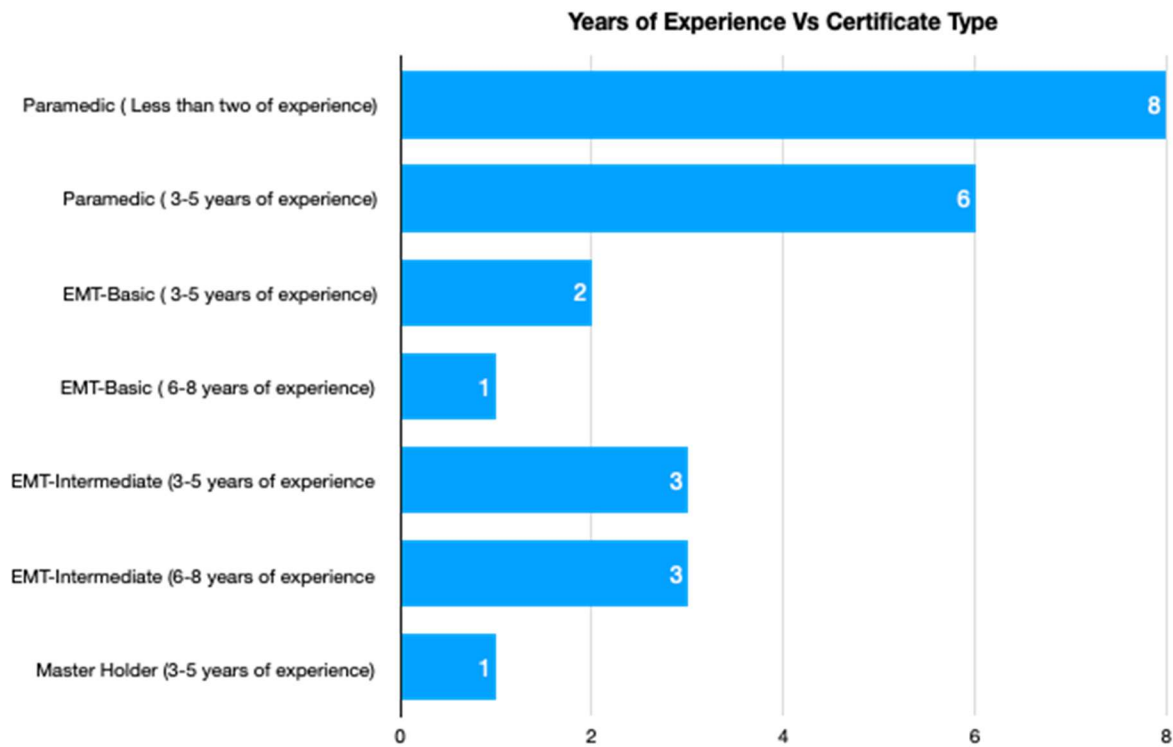
In addition to analyzing the demographic data, the researcher performed comparative analyses of the demographic data. The researcher compared the years of experience of the participants with the certificate types held to determine if any patterns arose such as if those participants with more experience also held certain certificate types.



## A Comparison of Years of Experience Versus Certificate Type

The demographic data and the data from the first two questions were further analyzed. Figure 4.1 depicts the findings from the comparison of the participants' years of experience to the type of certificate held. The emergency medical technicians have four types of certificate and each have different requirements and credentials. These certificates types are Paramedics, EMT-basic, EMT- intermediate and participants who hold a master's degree certificate. Figure 4.1 shows the years of experience among the participants (n=24) and their distribution across the four different types of certificate holdings.

*Figure 0.1 The participants Years of Experience Compared to Certificate Type*



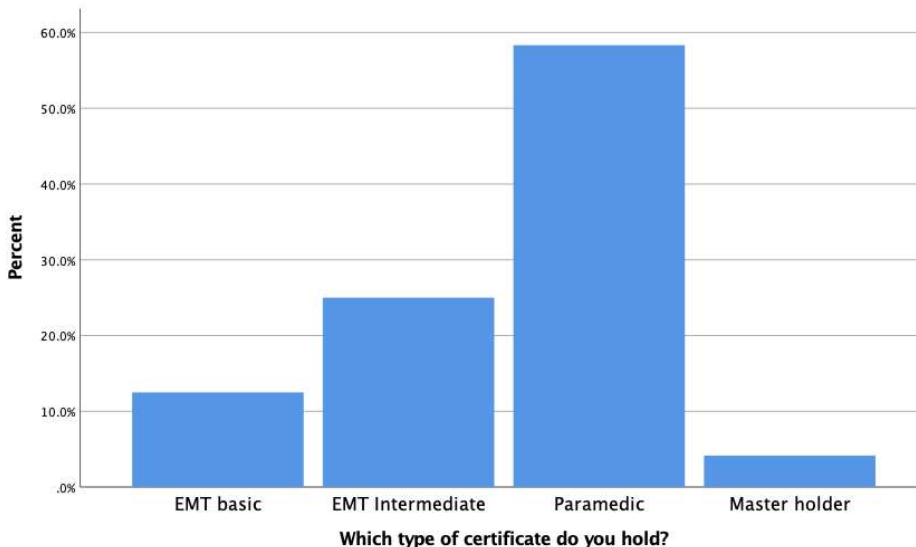
## Findings Survey Queries

### Part One: Responses to the Survey Questions (Multiple Choices)

The survey (See Appendix D) was completed online by the paramedics and EMTs (n=24) had four multiple choices questions. The findings are presented here in the order of the questions asked.

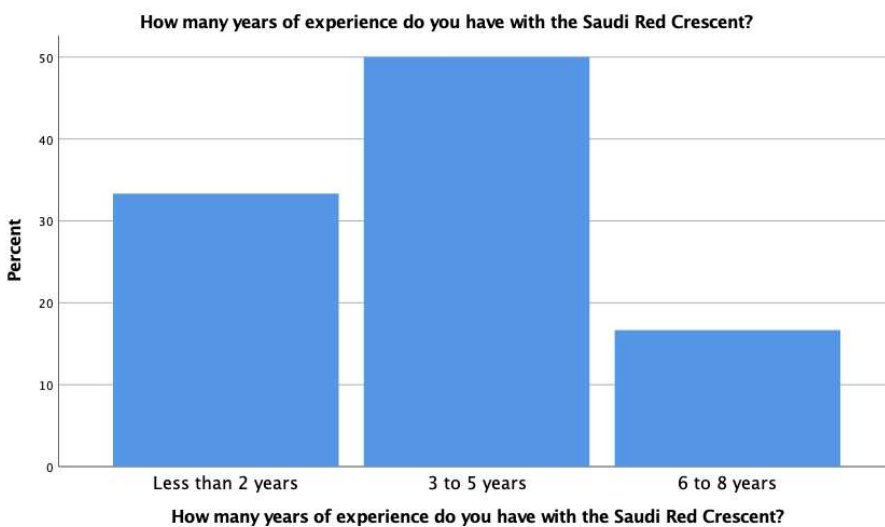
The first question asked participants to indicate which professional certifications they held. Figure 4.2 illustrates the certifications held by the 24 SRCA participants in the study. As shown in Figure 4.2 the participants hold various certificates in the emergency medical services. Three participants (12.5%) hold the Emergency Medical Technicians (EMT)- Basic certificate; six (25%) hold the EMT intermediate; 14 (58.3%) hold the Paramedics certificate; and, one (4.2%) participant holds a master's degree certificate.

*Figure 0.2 Emergency Medical Certifications held by SRCA*



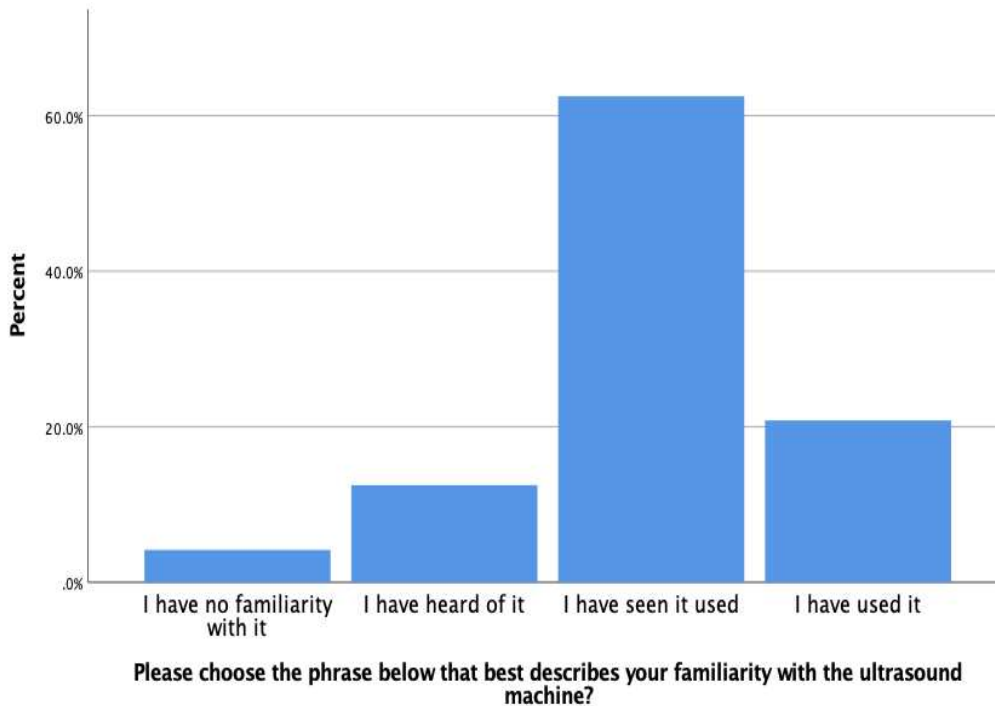
Participants were then asked to report their years of experience in the Saudi Red Crescent. The responses showed that the 24 participants also varied by years of experience (See Figure 4.3). The majority of the participants (n=12) (50%) had three to five years of experience. Eight participants (33.33%) had less than two years of experience, and four participants (16.7%) had between six- and eight-years' experience in the Saudi Red Crescent. As the figure shows, none of the participants had over eight 8 years of experience in the Saudi Red Crescent ambulances.

*Figure 0.3 Participants' Years of Experience in the Saudi Red Crescent*



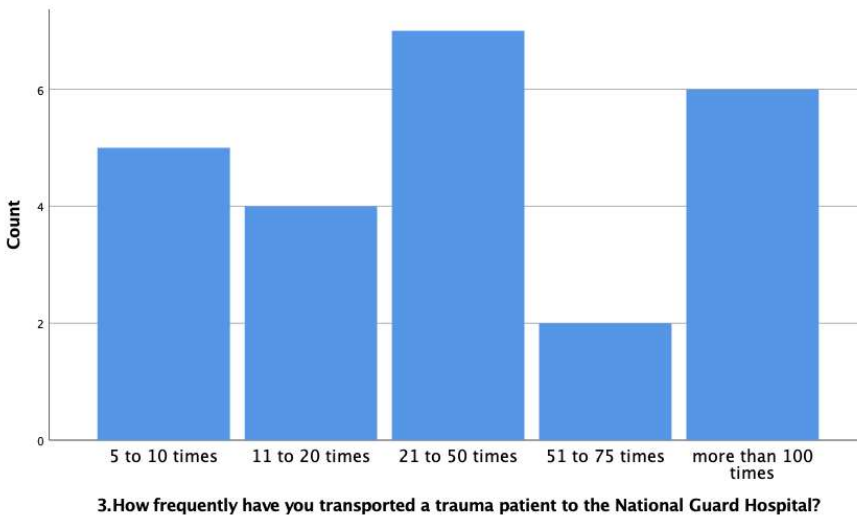
First, the participants were asked to rank their familiarity with the ultrasound equipment using a 4-point Likert Scale. Figure 4.4 illustrates the distribution of their responses. Fifteen participants (62.5 %) indicated that they had seen the ultrasound used in various instances, five of the participants (20.8%) reported that they had previously used the ultrasound, three participants (12.5%) noted that they had only heard about the ultrasound machines as a diagnostic tool, and finally, one participant reported having no familiarity with the ultrasound machine.

Figure 0.4 Familiarity of the Participants with the Ultrasound Equipment



Next, participants were asked to indicate frequency with which they have transferred trauma patients to the National Guard Hospital during their ambulance experience. As illustrated in Figure 4.5. Five participants (20.8%) estimated they have transferred trauma patients between 5 to 10 times to the National Guard Hospital over the course of their time with SRCA. Four participants (16.7%) reported a history of transferring trauma patients between 11 to 20 times; seven participants (29.2%) had transferred trauma patients to the hospital between 21 to 50 times, two of the participants (8.3%) had transported trauma patients between 51 to 75 times, and six participants (25%) indicated they had transported patients more than 100 times to the National Guard Hospital.

*Figure 0.5 How Frequently Have Participants Transported Trauma Patients to the National Guard Hospital?*



## **Part Two: Responses to the Survey Questions (Open End Questions)**

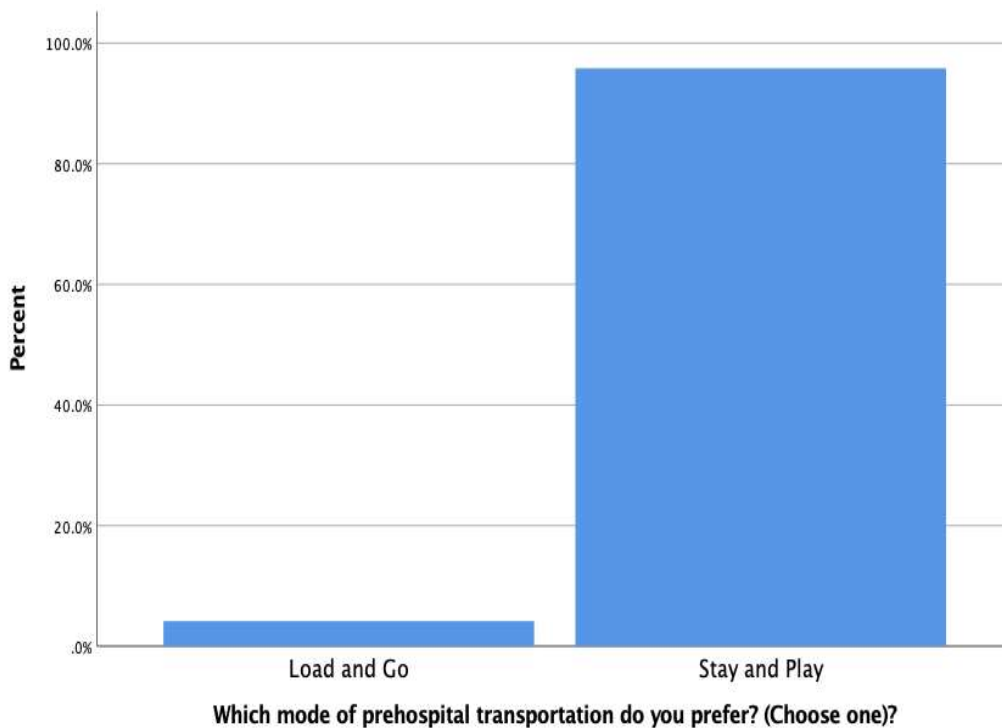
The online survey (See appendix D) also contained eight open -ended questions to further inform the research question. Data were organized through an excel sheet to support the analysis of individual questions as well as to compare the responses of the twenty-four paramedics and EMTs to each other to find the common themes across the participants' responses. Each question is described in turn:

### **Open-Ended Q1: Which mode of prehospital transportation do you prefer? Please explain the reasons for your choice:**

This question has two section a multiple choice and a short answer to explain the justification of their choice. Participants were asked to indicate which transportation method they preferred for patients with trauma. Their choices were “stay and play” (perform interventions in the field to help the patient, or “load and go” (quickly secure the patient into the ambulance and

head to the hospital with minimum prehospital intervention) As Figure 4.6 illustrates nearly all of the respondents (n=23) indicated a preference for “stay and play”.

*Figure 0.6 The Participants’ Preferred Mode of Transportation in the Prehospital Setting*



In fact, (99%) chose the “stay and play” as their preferable mode of transportation with only 1% (n=1) indicating a preference for “load and go” as their preferred choice for transporting trauma patients to the hospital.

To further probe why participants selected one transportation mode over the other, the question accompanied by a query asking participants to explain the reason for their choice. Twenty-three of the 24 participants provided a short statement of justification for their choice, with one participant providing no reason to support his response. Of the 23 who responded, five participants simply wrote “I don’t know” which also provided no justification for their choice.

The remaining participants (n = 18) offered a variety of reasons for their choice. Examples of their reasons are captured in Table 4.1.

*Table 0.1 Participants' Reasons for Choosing A Favorite Mode of Transportation*

---

- o All the ambulances in the SRCA are well equipped and does not need a load and go mode since we have capable paramedics and resources.
  - o If the case is critical, I will manage the airway or stop the bleeding, then I will transport the patient to the nearest hospital as soon as possible.
  - o It depends on the case, some cases you need to stop the bleeding, and some might need a CPR, so we can use the stay and play mode of transport.
- 

**Open-Ended Q2: Based on your familiarity with the ultrasound, what do you think will be the impact of equipping the Saudi Red Crescent ambulances with ultrasound machines to diagnose trauma patients in the prehospital setting?**

This question was designed to further examine the perceived impact of equipping the Saudi Red Crescent Authority with the ultrasound to help diagnose trauma patients in the prehospital setting. The participants were directed to provide a response based on their familiarity with the ultrasound machines. Three participants stated having no knowledge about the possible impact of the ultrasound and its application in the prehospital setting. One of participant stated that an implementation of the ultrasound could have a negative impact in terms of wasting paramedics' time on the scene to the detriment of the patient. Another participant mentioned that paramedics might not have enough time to employ the ultrasound at the scene while trying to perform basic interventions such as clearing patients' airways and supporting

breathing. This participant also mentioned that the movement of the ambulance might impede the use of the ultrasound and also noted that people who gather at the scene might limit the paramedic's ability to use the ultrasound there. One participant stated that there would be no impact if the ultrasound is implemented in the ambulance. Two participants mentioned that the implementation of the ultrasound might not be valuable in the ambulance and might negatively impact the "golden hour" aspect in trauma patients. Seven participants stated that a positive impact of implementing the ultrasound might be focused on early diagnoses of trauma patients especially if the patients are suffering from internal bleeding. Three of the participants mentioned that equipping the ultrasound in the Saudi Red Crescent would have a positive impact on the patient's condition and case assessment. The rest of the participants (n = 6) provided other ideas regarding the impact of the ultrasound on the Saudi Red crescent. Their reasons are captured in Table 4.2.

*Table 0.2 Participants Answer About the Impact of Equipping the Saudi Red Crescent Authority with the Ultrasound Machines*

- 
- It possible but is very expensive.
  - It could help in diagnosing some cases, but it needs an extensive training and also, needs a huge budget that is why I do not prefer it to be in the ambulance.
  - It is better to equip the SRCA with the ultrasound in order to save a lot of work and time and to know the condition of the patient in early stages it will impact the hospital in terms of early diagnoses and the hospital will be able to start the treatment upon arrival.
  - It is very important in diagnosing the patient and knowing how to deal with the injuries prior to the arrival to the hospital. Also, it will save time for the patients inside the emergency room.
-



- 
- To know exactly what I can offer to the patients and which hospital suites his case.
  - Implementing the ultrasound has a positive impact such as in patient with internal bleeding, hospital will be ready for trauma patients in terms of preparing the Operation Room (OR).
- 

**Open-Ended Q3: If we implemented pre-hospital ultrasound in the Saudi Red Crescent, what role do you think the National Guard Hospital’s Emergency Department would play?**

This question was asked to examine the perceptions of the paramedics and EMTs regarding the role of the National Guard Hospital in the possible implementation of the ultrasound in the Saudi Red Crescent Authority. Three of the participants stated they had no opinion about the possible role of the National Guard Hospital. Two participants mentioned that the role of the National Guard Hospital could be to reassesses the patient’s condition and the paramedics work. Six participants perceived that with the addition of the ultrasound, the hospital would have a prior knowledge about the patient’s condition and that would help in reduce the patient’s time in the emergency department and even result in bypassing the emergency department to go directly to the operating room. In addition, four of the participants mentioned that implementing the ultrasound in the Saudi Red Crescent Authority could help the National Guard Hospital to provide quicker medical intervention since the paramedics already obtained the ultrasound imaging and shared it with the emergency department ensuring more immediate treatment of the patient. This would mean, then, that the hospital could take a full advantage of the “golden hour” aspect of care of the trauma patients.

The remaining the participants (n = 8) provided a variety of roles that the National Guard Hospital might play if the ultrasound is implemented in the prehospital setting. Their

reasons are captured in Table 4.3.

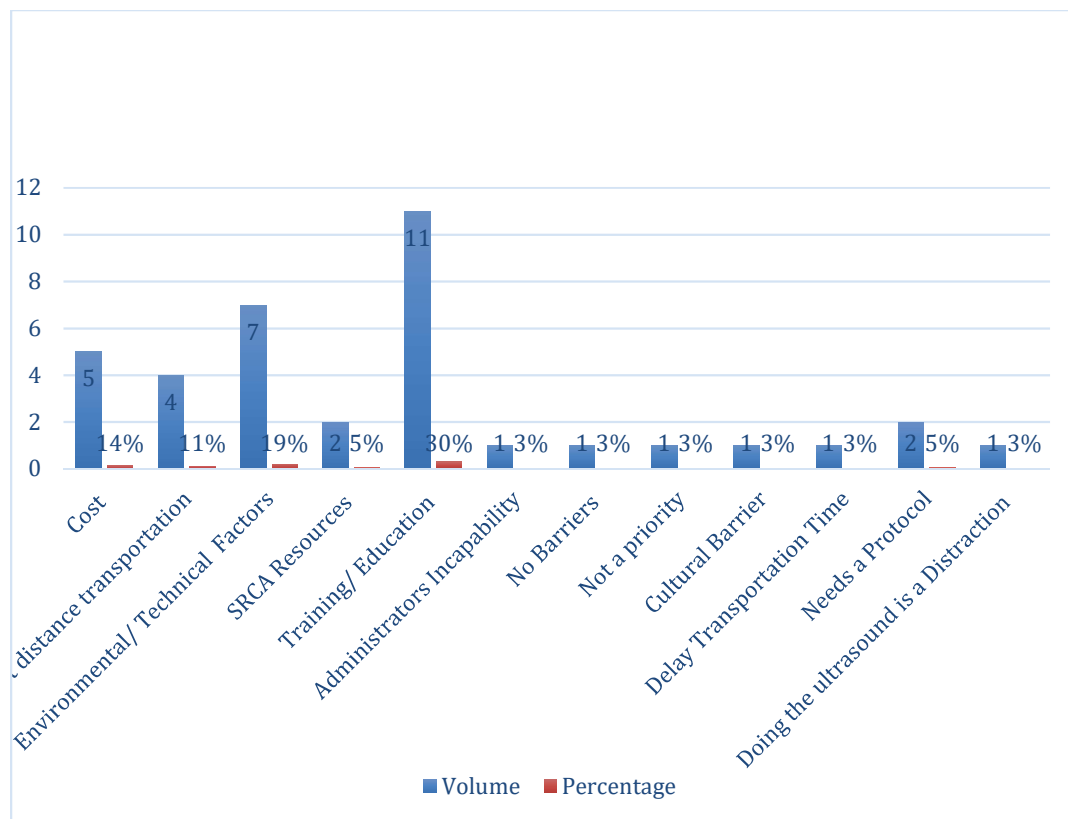
*Table 0.3 Participants' Perceptions of the Role of the National Guard Hospital in the Proposed Implementation of the Ultrasound Machines in the Saudi Red Crescent Authority and the Perceived Barriers*

- 
- Many things can't be done in the ambulance for example, blood transfusions. The National Guard Hospital
  - The hospital will provide an advance patient care based on the prehospital setting diagnoses by using the ultrasound.
  - The main role of the National Guard Hospital's Emergency Department is not performing the ultrasound but if we implement the prehospital ultrasound in SRCA that will help the Emergency Department to diagnose the patients, saving a lot of time by preparing the right resources such as surgical intervention.
  - The National Guard Hospital's Emergency Department will be ready to receive the patient which could increase the survival rate of the patient
  - The National Guard Hospital's Emergency Department will have the same role as it is right now.
  - The role of the hospital must be in a positive way.
  - A collaborative role between the two agencies.
  - Giving them detailed diagnoses.
-

**Open-ended Q4: What do you think would be the main barriers to the potential implementation of prehospital ultrasound in the Saudi Red Crescent? Please explain.**

This question was designed to reveal perceptions of existing barriers to implementing the ultrasound in the Saudi Red Crescent Authority. To further probe paramedics reasoning, they were directed explain why these things as barriers to successful implementation. Figure 4.7 illustrates the participants’ stated barriers to implementing the ultrasound in the Saudi Red Crescent Authority.

*Figure 0.7 Participants’ Perceived Barriers to Implementing the Ultrasound in the Saudi Red Crescent Authority*



As depicted in Figure 4.7 above, the majority of the participants (n=11) view training and education as the main barrier in implementing the ultrasound in the Saudi Red Crescent. Environmental and technical difficulties were considered to be the second main barrier (n=7) in implementing the ultrasound devices. The environmental and technical difficulties that were mentioned by the participants were mainly focused on the ambulance movement and the hot climate in Saudi Arabia that might cause the machines to malfunction. Cost of the ultrasound machines was the third most frequent barrier (n=5) mentioned. Participants felt that the cost of purchasing and maintain the machines would pose an obstacle to implementing the ultrasound in their organization. In addition, four participants felt that the short distance between the site of the trauma and the location of the National Guard Hospital could be a barrier for the Saudi Red Crescent to choose to implement such a device. Those participants mentioned that inside the city paramedics and EMTs cannot perform the ultrasound in a timely manner and might better serve the patient by driving the patient the short distance to the hospital and saw more value in employing an ultrasound during a long-distance transportation. The remaining participants provided a variety of other existing barriers of implementing the ultrasound in the Saudi Red Crescent. Their answers are captured in Table 4.4.

*Table 0.4 Participants' Responses to Perceived Barriers to Implementing the Ultrasound in the Saudi Red Crescent Authority*

- 
- **The capability of the SRCA are not enough to implement the ultrasound in the ambulance.**
  - **Not enough paramedics working in the back of the ambulance.**
  - **I disapprove the idea of implementing the ultrasound in the ambulance because the people who are responsible for the SRCA are inexperienced and they stayed in their positions for a long time and did not do anything to improve the prehospital setting.**
-

- 
- **I do not think there will be any barriers.**
  - **I think there are bigger problems in the Saudi Red Crescent that needs attention and fixing more than the application of the ultrasound.**
  - **It is hard to do the ultrasound inside the ambulance due to its movement. In addition, If the patient is female, performing the test can be uncomfortable and awkward.**
  - **It might delay the transportation time and It needs a lot of training and practice.**
- 

**Open-Ended Q5: Which current policies and protocols in the Saudi Red Crescent might act as barriers to the implementation of prehospital ultrasound?**

This question sought to examine perceptions connected to current policies and protocols that might act as a barrier within the Saudi Red Crescent Authority. Nine of the participants offered no opinions regarding existing policy or protocols that might act as a barrier within their organization. One participant mentioned that SRCA working hours policy where paramedics and EMTs must work a 12-hour shift could act as a barrier in his view to performing an effective ultrasound imagining. Two participants stated that there are no current policies or protocols related to how to use the ultrasound in their organization. Two participants perceived that the mode of transportation could act as a barrier in implementing the ultrasound in terms of policy and protocol since that load and go mode of transportation could limit their ability to effectively perform the ultrasound. One participant stated that administrators in the Saudi Red Crescent should visit other countries to observe EMS practices around the world in order to enhance the current practice in the organization that would shape policy and protocol. The rest of the participants provided a variety of responses regarding protocols and policy that might act as a barrier in implementing the ultrasound in the Saudi Red Crescent. Their responses are captured in Table 4.5.

*Table 0.5 Participants Answers about the Policy and Protocol that might Act as a Barrier in Implementing the Ultrasound in the Saudi Red Crescent*

- 
- **Cost of the machines.**
  - **Distribution of devices.**
  - **Many reasons.**
  - **Multiple EMS teams such as ALS and BLS. also, the SRCA do not trust the paramedics or the EMTs to diagnose or make decisions.**
  - **Not enough space of the device inside the ambulance.**
  - **Supply Department inside the SRCA, if the ultrasound is implemented, they might provide the necessary equipment that comes with the ultrasound such as GEL in one day but the next day they might not provide it which can disrupt our work.**
  - **Training.**
  - **I think the less experience in its use.**
  - **Paramedics at the SRCA did not know how to use the ultrasound.**
- 

**Open-Ended Q6: How does your work in the prehospital setting contribute to the work of the Emergency Room physicians at the National Guard Hospital?**

This question probed the paramedics and the EMTs regarding their views of their own contribution to the emergency doctors who work at the National Guard Hospital. Twenty-one percent of the participants mentioned that their work contributes to the emergency doctors by assessing the patient condition. Fifteen percent of the participant reported that their contribution mainly focuses on providing the emergency doctors a patient's detailed medical history that includes current information about the patient's status and condition. An additional 15 % of the participants mentioned that they considered early medical intervention to be their main contribution to the emergency doctors at the National Guard Hospital. Twelve percent of the participants mentioned that the work of SRCA is to help the National Guard Hospital to assess and diagnose the patients. The rest of the participants (n = 3) provided a variety of answers in

their contribution to emergency doctors at the National Guard Hospital. Their answers are captured in Table 4.6.

*Table 0.6 The Participants' Answers about their Contribution to the Emergency Doctors at The National Guard Hospital*

- 
- **I think our contribution to the Emergency Room physicians at the National Guard Hospital is 20%.**
  - **There is no benefit from our work, we are just a transportation services, doctors are doing the ultimate diagnoses and treatment.**
  - **I do not know.**
- 

**Open-Ended Q7: How confident are you in your ability to learn to use the ultrasound to accurately diagnose a trauma patient in the prehospital setting?**

Successful implementation of the ultrasound in SRCA would be enhanced by a high level of positive self-efficacy for learning to use the machine among the paramedics and EMTs. This question was asked to determine the perceived levels of self-efficacy among the paramedics and the EMTs to diagnose trauma patients by using the ultrasound in the prehospital setting. Forty-six percent of the paramedics and the EMTs mentioned that they were confident in their own ability to learn how to use the ultrasound. Thirty-two percent of the participants mentioned that they were confident that they could do it with proper training and education. In addition, 2 % of the participants stated that they were not confident in their ability to learn how to use the ultrasound. The rest of the participants (n = 3) provided a variety of answers regarding their confidence levels related to their ability to learn how to use the ultrasound to accurately diagnose trauma patients in the prehospital setting. Their answers are captured in Table 4.7.

*Table 0.7 The Participants' Responses to How Confident They Were in Their Ability to Diagnose Trauma Patients by Using the Ultrasound in the Prehospital Setting*

- 
- **I am confident but in one condition, provide us with capable professionals to train us.**
  - **I am not confident now, but we have to be involved in extensive training.**
  - **I will be confident in my ability if I learned how I can use the ultrasound inside the ambulance**
- 

**Open-Ended Q8: How confident are you in the ability of the paramedics and EMTs in the Saudi Red Crescent to learn to use an ultrasound and then accurately diagnose a trauma patient in the prehospital setting?**

This question was designed to determine perceived levels of collective efficacy among the paramedics and the EMTs working together in the Saudi Red Crescent on their ability to learn how to use the ultrasound in the prehospital setting. Fifty-four percent of the participants mentioned that they were confident in their fellow paramedics and EMTs in their ability to learn how to use the ultrasound. Seventeen percent stated they were not confident that their fellow colleagues in the Saudi Red Crescent Authority could learn to use the ultrasound successfully. In addition, 13% of the participants stated that they were confident that some of their fellow paramedics and EMTs could learn to operate the ultrasound successfully. The rest of the participants (n=4) provided a variety of answers to this question and those answers are captured in Table 4.8.

*Table 0.8 Participants' Responses Regarding Confidence in the Ability of the Paramedics and the EMTs to Learn how to use the Ultrasound in the Prehospital Setting*



- 
- **First provide the paramedics and the EMTs with extensive training.**
  - **I am confident in case of providing extensive and excellent training.**
  - **I am confident in some of the paramedics and EMTs but not all of them due to indifference.**
  - **Hopefully.**
- 

## **Summary**

The first group of participants (N=24) currently served as paramedics and EMTs with the Saudi Red Crescent Authority. Their responses to questions to the survey questions shed light on the existing barriers not only in SRCA but also in other organizations such as the National Guard Hospital. These barriers included but were not limited to identification of existing implementation barriers within SRCA, the role of the National Guard Hospital if the ultrasound were implemented in the SRCA, and the impact of using the ultrasound in the ambulance. Their responses identified areas of policy and protocol in the National Guard Hospital that might act as a barrier in implementing the ultrasound, and revealed both strengths and gaps in self and collective efficacy among paramedics and EMTs in the Saudi Red Crescent

The majority of the participants agreed that training and education were the main barriers to implementing the ultrasound machines in the Saudi Red Crescent. They also considered environmental and technical difficulties as the second main barrier of implementing the device. When asked about the role of the National Guard Hospital if the ultrasound is implemented in the SRCA, the majority of participants agreed that the hospital would have prior knowledge about the patient's condition if a device such as the ultrasound has been implemented in the ambulance—a factor that would assist in treating the patients with greater accuracy and

efficiency. They described the benefit of putting these devices in the hands of the paramedics and the EMTs, noting that the hospital would benefit from having prior knowledge of the case prior to receiving the patient. They concluded that this prior knowledge could result in patients spending less time in the emergency department resulting in early diagnoses of the patients. Most of the participants agreed that implementing the ultrasound in the ambulance would allow the paramedics to render early diagnosis of abdominal bleeding in trauma patients.

Other participants, however, mentioned that the implementation of the ultrasound could have a negative impact on patients. Their consideration of negative impacts was focused on the time spent to use the ultrasound imagining could delay the use of other life saving measures. These negative impacts could ultimately affect the golden hour aspect of trauma patient care.

In terms of policy and protocols within the Saudi Red Crescent Authority that might act as a barrier in implementing the prehospital ultrasound the majority of the participants could not think of a policy or protocol that might hinder the implementation of such a device. Others gave various responses regarding the policy and protocol within the Saudi Red Crescent that might act as a barrier of implementation the ultrasound device. Their answers were captured in Table 4.5.

Finally, in reporting their confidence in themselves and their colleagues, the majority of the participants described perceptions of high self-efficacy in their own ability to learn to the ultrasound device. Very few of the participants reported having low levels of confidence in their own ability to learn the ultrasound imaging. In terms of collective efficacy, the findings show that the majority of the participants had high levels of confidence—high collective efficacy—with respect to the ability of their fellow paramedics and EMTs to learn how to use the ultrasound. And, some participants reported that their perceptions of their colleague's ability to learn how to use the ultrasound was dependent on which particular colleague they were

considering. This finding tells us that the participants perceived some of their colleagues to be less capable than others.

### **Part Three: Responses of the interview Questions**

#### ***The Saudi Red Crescent Administrators***

The researcher conducted four interviews with four separate administrators who were working in the Saudi Red Crescent Authority. Each interview discussed the inherent barriers to the potential implementation of the prehospital ultrasound between the Saudi Red Crescent Authority (SRCA) and the National Guard Hospital (NGH).

#### **Administrator One:**

The first interview was conducted with Saudi Red Crescent Authority (SRCA) Administrator One, this administrator had spent more than ten years in the administrative arena (See Appendix E). He was an EMT in his early career, therefore, he was familiar with the multifaceted challenges that the Saudi Red Crescent Authority faces from both from clinical and administrative perspectives. Administrator One stated that the mode of transportation in the prehospital setting is solely based on the case itself. He added that with critical patients, fast transportation is the key to survival because medical professionals need to preserve the golden hour aspects of trauma patient care. He also mentioned that while SRCA typically transport the patients, SRCA can provide the medical intervention that the patient needs. In regard to the impact of possible ultrasound implementation in the ambulance, Administrator One stated that that it would have a positive impact in terms of early diagnoses and effective patient assessment.

When asked about possible barriers to successful implementation, Administrator One felt that the main barriers of implementing the prehospital ultrasound in the Saudi Red Crescent were

mainly focused on the device itself. He described those barriers as the ultrasound machine's portability and size, and the impact to the ultrasound of various environmental factors. He also noted the need for extensive training. In addition, Administrator One also mentioned that the work of the paramedics must be collaborative in nature with the emergency doctors in the National Guard Hospital in terms of ensuring that the right medical intervention and the most effective case assessment resulted from their work. Administrator One emphasized that both organizations must work together to ensure the successful implementation of the prehospital ultrasound. He also felt that the National Guard hospital would benefit from information regarding the condition of incoming patients that would result from the diagnoses of the patient by the paramedics using the ultrasound. This information, in his view, would enable the National Guard Hospital to prepare, in advance, the appropriate resources such as those required for early surgical intervention.

Finally, Administrator One commented on the overall shortage of training among the paramedics. He felt confident in the paramedic's ability to learn to use the ultrasound, but his confidence level was tied to the condition that the initiative would provide the paramedics with extensive courses related to its successful implementation.

**Administrator Two:**

Administrator Two from the Saudi Red Crescent Authority (SRCA) has spent more than 17 years both in clinical and administrative duties (See appendix F). Administrator Two worked as a paramedic in the ambulance and has an extensive background in patient care. As far as mode of transportation, Administrator Two stated a preference for using the "stay and play" mode due to the sufficient resources that SRCA paramedics had in addition to his confidence in the skills of the paramedics to carry out the medical interventions.

In terms of the ultrasound, Administrator Two had limited familiarity with it and had only seen it used in the emergency department. He also felt that the ultrasound implementation would have a more positive impact on the hospital than it would on the role of the paramedics in the ambulance. Administrator Two did not view an initiative to include the ultrasound in the ambulances as a priority because he felt the paramedics would not be able to engage in significant intervention based on information provided to them by the ultrasound, like if they discovered that a patient had internal bleeding, for example. Administrator Two also mentioned that the barriers inherent in implementing the ultrasound in the Saudi Red Crescent included ultrasound portability and size, cost, and the need for extensive training and environmental factors. He also concluded that transportation factors, such as the movement of the ambulance could hinder the ability of the ultrasound to function properly.

Administrator Two, felt strongly that since the ultrasound is not currently in the emergency medical services program's curriculum and that lack of familiarity and training could act as a significant barrier in the implementation process. Therefore, Administrator Two saw an urgent need for more productive collaboration between the Saudi Red Crescent Authority and the National Guard Hospital. His thoughts centered on the lack of confidence hospitals have in the paramedics, He added that the National Guard Hospital is not the only hospital that has no confidence in the paramedics' ability to conduct appropriate diagnoses and treatment. In his view, all of the hospitals that are associated with the ministry of health share this lack of confidence. To address this lack of confidence, administrator Two explained that both the Saudi Red Crescent and the National Guard Hospital function as separate organizations and are governed by different policies and protocols. Again, this institutional separation presents a barrier to shared confidence and successful use of the ultrasound. He therefore stated the need for

a unifying protocol on how and when to use the ultrasound if such an initiative is implemented. In conclusion, Administrator Two has confidence in the paramedics' ability to learn to use the ultrasound, but his confidence is predicated on providing the paramedics with extensive courses and professional development experiences.

### **Administrator Three**

Administrator Three of the Saudi Red Crescent Authority (SRCA) has nine years of experience both in clinical and administrative duties (See appendix G). He was an emergency medical technician (EMT) in his early career with SRCA. Administrator Three saw "Load and Go" as the preferable method of transportation in the Saudi Red Crescent because he saw the patient's time as critical. In his view, therefore, quick transportation to the hospital is key in the emergency medical services.

In regard to the ultrasound, Administrator Three stated that the ultrasound could have a positive impact on trauma patients by allowing the paramedics to conduct an early diagnosis. When asked about the role of the National Guard Hospital in an initiative to equip the Saudi Red Crescent with the ultrasound, Administrator Three emphasized the importance of collaboration between these two agencies for a successful implementation of the ultrasound. He stated that both agencies would need to adopt a shared protocol to guide paramedics regarding how and when to use the ultrasound and to guide the hospital employees regarding how to deal with trauma patients who were diagnosed with the ultrasound in the prehospital setting. In addition to a unifying protocol, Administrator Three stressed the need to consistently and intentionally monitor the progress of the implementation initiative of the ultrasound in the SRCA.

Regarding the existing barriers to implementing the ultrasound, Administrator Three felt that the main barriers for the Saudi Red Crescent were associated with device technology and the

needed for constant maintenance of the machines themselves. In addition, Administrator Three saw the cost of the device as a potential barrier and mentioned that the paramedics might be held financially responsible for any loss or damage to the ultrasound devices. Having said that, though, Administrator Three stated that the paramedics' work supported by the ultrasound could potentially contribute to the physicians' work in terms of case assessment, early diagnoses, and ultimately provide more timely medical intervention to the patients. Administrator Three is confident in the ability of the paramedics to learn how to use the ultrasound, but his confidence is dependent on the provision of extensive training with the ultrasound to the EMTs and the paramedics in the Saudi Red Crescent.

#### **Administrator Four**

Administrator Four of the Saudi Red Crescent Authority (SRCA) has 20 years of experience both in clinical and administrative duties (See appendix H). He started as an EMT basic in his early career with the Saudi Red Crescent and has held various and important positions within the organization.

Administrator Four prefers the "Load and Go" mode of transportation in prehospital setting and saw it as the safest mode of transportation of patients. He elaborated more on the reason behind his choice and stated that fast transportation of critical patients is the key element in the prehospital setting. He felt, therefore, that paramedics should transport patients to the hospital as soon as possible so the patients can undergo advanced medical treatment.

Administrator Four cautioned, however, that the mode of transportation should be dependent on the case itself so, in the case of non-critical patients, paramedics can use the "Stay and Play" mode since there is no life-threatening condition that would require fast transportation.

Regarding the ultrasound itself, Administrator Four concluded that implementation of such a device could have a positive impact on the Saudi Red Crescent because it would give the paramedics the necessary means for early medical intervention and more accurate diagnose of trauma patients. In addition, Administrator Four stated that the National Guard Hospital would also benefit from such an initiative in terms of receiving accurate information about incoming patients and preparing the right resources before the arrival of the patients.

In regard to the existing barriers, Administrator Four mentioned that a unifying protocol on how and when to use the ultrasound would be crucial for a successful implementation of the initiative. He also stated that the ultrasound would require proper sterilization since it would be used regularly on various patients; a factor that could become a barrier. He also saw the potential for the paramedics' work with the ultrasound to either contribute or hinder or the physician's work in many ways. For example, he felt that paramedics could positively contribute to the physician's work by accurately assessing the patients which would help physicians to select the right medical intervention. On the other hand, paramedics could hinder the physicians' work if they provided inaccurate information about a patient's condition. Administrator Four is confident in the ability of the paramedics to learn to use the ultrasound and then accurately diagnose a trauma patient in the prehospital setting.

## **Summary**

The administrators (n=4) in the Saudi Red Crescent were interviewed to gather their perspectives regarding the implementation of the ultrasound and uncovering perceived barriers that might negatively affect its application from an administrative point of view. Multiple interview questions revealed their preferable mode of transportation, existing barriers of



implementing the ultrasound, and the administrator's confidence in the paramedics' and the EMTs' ability to learn how to use the ultrasound.

Administrator one stated that the mode of transportation should be solely based on the case itself to determine when fast transportation is the key. In contrast, administrator two chose "Stay and Play" as his preferable mode of transportation since he felt that the Saudi Red Crescent had the necessary resources and capable paramedics to provide the patients with the right medical intervention. In contrast, administrator three preferred the "Load and Go" transportation mode stating that patient time was critical especially in case of trauma patients. Administrator Four agreed that "Load and Go" is preferable since it is the safest mode of transportation and the patient's time spent at the scene can be minimized.

In terms of the existing barriers to the implementation of the ultrasound in the Saudi Red Crescent the administrators again offered differing points of view. Both Administrators One and Two agreed there were multiple barriers to the application of the ultrasound such as ultrasound portability and size, environmental factors, training and cost. In contrast, Administrator Three felt that the ultrasound's constant need for maintenance might act as a barrier to the implementation process and mentioned the cost of the ultrasound machines as well. Administrator Four pointed out the barrier of the need to constantly sterilize the device since it will be used on various patients. He also mentioned the need for a unifying protocol on how to use the ultrasound saying that the lack of such a protocol would be a barrier. When asked about their confidence in the paramedics' and the EMTs' ability to learn how to use the ultrasound machines, the majority of the administrators agreed that their confidence in the paramedics was conditional. They again highlighted the need for the EMTs and paramedics to receive the necessary education and training required for successful implementation.

### ***The National Guard Hospital Emergency Physicians***

The researcher conducted interviews with two Emergency Physicians who either previously worked with or are currently working with The National Guard Hospital. The emergency doctors have significant experience in the administrative and clinical duties both in the hospital and in the prehospital setting. The questions probed the inherent barriers to the potential implementation of the prehospital ultrasound between the Saudi Red Crescent Authority (SRCA) and the National Guard Hospital (NGH).

#### **Emergency Physician One**

Emergency Room Physician One is a retired emergency doctor in the National Guard Hospital. He has had significant experience in the emergency department and the prehospital setting (See Appendix I). He had worked for the hospital for almost 17 years that provided him with a great deal of varied experience both in the hospital and the prehospital emergency services. During the interview, Emergency Physician One was asked for his opinion regarding the best mode of transportation for maximum patient benefit in the prehospital setting. In his response, he noted that the decision of whether to use “Stay and Play” or “Load and Go” is dependent on the particular case itself. He elaborated more on that by saying that in a case of Cardiopulmonary Resuscitation (CPR) paramedics need to use the “Stay and Play” as the preferred mode of transportation because he felt it would be dangerous to interrupt the CPR process.

Emergency Room Physician One had a different viewpoint regarding trauma patients. For these patients he advised the use of the “Load and Go” mode of transportation. He felt this was preferable since paramedics would be less likely engage in significant medical intervention for

the patients because he views that the treatment of trauma patients does not occur on the scene nor in the emergency department. Medical treatment for trauma patients, in his opinion, happens on the surgeon's table. He went on to explain that in some instances, paramedics can use a combination of modes to address the trauma patients' needs. For example, if a trauma patient is bleeding, then, the paramedic must stop the bleeding (Stay and Play) before transporting the patient (Load and Go) to the nearest hospital.

When asked about the usage of the ultrasound in the hospital or the prehospital setting, Emergency Room Physician One explained that this device is very significant, underscoring that emergency rooms cannot operate without it. In terms of the prehospital setting, his belief is there is a need to implement an ultrasound since it will help the emergency doctors in prepare the right resources in anticipation of the patient's needs. Also, he believes the ultrasound has the potential to help in triage enabling the receiving emergency physicians to make better decisions regarding sending the patient to the right facility. He qualified his responses saying that there is always the fear that in implementing the ultrasound in the prehospital setting and adopting a "Stay and Play" mode the system might lose time at the expense of patients care.

In response to the interview, Emergency Room Physician One commented on the impact of an initiative to use the ultrasound in the prehospital setting. In his view, the impact will depend on the location of the accident and how quickly the transportation to the hospital can happen. He gave the following example, "if we have an accident near the National Guard Hospital and the patient does not have a file with our hospital if the patient has a positive Focused Assessment with Sonography for Trauma (FAST) when the paramedics used the ultrasound that means paramedics must transport the patients to the hospital even if the patient

does not have a file with our hospital. Also, if the patient has a negative FAST, we can transport the patients to the hospital where he has his file in”.

Next Emergency Room Physician One was asked for his opinions of the role of the emergency doctors at the National Guard Hospital if there was implementation of the ultrasound in the Saudi Red Crescent. In his response, he mentioned that the role would be focused on the supervision of the ultrasound scans and would require putting shared protocols in place to train the paramedics. He added that those leading the initiative must figure out how many scans would be needed during the training period in order to provide evidence that the paramedics are able to accurately read the ultrasound scans. In other words, he strongly suggested that any initiative must contain quality indicators rather than simply relying on indicators of quantity.

In regard to the potential barriers of implementing the ultrasound, Emergency Room Physician One said that the cost of the ultrasound could present as a barrier. In addition to the initial cost, the ultrasound device would require constant maintenance, training and education. He noted that environmental factors such as sunlight blocking the reading of the scan might also present barriers depending on the location.

To probe further, the researcher asked about the current policies and protocols within the National Guard Hospital that might act as a barrier in the implementation of the ultrasound in the Saudi Red Crescent was posed. The emergency physician responded that even in the emergency room department within the National Guard Hospital, areas of mistrust become barriers. He said that for example, radiologists often do not trust the emergency room’s first ultrasound scan. Therefore, he explained the importance that any initiative to employ ultrasounds in the field must include systematic ways to create and sustain trust between current emergency doctors and radiologists as well as between the Saudi Red Crescent Authority and the emergency physicians.

Emergency Room Physician One also saw the potential for the paramedics' work to either hinder or contribute to the physician's work in many ways in terms of the initiative to use the ultrasound. He mentioned that all paramedics deeply contribute to the work of emergency physicians yet cautioned that as an emergency doctor he thinks the root problem with the paramedics and the emergency doctors lies in the current culture. He stated that the two entities do not work to intentionally collaborate, nor do they have a strong relationship with each other. He stated that unless they learn to work together and trust in each other the emergency room physicians and Saudi Red Crescent Authority cannot function in an effective way. In his view, this lack of trust is the core problem between the two important groups of health professionals.

When asked whether he was confident in the paramedics' ability to learn how to use the ultrasound, he mentioned that some of the paramedics have the ability to learn it. But the main question he had was whether all the paramedics would be willing to learn. He wondered if there would be resistance from the paramedics themselves about using the ultrasound in the ambulance.

In conclusion, Emergency Room Physician One was confident in all paramedics' ability to learn to use the ultrasound if they make it a priority. He strongly felt that if they made a priority it would be very possible to put a strategic plan in place to both implement the ultrasound in the prehospital setting, and also build trust between the National Guard Hospital and the Saudi Red Crescent Authority. This plan must continuously engage all stakeholders in education, problem solving, and team building to ensure the success of the initiative.

## **Emergency Physician Two**

Emergency Room Physician Two was currently working in the National Guard Hospital (See Appendix J). He served in many important positions within the Hospital as well as within King Saud bin Abdul-Aziz University for Health Sciences.

When asked which mode of transportation was preferable, Emergency Room Physician Two stated that using “Load and Go” was the preferable choice for transporting patients to the hospital since using “Stay and Play” requires more experience and improved protocols in order to deal with the patients on the scene. He also stated that as an emergency room doctor he uses the ultrasound on a regular basis, and in his opinion, it plays a significant role in diagnosing the patients in the hospital.

When asked about the impact of equipping the Saudi Red Crescent ambulances with ultrasound machines, Emergency Room Physician Two responded that the Saudi Red Crescent was currently undergoing major improvements at all levels. He felt that the impact would be positive because it would help the emergency doctors prepare the right resources prior to the arrival the patient. In addition, he cited evidence that using the ultrasound in the prehospital setting decreases the mortality rate among patients. Therefore, he saw significant positive impact regarding implementation.

Emergency Room Physician Two commented on the role of the National Guard Hospital in an initiative to equip ambulances with the ultrasound. In his view it would enable the emergency room to dispatch the appropriate team member(s) since they would know in advance from the paramedics on the scene that they have an incoming patient with a Positive Focused Assessment with Sonography for Trauma (FAST). Also, working to implement the ultrasound

initiative would enable the hospital to potentially create a protocol that would allow trauma patients to go directly to the operation room.

When asked about existing barriers, Emergency Room Physician Two mentioned that in his opinion there were no barriers at the National Guard Hospital. He did, however, mention that in regard to the National Guard Hospital in terms of policy and protocol, a barrier might exist given that there is no specific emergency door for the patients who are being transferred by the ambulance. In the Saudi Red Crescent, however, he identified the following as barriers: a) training the paramedics to effectively perform the ultrasound; b) the movement of the ambulance; and, c) the device itself and how accurate it really would be in diagnosing the trauma patients.

He also saw the potential for the paramedics' work to either hinder or contribute to the physician's work in many ways. For example, he felt they could contribute to the emergency physicians' work if the paramedic was able to perform an accurate medical assessment. In contrast, he felt paramedics could hinder the work of the physicians that inaccurate assessment prevented the paramedics from providing advance notice about the patient's condition. He also discussed that personal belongings of the patients sometimes get lost on the scene creating a conflict with the patient's family and he worried that this might happen more frequently.

This emergency doctor is confident in the paramedics who are currently enrolled in the emergency medical services program at King Saud bin Abdul-Aziz University for Health Sciences. But he did not feel qualified to judge the paramedics who are currently working in the Saudi Red Crescent because he is not involved with them.

## **Summary of the Findings from the Emergency Room Doctors**

The data from the interviews with the emergency room doctors shed light on the inherent barriers of implementing the ultrasound in the Saudi Red Crescent. Both emergency doctors have an extensive experience in the hospital and prehospital setting. The interviews probed for perceptions regarding existing barriers of implementing the ultrasound, barriers in terms of policy and protocols in the National Guard Hospital, the role of the National Guard Hospital in the implementation process, and how confident the physicians were in the probability that the paramedics and EMTs could successfully master the use of the ultrasound.

In terms of the inherent barriers, the Emergency Physician One identified cost, consistent maintenance, environmental factors, training and education as the possible barriers. In contrast, the Emergency Physician Two felt that there were no barriers in the National Guard Hospital but discussed multiple barriers within the context of the Saudi Red Crescent. These barriers included training, movement of the ambulance and the accuracy of the device in diagnosing trauma patients.

When asked about policies and protocols that might act as a barrier in the National Guard Hospital, the two physicians interviewed offered different points of view. Emergency Physician One mentioned that there was already mistrust within the hospital itself. He gave the example of the lack of trust between the emergency doctors and the radiologists in the hospital in terms of the authentication of the ultrasound imaging. He also explained that this mistrust could very well extend to the paramedics when the ultrasound is implemented as a diagnostic tool in the ambulance. He therefore urged for ways to create and maintain trust among all stakeholders. In contrast, the Emergency Physician Two simply stated that the hospital did not have a specific emergency door for the ambulances.



In their responses to the query regarding the role that the National Guard Hospital might play in the ultrasound initiative, the physicians focused on different things. Emergency Physician One viewed the role of the Hospital as supervising the ultrasound scans and creating a protocol to teach paramedics on how to use the ultrasound as the main roles that the National Guard Hospital might play in the implementation process. Emergency Physician Two discussed that the hospital would gain the advantage of knowing the patient's condition prior to the patient's arrival allowing the emergency medical professionals to prepare the right resources in advance. He also mentioned a role in creating policy and protocol but centered his discussion on ways the hospital might help create a protocol that would allow patients to go directly to the operation room.

As far as their confidence in the ability of the EMTs and paramedics to master the ultrasound, again they presented different perspectives. Emergency Physician One shared that he felt confident that some, but not all paramedics and the EMTs could use it accurately and efficiently. Specifically, he wondered whether all paramedics and EMTs would be willing to make mastering the ultrasound a priority. Emergency Physician Two did not feel qualified to provide an opinion regarding the ability of the paramedics and the EMTs working in the Saudi Red Crescent, since he was not involved with them.

### **Findings from the Comparative Analysis of The Data from All Stakeholders**

This section focuses on comparing responses across stakeholders to identify contrasting perspectives, frequently given responses, and common themes across stakeholder groups—Paramedics, EMTs, SRCA Administrators and Emergency physicians. The data collection instruments (See Appendices C and D) employed common questions enabling comparative analysis of the responses. These questions included but were not limited to the preferred mode of transportation along with a rationale for the choice; the impact of equipping the Saudi Red

Crescent with the ultrasound; and, the main barriers in implementing the ultrasound. Each question is described in turn:

### **The Preferred Mode of Transportation and the Rationale for their Choice**

Stakeholders were asked to state their preferred mode of transportation of the patient from the scene of the trauma. As discussed previously the “Stay and Play” mode implies that the Saudi Red Crescent paramedics and EMT’s would treat the patient in some way on the scene and then proceed to the hospital. In contrast “Load and Go” means that the patient is immediately loaded into the ambulance and transported to the hospital for all treatment.

Table 4.9 displays the responses of each stakeholder group along with their rationale for their stated choice to assist in the comparative analysis.

*Table 0.9 The Preferable Mode of Transportation Across Participants and the Reasoning of their Choice*

Participants	Mode of Transportation “Stay and Play” or “Load and Go”		Rationale for Choice
Paramedics and the EMTs (N=24).	n=23 Stay and Play	n=1 Load and Go	<ul style="list-style-type: none"> <li>• Treatment over fast transportation.</li> <li>• Patients’ stability and treatment.</li> </ul>
SRCA Administrator One.		“Load and Go”	<ul style="list-style-type: none"> <li>• Fast Transportation is the key in critical patients.</li> </ul>
SRCA Administrator Two.	“Stay and Play”		<ul style="list-style-type: none"> <li>• Sufficient resources and capable paramedics in the SRCA.</li> </ul>

SRCA Administrator Three.		“Load and Go”	<ul style="list-style-type: none"> <li>• Fast transportation is the key in the Emergency Medical Services.</li> </ul>
SRCA Administrator Four.		“Load and Go”	<ul style="list-style-type: none"> <li>• Fast transportation is the key in the prehospital setting.</li> </ul>
Emergency Physician One.	“Stay and Play” in Cardiac Arrest Patients.	“Load and Go” in Trauma Patients.	<ul style="list-style-type: none"> <li>• Mode of transportation depends on the case itself.</li> </ul>
Emergency Physician Two.		“Load and Go”	<ul style="list-style-type: none"> <li>• “Stay and Play” requires more experience and better protocol.</li> </ul>

As Table 4.9 illustrates the majority of the paramedics and the EMTs chose “Stay and Play” as their preferable mode of transportation. Their responses provided common rationales focused on preferring on scene treatment over fast transportation, as well as the increased patient stability that the “Stay and Play” mode provides.

In contrast, the administrators in the Saudi Red Crescent who oversee the paramedics and the EMTs in their station disagreed among themselves. Administrators One, Three, and Four chose “Load and Go” as their preferable mode of transportation with rationales mainly focused on fast transportation. Clearly they view quick transport to the hospital as the paramedics’ and EMTs’ primary role in the Emergency Medical Services. Administrator Two, however, stated that his choice was “Stay and Play” reasoning that the SRCA has sufficient resources and capable paramedics to handle any patient’s case on the scene.

There is also disagreement among the emergency doctors who also voiced different perspective on the mode of transportation in the prehospital setting. Emergency Physician One stated that the choice the paramedics make should depend on the case itself adding that in case of trauma

patients using “Load and Go “is the appropriate. In the case of trauma, he stated that the paramedics should not engage in a definitive treatment on the scene. He did, however, urge the use of “Stay and Play” in patients who suffer from Cardiopulmonary Resuscitation (CPR). In contrast, Emergency Physician two chose “Load and Go” for all cases stating that “Stay and Play” requires more experience and protocols.

**Findings from the Question: What would be the impact of equipping the Saudi Red Crescent ambulances with ultrasound equipment to diagnose trauma patients in the prehospital setting?**

All participants responded to this question to determine the impact of equipping the Saudi Red Crescent Authority with the ultrasound machines. Table 4.10 shows the answers of the impact of the ultrasound across all participants in order to find the differences and the common themes.

*Table 0.10 Most Frequent Participants’ Responses by Group Regarding the Impact of Equipping the Saudi Red Crescent Ambulances with Ultrasound Machines*

Participants	Most Frequent Response
Paramedics and the EMTs (n=24)	<ul style="list-style-type: none"> <li>• Positive Impact and early diagnoses of trauma patients.</li> <li>• Negative impact (wasting the patients time in doing unnecessary testing).</li> </ul>
Administrator One	<ul style="list-style-type: none"> <li>• Early diagnoses and patient’s assessment.</li> </ul>
Administrator Two	<ul style="list-style-type: none"> <li>• Not a priority (the paramedic’s and the EMs will not engage in a significant intervention if the patients have internal bleeding.</li> </ul>
Administrator Three	<ul style="list-style-type: none"> <li>• Early diagnoses</li> </ul>
Administrator Four	<ul style="list-style-type: none"> <li>• Early medical intervention and accurate diagnoses.</li> </ul>

Emergency Physician One.	<ul style="list-style-type: none"> <li>• The impact depends on the location of the accidents and how quickly the transportation to the hospital can happen.</li> </ul>
Emergency Physician Two	<ul style="list-style-type: none"> <li>• Positive impact (will help the emergency doctors prepare the right resources in advance.</li> </ul>

As Table 4.10 shows, the majority of the paramedics and the EMTs believed the impact of the ultrasound implementation would be positive and would provide them with a tool that would help in diagnosing trauma patients with internal bleeding. However, 15% of the paramedics and the EMTs mentioned that the implementation might have a negative impact in terms of wasting time with the patients at the scene engaged in unnecessary medical testing.

SRCA Administrators one, three and four agreed with the majority of the paramedics and the EMTs in terms of the positive impact of the ultrasound in their organization. They stated that the ultrasound implementation would help in early diagnoses and medical intervention.

Administrator Two, on the other hand, did not predict a positive impact stating that implementation of the ultrasound in the ambulances was not a priority since it would be unwise for paramedics and EMTs to engage in a significant intervention if patients have internal bleeding.

As for the emergency physicians, physician one mentioned that the impact of the ultrasound would be dependent on two factors—the location of the accident and how quickly the ambulance could transport the patient to the hospital. In contrast, Emergency Physician Two agreed with the paramedics and EMTs that the impact would be positive and would help the emergency doctors to select and prepare the right resources.

## Findings from the Question: What are the Main Barriers to the Implementation of Prehospital Ultrasound in the Saudi Red Crescent?

The responses to this question revealed the main inherent barriers of the ultrasound implementation in the Saudi Red Crescent. Table 4.11 compares the responses regarding the barriers across all participant groups.

*Table 0.11 Comparison of Participants' Responses by Group Regarding the Main Inherent Barriers of the Ultrasound Implementation in the Saudi Red Crescent*

Participants	Main Barriers to the Implementation of Prehospital Ultrasound in the Saudi Red Crescent.
Paramedics and EMTs	<ul style="list-style-type: none"> <li>• Training and education, environmental and technical factors.</li> <li>• Cost and short distance transportation.</li> </ul>
Administrator One	<ul style="list-style-type: none"> <li>• Ultrasound portability and size, extensive training and environmental factors.</li> </ul>
Administrator Two	<ul style="list-style-type: none"> <li>• Ultrasound portability and size.</li> <li>• Cost, extensive training and environmental factors</li> </ul>
Administrator Three	<ul style="list-style-type: none"> <li>• Device technology, constants maintenance, cost and paramedics and the EMTs will be financially obligated for the ultrasound device.</li> </ul>
Administrator Four	<ul style="list-style-type: none"> <li>• Constant sterilization of the ultrasound device due to its regular use.</li> <li>• A need for unifying protocol on how and when to use the ultrasound on trauma patients.</li> </ul>
Emergency Physician One.	<ul style="list-style-type: none"> <li>• Cost, constant maintenance, training and education.</li> <li>• Environmental factors.</li> </ul>
Emergency Physician Two	<ul style="list-style-type: none"> <li>• Training and education, how accurate the device is in diagnosing trauma patients and the movement of the ambulance.</li> </ul>

As Table 4.11 illustrates, the majority of participants identified common barriers to the implementation of the ultrasound in the Saudi Red Crescent. Cost, environmental factors, training and education were mentioned by almost all participants.

For the paramedics and EMTs, perceived barriers focused on training. This could be due to the fact that ultrasound skills and knowledge is not part of the current curriculum of the emergency medical services professionals. In addition, this group also saw short distance transportation as a potential barrier since all emergency transportation happens inside the city and the ultrasound imaging process might delay the transportation time as well as other important medical intervention.

### **Common Themes that Emerged from the Comparative Analysis**

The comparative analysis of responses depicted in Tables 4.9, 4.10 and 4.11 revealed three common themes depicted here in Table 4.12. The themes will be addressed fully in the discussion in Chapter 5 of the study.

*Table 0.12 Emerging Themes from the Data Analysis*

<ul style="list-style-type: none"><li>• Paramedics and the EMTs are willing to be more involved with Patient Care and confident in their own ability.</li><li>• There is a lack of trust between stakeholders within the Saudi Red Crescent.</li><li>• If an initiative to implement the ultrasound in the prehospital setting is undertaken its success or failure will be determined by Cost, Environmental Factors, Education and Training.</li></ul>
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### **Summary of the findings**

Multiple findings were emerged in chapter four; the majority of the participants believes that education and training is considered to be the main barrier of the implementation of the ultrasound in the Saudi Red Crescent hence, the need to create an educational plan to address this specific perceived barrier. In addition, cost and environmental factors are considered to be one of the main barriers in the implementation of the ultrasound within the current structure of the Saudi Red Crescent Authority. The participants of the study had a wide range of responses to the impact of equipping the Saudi Red Crescent with the ultrasound machines where they mentioned either the ultrasound will have a positive impact or whether the impact is dependent on the location of the accidents. In terms of choosing the appropriate mode of transportation, the majority of the paramedics and the EMTs chose “Stay and Play” as their preferable mode of transportation in contrast, the rest of the participants chose “Load and Go” as their preferable mode of transportation.



## **Chapter 5: Discussion, Conclusions, and Recommended Actions**

The following discussion of findings is guided by the research question: *What do relevant stakeholders perceive as barriers to the potential introduction and effective use of prehospital ultrasound in the Saudi Red Crescent Authority?*

The study examined a proposed initiative to incorporate prehospital ultrasound within the current structure of the Saudi Red Crescent Authority (SRCA). “Ultrasound is a form of medical imaging that is portable, non-invasive, painless, and does not expose the patient to ionizing radiation. With proper training and education, prehospital providers can use the ultrasound machines to obtain immediate anatomical, diagnostic, and functional information on their patients” (Taylor et al., 2014). The study explores the needs, issues and barriers associated with such an initiative within the unique contexts of Saudi Arabia. The literature review begins by tracing the origins of the Saudi Red Crescent Authority (SRCA) and the influence of Islam in crafting the Emergency Medical Services (EMS) in the Kingdom of Saudi Arabia. SRCA is a government-based organization that is focused on emergency medical services in the prehospital setting to ensure medical and non-medical patients will be treated and transferred to the nearest hospital.

### **Discussion of the Findings**

The research question and the resulting study were designed to reveal and analyze the relevant stakeholders’ perceptions about the barriers of the potential introduction and effective use of prehospital ultrasound in the Saudi Red Crescent Authority. As depicted in Chapter 4, Figure 4.12 three key themes emerged from findings. Each theme, and several inferred contributing factors, are discussed here to note connections to the study’s theoretical framework.

**Theme One: Paramedics and EMTs are Willing to be More Involved with Patient Care Revealing High Levels of Self-Confidence in Their Ability.**

The majority of the paramedics and the EMTs chose “Stay and Play” as their preferable mode of transportation. This specific mode of transportation requires that the emergency medical professionals are more engaged in-patient care. The paramedics’ and the EMTs’ choice reflect desire to be more involved with patients care on the scene. This reveals a perception of high levels of positive self-efficacy in their ability to be involved with and successful leaders of advance medical interventions. It is also reflective of a high self-confidence.

From their responses it is safe to assume that the paramedics not only want to be more engaged in the prehospital setting, but also feel they can rely on their own past performances at the scene and see them as mastery experiences. A mastery experience is an individual’s previous experience in successfully completing a specific task and is considered to be the most important source of an individual’s perception of self-efficacy. Successful experience increases perceptions of self-efficacy and, in contrast, unsuccessful experiences weakens it (Bandura,1994). Over the course of their service in the Saudi Red Crescent Authority the paramedics and EMTs have many chances to experience their roles and their ability during the two modes of transportation from the scene. They are very familiar, therefore, with the potential for helping the patient during each mode as well as potential the barriers to effective patient care of each mode. It is very telling, then, that the majority choose “Stay and Play” as their preferable mode of transportation.

The high levels of positive self-efficacy for patient care on the scene expressed by the paramedics and the EMTs could be an asset during the implementation of new diagnostic devices in the prehospital setting such as the ultrasound. But their confidence in their ability alone is not enough to ensure the successful implementation of the ultrasound in the field. Successful

implementation that ensures excellent patient care, must be guided by research-based measures such as specific policy and protocols that the paramedics and the EMT's will use as criteria to determine which conditions support the decision stay on the scene to treat the patient and use the ultrasound, and when it is imperative for the EMTs to quickly load the patient for the trip to the hospital as well as the decision to either conduct the ultrasound testing or transporting the patients without the ultrasound testing. Providing such protocols and criteria will give the paramedics and the EMTs the opportunity to judge their behavior and comparing those behavior against the protocol or the criteria provided. In addition, these criteria will also help the paramedics and the EMTs to monitor their own behavior and how they view their own self-reflection (Bandura,1991; Eva & Regehr, 2005).

In order for self-assessment to be well contributed to the paramedics and the EMTs performance, the criteria must be described in terms and appropriate to context as well as defined and agreed upon public terms. In addition, these criteria must be observable by the paramedics and the EMTs themselves and by someone observing them performing, using common, specific, and public criteria that describe specific aspects of a successful performance. If there are several criteria, they must be separate and distinguishable from one another. The criteria will help the paramedics and the EMTs to recognize their current gap in the ultrasound knowledge and skills. The criteria will also help the paramedics and the EMTs recognize what they are doing well so they can continue doing it (Moss & Brookhart, 2015). This ability to choose to repeat actions that are correct and to change, improve, or stop doing actions that are incorrect is at the heart of self-regulation. Through this exercise of forethought, paramedics and the EMTs can motivate themselves while guiding their own actions in a more anticipatory and proactive manner (Zimmerman, 2000).

The paramedics and the EMTs overwhelmingly chose “stay and play” as their preferable mode of transportation. This choice may have been based on the intensity of their emotions, how they are perceived and interpreted their physical reactions and decisions (Bandura, 1997, p. 108).

Another possible explanation for their high self-efficacy could be that the paramedics and the EMTs might be overconfident in their ability. (This possible explanation is mentioned here and discussed in Theme Two, Contributing Factor Three).

Generally, there is still a disagreement regarding which mode of transportation is appropriate to use in the emergency medical services and whether it depends on the case itself. Research indicates that, “Stay and Play” as a mode of transportation can be a barrier to effective patient care since the implementation of the ultrasound machines for some trauma patient imaging might detrimentally alter the golden hour (Beuran et al., 2012). It is crucial, therefore that choice of whether or not to implement the ultrasound must be guided by the paramedics and the EMT’s adherence to specific policy and criteria to determine which mode of transportation is suitable for ultrasound usage and when it is more important to hasten the transport to the hospital to take advantage of the golden hour for trauma patients.

**Theme Two: There is Disagreement within the Saudi Red Crescent Authority Revealed Through their Choices of the Appropriate mode of Transportation.**

The majority of the SRCA station administrators choose “Load and Go” as their preferable mode of transport because they consider fast transportation as the key to effective patient treatment in the prehospital setting. The perspectives of the station administrators contradict that of the EMTs and Paramedics in their stations who resoundingly chose “Stay and Play” as their preferable mode of transportation.

This discrepancy is possibly more than a difference of opinion since, often, opinions are based on beliefs people hold regarding the ability of their colleagues to perform at a level of excellence. In other words, perceptions of self and collective efficacy can shape the beliefs medical professionals hold about their own individual ability and collaborative ability of their team (Watson, Chemers & Preiser, 2001). The following discussion of this difference of opinion is organized by possible, interconnected contributing factors that can be inferred from their dissenting opinions by role. The discussion of those possible contributing factors may help to explain the discrepancy between the administrators, paramedics and the EMTs, in terms of choosing the mode of transportation. Several possible contributing factors are considered and illustrated in Table 5.1.

*Table 5.1 Possible Contributing Factors to Opposing Views Regarding Choice of Transportation*

- Administrators may not trust the paramedics and the EMTs to be more involved in the prehospital setting
  - A lack of clear, shared policy to assess and choose the appropriate mode of transportation
  - Paramedics and the EMTs May Be Overconfident and Under Competent
  - SRCA Administrators might not be engaged in continuous monitoring of the impact of daily actions of emergency medical services provided by SRCA in the field
  - Paramedics, EMTs and Administrators may have different views of the mission of SCRA and how the emergency medical services should work.
- 

Each possible contributing factor is discussed in turn.

**Inferred Contributing Factor One: The Administrators may not trust the Paramedics and the EMTs to be more Involved in the Prehospital Setting.**

The selection of opposite modes by SRCA professionals (Paramedics, EMT's and Administrators) when at the same station may reveal more than a simple disagreement. "Load and Go" is mainly focused on fast transportation and as such involve minimal interaction of the EMT's and Paramedics with patients. The discrepancy between choice of the administrators on one hand, and paramedics and EMTs on another could indicate that the administrators have low levels of trust in the paramedics' and the EMTs' ability to successfully treat patients in the field. This could possibly be attributed to the administrator's little confidence regard to the diagnostic and treatment ability of the ambulance staff. The administrators may have based their choice on their belief that the Paramedics and EMTs lack the knowledge and the skill to ensure effective patient care. Collective efficacy theory (Watson, Chemers & Preiser, 2001) provides us with a lens through which to examine this perception. Collective efficacy is determined by a shared belief in the abilities and skills of a given group of people and the ability of those people to work together to be successful at the task at hand. It also requires trust within the group that all individuals can effectively use those abilities to achieve a shared set of goals. It is this shared belief in the collective ability and expertise of individuals within the group that activates the confidence of group members in each other and strengthens their ties to one another to both create and pursue a shared set of goals to benefit the larger population (Bandura,1997). It can be argued, therefore, that the collective efficacy between the administrators and the paramedics and EMTs may be low to non-existent. A causal explanation might lie in the fact that although the two groups work within the same organization and even during the same shift, they do not work together, each sticking to the role of ambulance staff and administrative staff. They might not operate with a shared vision about how the emergency medical services should function. The administrators could also be unable to observe the members of the ambulance staff during an

actual medical emergency. And finally, the administrators might be unable to have specific criteria that they use to assess instances in the performance of the paramedics and EMTs by comparing what the ambulance staff does to those specific success criteria (Bandura, 1991; Zimmerman, 2000). Having specific criteria would help the administrators recognize and monitor the specific actions that contribute the effective performances and decisions of the EMTs and paramedics (Eva & Regehr, 2005; Moss & Brookhart, 2015).

**Inferred Contributing Factor Two: A Lack of Clear, Shared Policy to Assess and Choose the Appropriate Mode of Transportation.**

The discrepancy between the SRCA administrators, paramedics, and the EMTs could also be driven by the lack of a clear-cut policy in the Saudi Red Crescent Authority that communicates exactly what should be considered before choosing the mode of transportation. Specific guidelines would not only promote increased collective efficacy but would provide the individual members of the team with a way to self-regulate their decision-making process and their actions (Bandura, 1991; Eva & Regehr, 2005; Zimmerman, 2000).

The creation of a unifying policy that would help all members of the group determine the best mode of transportation would be crucial to the potential implementation of prehospital ultrasound in the Saudi Red Crescent. In addition, having a specific checklist that outlines what to look for in order to make a sound decision would promote self-assessment, self-regulation, and both individual and collective efficacy (Bandura, 1997; Eva & Regehr, 2005; Watson, Chemers & Preiser, 2001). The current state of not having a clear policy or protocol about which mode of transportation the paramedics should choose could be a huge barrier to the implementation of the ultrasound devices in the ambulance. A shared, sound, research-based

policy or the protocol would ensure that the mode of transportation is dependent on the specific medical attributes of case that the paramedics are facing on the scene. It is crucial to recognize that each medical case that the healthcare professionals face on a daily basis are different a variety of ways and that complex combination of possible factors requires medical intervention and tactics that are tailored to the specific trauma patient including choosing an appropriate mode of transportation.

### **Inferred Contributing Factor Three: Paramedics and the EMTs May Be Overconfident and Under Competent In-Patient Care**

The discrepancy between their choice of transportation modes could also be based on a third factor. The prehospital healthcare professional's (paramedics and EMTs) perceived self-efficacy could be higher than their actual ability to engage in effective patient care. This state of over confidence could be based on the current lack of specific policy and criteria against which prehospital care professionals could assess their own performance in order to reach evidence-based conclusions regarding their levels of mastery. Without a set of specific guidelines against which they can self-assess and self-regulate, the prehospital team can easily and mistakenly conclude that their levels of knowledge and skill are much higher than they actually are (Bandura, 1991; Eva & Regehr, 2005). In other words, the EMTs and paramedics could be both confident and incompetent. This over confidence could come from judging past experiences as warranting mastery, when in actuality their past experiences might reveal gaps in skill and knowledge when compared to specific criteria and protocols. In other words, by using their own unsubstantiated observations of successful action, or their belief that they could if given the chance perform in an effective way, the paramedics and EMTs might consider themselves competent in-patient care without compelling evidence from their true performances in the field.



Prior to having a first-hand experience, there is some evidence that judgments of initial self-efficacy can be overestimated. The paramedics and the EMTs in the Saudi Red Crescent have not been involved in any first-hand experience of the ultrasound testing and imaging in the prehospital setting therefore, their high self-efficacy in their ability to diagnose trauma patients using the ultrasound might be based on overconfidence. The overconfidence can affect the paramedics and the EMTs decision process as well as their performance. With the self-monitoring of one's functions, individuals can influence their own motivations as well as their own actions while paying attention to their current performances aren't readily perceived. Not having clearly described criteria for choosing the appropriate mode of transportation will not give the paramedics and the EMTs the chance to self-regulate and assess in order to make valid and appropriate decisions (Bandura, 1986; Nabavi, 2012; Salanova, Lorente, & Martinez, 2012; Stone, 1994; Zimmerman, 2000).

**Inferred Contributing Factor Four: SRCA Administrators Might Not Be Engaged in Continuous Monitoring the Impact of Daily Actions of Emergency Medical Services Provided by SRCA**

Another way to causal factor that might explain the discrepancy between choices for modes of transportation could be the lack of administrator monitoring and evaluation of what is really happening in the emergency medical services in their organizations. The administrator's level of involvement is determined by current differences in their job description and work duties. On one hand, the paramedics and the EMTs are more involved in the emergency medical services from a clinical duty perspective. On the other hand, the administrators are more focused

on administrative duties outside of the daily happenings in the field. These different work duties could explain the discrepancy in their choices regarding the preferable mode of transportation.

What we know about collective efficacy in groups and teams is that it is based on having shared beliefs among members of the groups to accomplish their shared goal (Bandura, 1997). We can assume that there might not be shared beliefs between the administrators and the paramedics about the need to continuously monitor the paramedic's daily action to accomplish a high level of excellence in the emergency medical services. Also, we can assume that there may be a lack of protocol or a criterion that can be used to monitor the paramedics and the EMTs performance on their daily work. This lack of criteria can limit the ability of the paramedics and the EMTs to self-assess and regulate their behavior against set of standards (Moss & Brookhart, 2015). The criteria and the protocol function as a mechanism for the identification of the paramedic's strengths and weaknesses (Eva & Regehr, 2005; Nabavi, 2012; Zimmerman, 2000).

**Inferred Contributing Factor Five: The Paramedics, the EMTs and the Administrators May Have Different Views about The Mission of SCRA and How the Emergency Medical Services Should Work.**

Finally, part of a causal explanation for the discrepancy revealed by the choice of the preferable mode of transportation could indicate that the health care professionals on one hand and the administrators on the other have conflicting views about how the emergency system should work. The choice of the health care professionals in the Saudi Red Crescent to "Stay and Play" could indicate a desire to be more involved in-patient care. Their choice may reveal their belief that they are being underutilized as medical professionals. On the other hand, administrators might view the emergency medical services as a transportation system where minimum intervention on the behalf of the Paramedics and EMTs in favor of getting the patients

to the emergency room staffed by physicians and filled with the latest diagnostic equipment and a range of treatments is the best approach. This huge difference in their perceived main purpose of the emergency medical services could be explained by low or negative levels of collective efficacy, and the lack of shared beliefs and goals. Collective efficacy is based on members of groups holding common beliefs that enable them to have confidence that they will be able to accomplish shared goal (Bandura, 1997). The different views that the SCRA and hospital professionals hold about how the system should work might also be explained by the lack of shared criteria and protocols that guide how the emergency medical services should function. These shared criteria for success and protocols for decisions could help both paramedics and administrators self-assess and self-regulate in ways that would promote success (Moss & Brookhart, 2015; Zimmerman, 2000).

This huge difference in overall conception of the purpose of SRCA could potentially be a barrier to the implementation of the ultrasound as a diagnostic tool that requires investing considerable time on the scene. First and foremost, the implementation of any diagnostic tool must take into the account the golden hour aspect in trauma patients. Crowley stated, “the first hour after injury will largely determine a critically-injured person’s chances for survival” (Crowley, 1975). No matter what, the implementation of the ultrasound must not alter the golden hour aspect in trauma patients. A lack of shared understanding of how SCRA professionals should approach medical intervention could be based on the perception that any intervention by SCRA professionals on the scene would be too time consuming and undesirable.

**Theme Three: If an initiative to implement the ultrasound in the prehospital setting is undertaken its success or failure will be determined by Cost, Environmental Factors, Education and Training.**

In order to understand in advance what barriers might exist that would prevent the successful implementation of an initiative to place ultrasound equipment in the ambulances, the researcher asked the relevant stakeholders to identify the potential barriers that might derail a successful implementation. As the data showed, the majority of stakeholders (paramedics, EMTs, SRCA administrators, emergency physicians) agreed that cost, environmental factors, education and training can be the major barriers in implementing the ultrasound in the Saudi Red Crescent Authority.

The barriers revealed in the data analysis can inform the likelihood of implementing the ultrasound successfully and guide the proactive creation of systems and decisions that can both prevent the barriers in the first place or help to overcome those barriers during planning and implementation. A perceived barrier that is especially pertinent to the focus of this study is the need for high-level training and education. This finding is consistent with previous studies (Taylor et al. 2014; Sajid, et.al, 2020).

Since the ultrasound is currently not used by the Saudi Red Crescent, the medical services programs in the Kingdom of Saudi Arabia curriculum does not include the teaching of ultrasound skills and knowledge. In order to understand the educational needs for implementing the ultrasound in the hospitals and the ambulances, it is important to acknowledge that implementing the ultrasound in each setting requires tailoring a curriculum to meet the specific environmental factors present in each setting. In the prehospital setting, such as the curriculum would have to address the impact of the environmental factors that are associated with the

emergency medical services in the field as opposed to the controlled environment of a hospital emergency room. There are many mitigating factors such as high temperatures, sun light, and the ultrasound battery itself among many other factors, Therefore, any education and training associated with the implementation of the ultrasound in the ambulance would must be taken into consideration along with the needs for that curricular component to include protocols for how to use the ultrasound effectively in the face of various environmental conditions.

### **Summary of the Emerged Themes**

The themes that were discussed above emerged after the data analysis. The themes reveal that paramedics and EMTs are willing to be more involved with patient care and confident in their ability and perhaps over confident, there is a lack of trust between stakeholders within the Saudi Red Crescent, if an initiative to implement the ultrasound in the prehospital setting is undertaken its success or failure will be determined by cost, environmental factors, education and training, Paramedics and EMTs have High Level of confidence in their ability to diagnose trauma patients by using the ultrasound.

Theme one revealed that the paramedics and the EMTs desire to be more involved with patient care hence their choice of “Load and Go” as the preferable mode of transportation. Their choice can be interpreted as indicating perceived high self of efficacy in their ability to be successfully engage in onsite patient care. Their high self-efficacy, though, may not be reflective of their actual past positive performance in the prehospital setting. Yet, the paramedics and the EMTs choice of stay and play on the scene can be used as motivation to learn and implement the use of diagnostic devices such as the ultrasound.

Second theme, there is a lack of trust between stakeholders within the Saudi Red Crescent hence their different choices of the mode of transportation. The different choice can indicate the paramedics and the EMTs on one hand and the administrators on the other do not have shared beliefs or shared goals. This could indicate a lack of collective efficacy between administrators, paramedics and EMTs. In addition, their disagreement might be explained through multiple contributing factors: Administrators may not trust the paramedics and the EMTs to be more involved in the prehospital setting, there is a lack of clear, shared policy to assess and choose the appropriate mode of transportation, paramedics and the EMTs may be overconfident and under Competent and SRCA administrators might not be engaged in continuous monitoring of the impact of daily actions of emergency medical services provided by SRCA in the field.

Third theme, if an initiative to implement the ultrasound in the prehospital setting is undertaken its success or failure will be determined by cost, environmental factors, education and training. As the data shows, all stakeholders agreed that cost, environmental factors, education and training are the main barrier of the implementation of the ultrasound in the Saudi Red Crescent. These barriers are critical to resolve in order for a successful implementation of the ultrasound imaging and testing.

### **Limitations**

The researcher employed a relatively small sample of the paramedics, EMTs, emergency physicians, SRCA administrators currently serving in Saudi Arabia. The small sample limits the generalizability of the findings and therefore does not represent a comprehensive perspective on the main barriers of implementing the ultrasound within the Saudi Red Crescent Authority.

The researcher, who is a member of the Saudi Red Crescent Authority may bring a biased perspective to the interpretation of the findings in terms of confirmation bias. This can occur when a researcher forms or holds a hypothesis or belief and uses respondents' information to confirm that belief. To minimize bias the researcher made several passes through the data and continually reevaluate impressions of respondents and challenged preexisting assumptions and hypotheses.

Finally, there is a paucity of previous studies in the ultrasound application in the prehospital setting in the kingdom of Saudi Arabia.

### **Recommendation for Future Research**

There are many stakeholders associated with the emergency medical services system in Saudi Arabia that were not included in this research. These stakeholders are The Saudi Commissions for Health Specialties, King Saud bin Abdul-Aziz for Health Sciences, Ministry of Health, Ministry of Education and Ministry of Finance. Based on the data analyzed and discussed, this study points to several areas of future research. It is recommended that all stakeholders mentioned above must be included in future research to further examine this complex and multifaceted proposed initiative. The examinations that include those stakeholders could reveal more potential barriers to the incorporation of the ultrasound devices within the current structure of the Saudi Red Crescent Authority and within any improved or newly established structures.

Second, the findings of this research strongly support the creation of a detailed educational program along with structures for continuous improvement research to support any initiative for implementing the ultrasound course in the Saudi Red Crescent. The program must

be obligatory in order to for SCRA personnel to be licensed to work as a healthcare provider. It is also suggested that the Saudi Commissions for Health Specialties is the designated institution to provide such licensing. Based on this study, it is recommended that an ultrasound course be established and any certification that results from successful completion of that course be renewed every year to attain a high level of skill and knowledge. It is recommend incorporating social theories such as self and collective efficacy not only in the ultrasound course but also in the current curriculum of the emergency medical services program in Saudi Arabia to promote high level of self-confidence within the healthcare providers. Health care professional in the Emergency Medical Services are currently using a unified protocol on how medically can encounter emergency cases. The current protocol is divided based on the case type that the paramedics are dispatched to. Medical or trauma patients both have different protocol to be followed during a call yet none of those protocols can explain when the health care professional can use the ultrasound. We recommend in future research to adjust the current trauma protocol to make it suitable for the health care professional to know when the right step to do the ultrasound imaging and also doing clinical trials to verify the suitability and effectiveness of the proposed protocol. As the data shows, the cost of the ultrasound devices is one of the main barriers to the implementation of the ultrasound in the ambulance. We recommend in future research creating an extensive budget plan to overcome this barrier. To that end, and to guide future research and initiatives, a detailed Action Plan for such a program is included later in this discussion (See Table 5.2).

### **Contributions to the Field of the Educational Leadership**

The implementation of the ultrasound devices in the Saudi Red Crescent is not an easy step to do. It needs a huge contribution from all stakeholders who are involved either directly or



indirectly in the Emergency Medical Services system in Saudi Arabia. In addition, it is the responsibility of all the paramedics and the EMTs leaders to recognize the importance of incorporating diagnostics devices such as the ultrasound in the prehospital setting.

This research revealed the inherent barriers of implementing the ultrasound within the context of the Saudi Red Crescent Authority. In addition, the research explored the different perspective from different stakeholders. As data showed, training and education are considered to be the main barriers in incorporating the ultrasound within the ambulance services. As an educational leader, this research gave me the opportunity to discover the huge educational gap in the paramedics and the EMTs ultrasound skills and knowledge. Not only the paramedics and the EMTs who needs to recognize the importance of the ultrasound skills and knowledge but also educational leaders in Saudi universities. Both they need to work collaboratively to fill in the gap in the current curriculum of the emergency medical services program in the kingdom of Saudi Arabia.

### **Action Plan for the Design and Implementation of Continuous Educational Support for Ultrasound Implementation in the Saudi Red Crescent.**

The following educational action plan (Table 5.2) outlines a three-year initiative that addresses the main barriers revealed in the study regarding implementing the ultrasound in the Saudi Red Crescent. As the data shows, education and training are consider to be one of the main barriers in the implementation of the ultrasound devices in the ambulance therefore, the action plan will focus on creating a three year action plan that will focus on proposing a curriculum that both promotes mastering of important skills and concepts while also providing learning opportunities to increase collective efficacy among stakeholders and individual self-regulation

and self-assessment skills for to increase each person's self-efficacy for effective use of the ultrasound.

*Table 5.2 Components of An Action Plan for Implementing the Ultrasound in the Saudi Red Crescent*

- Form a steering committee
  - Establish an educational course and follow-up courses for ultrasound licensure
  - Establish major topic components for the educational course
- 

### **Component One: Forming a Steering Committee**

Based on the findings, it is suggested that the first step should include the creation of a respected and diverse Steering Committee to oversee the application of the ultrasound in the Saudi Red Crescent Authority in terms of policy and protocol creation and implementation. The Steering Committee would decide on the priorities or order of business for the initiative and manage the general course of its operations. In general, Steering Committees are made up of various people, and can include some combination of senior stakeholders, experts, executives, representatives from the various departments, and could also include community representatives from the areas served by the ambulances and hospital. Members of steering committees meet and collaborate to define, prioritize and control projects and provide guidance on issues that could surface before, during, and after the implementation such as budgets, educational needs, policy and protocol, marketing strategies, and project management concerns.

Members of such a committee should include those with expertise in a variety of areas such as how to implement the ultrasound as a diagnostic tool for trauma patients in the prehospital setting, experts associated with the emergency medical services system, and those

who would be instrumental implementing the ultrasound. A Preliminary list is depicted in Table 5.3.

*Table 5.3 Suggested Composition of the Steering Committee for the Ultrasound Initiative*

- 
- 1- Ministry of Health.
  - 2- The Saudi Red Crescent Authority
    - a. Administrators
    - b. Paramedics
    - c. EMTs
  - 3- Ministry of Education.
  - 4- The Saudi Commission for Health Specialties.
  - 5- King Abdullah Medical Research Center
  - 6- The National Guard Hospital
    - a. Emergency Room Physicians
    - b. Emergency Room Administrators
  - 7- Private Sector Representatives
    - a. Medical Supply Companies
    - b. Community Representatives
- 

The Steering Committee must be able to work together to both plan the initiative and monitor and assess its progress. Table 5.4 outlines that work through statements of priorities.

*Table 5.4 Suggested Priorities for the Steering Committee*

---

**The Committee will be able to:**

- **Oversee the application of the ultrasound in the Saudi Red Crescent Authority.**
  - **Create, refine, and communicate policy and protocol for the successful use of the ultrasound.**
  - **Create a shared policy and protocol to guide high-level communication and collaboration between the Saudi Crescent Authority and the ministry of health hospitals.**
  - **Create a needs analysis and implantation audit of the specific knowledge and skill levels of individuals and groups to inform the design of a rigorous curriculum to support the initiative.**
  - **Guide the creation and implementation of a nation-wide ultrasound educational course for paramedics and EMTs.**
  - **Change the Credential Requirements for paramedic and EMTs in Saudi Arabia**
-

- 
- **Oversee the impact of the ultrasound before, during, and after implementation as clinical trials**
  - **Ensure collaboration between government identities and the private sector in supplying the ultrasound machines.**
- 

### **Committee Configuration and Members' Responsibilities**

A detailed overview about the responsibilities and duties of each stakeholder in the committee and the committee configuration is displayed in Table 5.5. Each stakeholder should have a specific role in the implementation of the ultrasound. Members will have the opportunity to address their concerns and examine potential barriers that might affect the implementation process. As shown in Table 5.5, The Ministry of Health could serve as the chair of the committee, since the ministry has access to many resources. What's more, the Saudi Red Crescent Authority falls under the jurisdiction of the Ministry of Health. As the initiative progresses from the planning stage to the implementation of the ultrasound, additional stakeholders might be added to the committee depending on the issues that arise and the value that an additional member might bring to the table. For example, more government agencies might be included in the future such as the Ministry of Finance since it plays a huge role in the budget and distribution of funds across the whole of government related agencies including the ministry of health and the Saudi Red Crescent Authority.

*Table 5.5 Possible Roles and Responsibilities of the Proposed Core Members of the Steering Committee Individual Members*

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The Ministry of Health (Chair) will be able to:

- Create a shared protocol for hospitals receiving trauma patients who have already been diagnosed using the ultrasound and notifying other stakeholders of such a protocol.
- Report any barriers occurring across all hospitals for receiving trauma patients who have been diagnosed using the ultrasound.
- Oversee the progress of each stakeholder group.

---

**The Saudi Red Crescent (Member) will be able to:**

- Oversees the application of the ultrasound within their organization.
  - Document the process of implementing the ultrasound in the ambulance.
  - Come up with a protocol on how and when to use the ultrasound on trauma patients.
  - Report any barriers either within the organization or with current stakeholder in the committee.
- 

**The Saudi Commission for Health Specialties (Member) will be able to:**

- Approve the course that was recommended by the ministry of education as a requirement for the paramedics and the EMTs credentials.
  - Make the course a mandatory requirement for the paramedics and the EMTs to renew their credentials
- 

**King Abdullah Medical Research Center (Member) will be able to:**

- Monitor the progress and the effectiveness of the ultrasound implementation from a research aspect.
  - Initiate clinical trials to test the protocol on how and when to use the ultrasound that was recommended by the Saudi Red Crescent Authority.
- 

**Private Sector (Medical Supplies Companies) (Member) will be able to:**

- To provides the ultrasound devices that will equip the Saudi Red Crescent ambulances.
  - To provide a type of the ultrasound devices that are portable and persist any strong environmental condition.
  - The selected company must provide the essential maintenance for the devices when its required.
-

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**Ministry of Education (Member) will be able to:**

- **Come up with an educational course to teach the ultrasound skills and knowledge.**
  - **Implement the course within the current curriculum across the emergency medical services program around the kingdom universities**
- 

**Connection to theory**

The steering committee formation is an essential part of forming collective efficacy between relevant stakeholders. According to the data, there is a lack of trust between some of the stakeholders therefor, building trust is the main goal in the action plan so using the steering committee as a tool to build the necessary trust between all relevant stakeholders is crucial. Collective efficacy is mainly focused on shared perception to accomplish a shared goal. The theory also helps in activating the confidence within the member of the of any groups as well as strengthen their ties on each other to create shared goals (Watson, Chemers & Preiser, 2001). The steering committee will be able to work on a shared goal which is the implementation of the ultrasound devices. In regard to self-efficacy, there is a need to promotes self-efficacy among individual members and collective efficacy among the steering committee teams as a whole. The success and the failure of role models can either enhance the steering member committee's self-efficacy or decreases it (Bandura, 1977; Watson, Chemers & Preiser, 2001). The steering committee must include role models in the field of the emergency medical services that are well recognized and well respected. These role models can increase the members of the steering committee motivation and performance. In addition, another way to enhance the self-efficacy of the steering committee is by verbally encourage the members as well as communicating with

them and providing them with constructive feedback. The steering committee members must be provided by a set of criteria in the meeting so they can self-assess and regulate against these criteria.

### **Component Two: The Ultrasound Educational Course**

The action plan must also detail the creation, delivery, and consistent systematic improvement of educational training to address the gap in the paramedics' and EMTs' ultrasound skills and knowledge. According to the data analysis, the lack of training and education was considered to be one of the main barriers to a successful implementation of the ultrasound in the Saudi Red Crescent. Therefore, the need to address this barrier is essential for a successful implementation process.

The first part of the educational plan is the creation of an educational course that will focus on teaching the skills and the knowledge required to effectively use the ultrasound as a diagnostic tool in the prehospital setting. The educational course can be delivered in three days since research supports that the foundational knowledge and skills of learning to use the ultrasound does not require more time to master. Rooney et al (2016) found that paramedics were able to effectively interpret the ultrasound imaging after a 3-hour session on the ultrasound skills and knowledge. The study concluded that the paramedics were effective in obtaining the ultrasound imaging of the heart and were able to diagnose and interpret the image in an effective and accurate way (Rooney et al., 2016). A second study examined if the paramedics were able to interpret and diagnose abdominal bleeding and aortic exam after a 6-hour session. The study concluded that after a short session the paramedics had mastered the material and demonstrated a high level of accuracy in obtaining the abdominal aortic FAST examination (Heegaard et al.,

2010). Both studies can help us shape the educational course that we are planning and provide a level of confidence in the outcomes of a specifically designed educational course that would be span three days and contain multiple hands-on training experiences as well as lectures. For the hands-on training section, bringing an ultrasound device in the classroom to be tested by the paramedics and the EMTs will help to increase their level of skills

While it is proposed that the course begin with a comprehensive examination of the knowledge related to the application of the ultrasound application in both the hospital and the prehospital setting; before opening the doors to train all the paramedics, a few extra steps are essential to ensure the effectiveness of the overall educational initiative.

At first, the action plan suggests the training of a small group of a few highly skilled and experienced paramedics that are currently working in the Saudi Red Crescent and have served successfully in that capacity for an extended period of time. Included here are specific criteria for how to choose the high skilled paramedics mentioned in Table 5.6.

*Table 5.6 The Criteria for Choosing the High skilled Paramedics to be Trained*

- 
- **Holds a bachelor's or master's degree in the Emergency Medical Services program.**
  - **Has more than 20 years of experience in the Saudi Red Crescent Authority.**
  - **Currently possesses a valid credential from the Saudi Commission for Health Specialties to practice their clinical duties.**
  - **Recognized by others as highly skilled in the field of Emergency Medical Services.**
- 

The training for the highly skilled group course can range from two to three weeks. The high skills paramedics will be trained in the knowledge and the skills of the ultrasound by highly skilled physicians who are specialized in the ultrasound imaging. The high skilled physicians



will be chosen based on a set of criteria (Table 5.7) to ensure that we attain a high level of effective delivery of the course.

*Table 5.7 The Criteria of Choosing the High Experienced Physicians*

- 
- **Hold a bachelor’s degree in Medicine and Surgery.**
  - **Hold more than 20 years of experience in clinical practice.**
  - **Currently possess a valid credential from the Saudi Commission for Health Specialties to practice his or her clinical duties.**
  - **Must had a comprehensive training of the ultrasound application and imaging.**
- 

In addition, training the high skilled paramedics on the knowledge and skills of the ultrasound, this group will be trained on how to assess and coach the paramedics in the ambulance to establish more opportunities for mastery and encourage a process of systematic and continuous improvement.

Once the high skilled paramedics are trained, they can then train others in the necessary knowledge and skills of the ultrasound machines and its application in the prehospital setting. The three-day session will include lectures and hands on training. The hands-on training can include a real person testing experience for more accurate and authentic imaging. A pretest and posttest of mastery of the knowledge and skills will be administered to assure quality and a confidence scale will be used to determine the levels and growth of individual and collective self-efficacy. These assessments will be conducted before and after the conclusion of the course to monitor the impact of the course, note areas where the course can be improved and provide the core team of trainers with information they can use to tailor the experiences they will coach in their ride-along in the ambulances.

After completing the course, the trained paramedics will get a certificate of completion. The paramedics will be able to earn a second level of certification is pending the hands-on

assessments that will be conducted in the field that will involve application of the ultrasound and interpreting its results in the ambulance in real cases. These assessments are part of the suggested design for a continuous improvement effort that will involve the high skilled paramedics engaging in ride along with the first level certified paramedics in the ambulance. The ride along will enable highly trained core team to assess the paramedics' skills to conduct the ultrasound imaging. What's more the trainers will be able to assess whether the paramedics followed the written protocol on how and when to use the ultrasound in the trauma patient. Paramedics who are found to be highly competent as a result of these assessments will receive Certifications of Distinction and will be given a license to use the ultrasound as a diagnostic tool in real patients in the ambulance.

This system of continuous improvement recognizes that the skill with the application and interpretation of the ultrasound are operator dependent. There is a crucial need to build into the system regular opportunities refreshment courses so paramedics and EMTs can sustain a highly effective level of ultrasound use. That is why it is suggested that all paramedics and EMTs must renew their certifications on annual basis in order to preserve a high level of performance and patient care. After the ride along assessment, the ultrasound course will be reevaluated on an evidence-based research to ensure making a system of continuous improvement. The system of continuous improvement will help recognizing the gap in the paramedic's knowledge and skills that needs to be addressed in the upcoming refreshment courses. The course will be focused on the ultrasound knowledge and skills in terms of diagnosing trauma patients by performing the FAST examination to the abdomen of the patients. The FAST examination is critical to identify whether the patients are suffering from internal bleeding. The course must provide to the

paramedics and the EMTs a well-tested protocol on how and when the paramedics should perform the ultrasound.

### **Research and Theoretical Support for the Proposed Educational Initiative**

Creating the ultrasound course by using social theories such as self-efficacy and collective efficacy are essential to increase the paramedics ultrasound knowledge and hands on skills. Vicarious experiences can be a huge role in the educational plan, starting by training a few capable paramedics so in the future those training paramedics can go on and teach others. The regular paramedics will absorb the skills and the belief from observing that other paramedics have already been attain a high level of expertise and confidence in the knowledge and the skills of the ultrasound which subsequently will increase self-efficacy among trainees. In addition, Mastery experiences can play a huge role in the trainee self-efficacy, A successful experience increases the perceived self-efficacy, in contrast, an unsuccessful it weakens it (Bandura,1994; Watson, Chemers & Preiser, 2001). Positive past performance of the ultrasound imaging can increase the self-efficacy of the paramedics where negative past performance of the ultrasound imaging can weaken it.

Comparing oneself to success criteria really matters. Self-assessment is a mechanism for the identification of one's strengths and weaknesses as well as process that determines and considers complementary functions. In addition, self-assessment can be more effective if individuals can self-monitor their abilities against a clearly described criteria. In the ride along section of the educational course: the high skilled paramedic will ensure that the paramedics will self-assess against a protocol on how and when to use the ultrasound and how to perform a successful ultrasound imaging (Eva & Regehr, 2005; Zimmerman, 2000). In addition, there is a need to create an outlined curriculum that will be used to teach the healthcare professionals.

### **Component Three: The Major Components of the Proposed Curriculum of the Ultrasound Course**

This component of action plan outlines the major components of the ultrasound course curriculum. The curriculum will help us ease the implementation process of the ultrasound in the future. As discussed earlier, the ultrasound educational course will last for three days and will target any healthcare providers who are currently working in any emergency medical services agencies in Saudi Arabia. The major component of the curriculum will address the vision, mission of the course, the purpose of the course, the desired outcome, curriculum units with its learning goals, the proposed schedule of the class and the incorporation of the social theory in the classroom. These major components of the curriculum will be discussed in turn:

#### **A- Vision of the Ultrasound Course**

The vision of the course is to enhance and increase the healthcare providers knowledge and skills of the ultrasound machines as a prehospital diagnostic tool for all the emergency medical services personnel in the kingdom of Saudi Arabia. In addition, the ultrasound course must be included in all the curriculum of the emergency medical services program in all the Saudi universities. Making the ultrasound course a mandatory requirement for healthcare providers to take in order to be recertified to do their clinical duties. The ultrasound course must promote the healthcare professional confidence and trust in acquiring the knowledge and the skills of the ultrasound testing and imaging.

#### **B- Mission of the Ultrasound Course**

The course will provide the healthcare provider the necessary knowledge and skills of the ultrasound machines and its application outside the hospital. The ultrasound course will serve

any healthcare professional who are interested to learn the diagnostic capabilities and the application of the ultrasound in the ambulance. We target the paramedics, EMT basic, EMT intermediate, emergency medical services administrators and EMS chiefs. The course will provide the necessary educational materials in the course as well as advanced medical simulation laboratory to illustrates a real testing opportunity of the ultrasound skills and knowledge.

### **C- The Purpose of the Curriculum**

The purpose of the curriculum is to prepare the healthcare providers in the emergency medical services to extend their skills and competencies of the ultrasound machines. The curriculum will help summarize to the students the main topics and skills that will be covered in the three days course period. The curriculum will explain to the students the requirement of the course in order for them to be prepared intellectually and mentally.

### **D- Desired Outcome of the Curriculum**

The students should learn the necessary knowledge and skills of the ultrasound application and its used in the prehospital setting. This include the diagnostic capability of the device as well as the skills of conducting the ultrasound imaging. The healthcare professionals must show a high level of diagnostic accuracy of the ultrasound imaging.

### **E- Curriculum Units and Learning Goals**

The ultrasound curriculum is consisted of multiple units. These units will be accompanied by learning goals to establish a high level of skills and content. These units are explained in turn:

#### **1- The Ultrasound Knowledge Unit**

**Learning Goal:** The student will be able to learn the general knowledge of the ultrasound device and its use in the healthcare field, Its history, application, capability, and accuracy. In addition, the student will learn the physics of the ultrasound machines and the functionality of its each part as well as the general anatomy and the physiology of each organ of the body including neck, head, spine, abdomen, central nervous system, male pelvis and female pelvis and the difference of the ultrasound imaging between the different gender especially in pregnant female. The students will also be able to learn the different use of the ultrasound machines in the hospital and outside of the hospital and the impact of the environment factors that were discovered in this research on the ultrasound imaging capability and authenticity.

## **2- The Ultrasound Scanning Skills Unit**

**Learning Goal:** The student will be able to learn and practice the skills of the ultrasound imaging in a simulation laboratory. The ultrasound skills and competency are dependent on many factors: one of the main factors is operator dependent which means that there are no conclusive findings to suggest what type and length of training produced operators who could dependably produce accurate and speedy readings (Rippey and Royse, 2009). In that case, each student must be closely monitored their skill progression of the ultrasound imaging thorough out the course. The student will also be able to learn at first the normal scanning of the body organ and then the scanning of the pathology of each scanned organ of the abdomen and the whole body. As Taylor, et al, 2014 stated that the main purpose of the ultrasound testing is to identify the source of a certain disease or exclude pathology in the specific organ or structure. In addition, the students will be able to know the process of getting the informed consent in doing the ultrasound testing as well as making sure that patient safety becomes a priority in conducting an

ultrasound imaging. The students will be able to practice in hand the different protocol of doing the ultrasound testing in trauma patients within the Saudi Red Crescent Authority or any other health agencies in the kingdom of Saudi Arabia. The students will be able to learn the Focused Assessment with Sonography for Trauma (FAST) examination and the current indication to use the test. The students will be evaluated during the scanning skills unit to make sure that their level of competency is high.

### **3- The Prehospital Ultrasound Knowledge Unit**

**Learning Goal:** The student will be able to learn the use of the ultrasound in a different setting, different environment and different medical practice. The prehospital ultrasound unit will be focused on the conduction and the interpretation of the ultrasound imaging in the ambulance and the accompanying environmental factors that can hinder the ability to conduct the ultrasound testing. By explaining the different mode of transportation that might affect the ultrasound testing, the student must be able to recognize and choose the appropriate mode of transportation that will guarantee the successful usage of the ultrasound machines.

### **4- The Prehospital Ultrasound Scanning Unit**

**Learning Goal:** The students will be able to identify the main pathologies in the abdomen that can be detected by using the ultrasound device in the prehospital setting. The identification of these pathologies can help determine the best medical approach that the healthcare professional can take to ensure patient safety and wellbeing. The students also will learn the skill of doing the ultrasound imaging in the prehospital environment and how they can interpret the ultrasound

scans. In addition, the students will learn how to communicate with the receiving hospitals in terms of consultation.

### **5- The Ride Along Unit**

The ride along components in the educational plan will be conducted by the first level certified paramedics after finishing the three days course to examine the student's skills in conducting the ultrasound imaging in the ambulance on real patients.

**Learning Goal:** The student will be able to examine their skills learned in the ultrasound course to conduct the ultrasound imaging on real patients. The students will be able to monitor and assess their level of competency against specific criteria.

### **F- The Proposed Schedule of the Ultrasound Course**

The ultrasound course will last for three days from 9:30 AM until 3 PM (See Table 5.8). The course will be held at King Saud bin Abdelaziz University for Health Sciences since they have a well-equipped simulation laboratory in their facility. The Morning class will be focused on lectures using PowerPoints and group discussion as the afternoon class will be focused on the hands-on training. After the completion of the course, it is the responsibility of the course manager to schedule the ride along section of the program.



*Table 5.8 Ultrasound Course Schedule*

Date/ Day	Class Topic	Time	Instructor
Day One: Morning Class	The Ultrasound Knowledge Unit	8 AM-12 PM	To be Assigned
Day One: Afternoon Class	The Ultrasound Scanning Skills Unit	1 PM-4 PM	To be Assigned
Day Two: Morning Class	The Prehospital Ultrasound Unit	8 AM-12 PM	To be Assigned
Day Two: Afternoon Class	The Prehospital Ultrasound Scanning Unit	1 PM-4 PM	To be Assigned
Day Three: Morning Class	The Ride Along Unit (procedure and scheduling)	8 AM-12 PM	To be Assigned
Day Three: Afternoon Class	End of Course Evaluation (Written and Practical testing)	1 PM-4 PM	To be Assigned

### **G- The End of Course Evaluation**

In the end of the course there will be an evaluation on the knowledge and the skills of the ultrasound diagnoses of trauma patients. The evaluation will be consisted of three parts: written practical, and ride along evaluation. The written evaluation will assess the knowledge of the ultrasound application in the healthcare field where the practical evaluation will assess the skills and the student's competency in doing the ultrasound imaging and diagnoses. The ride along evaluation will assess the skills of the ultrasound imaging on real patients. The written evaluation will be consisted of multiple choices on the units and the topics that were discussed in the course. The practical evaluation will focus on the skills of each students in their level of competency in doing the ultrasound imaging and interpretation. In order to be competent in the knowledge and

the skills of the ultrasound, the students will need 88% score to pass the written and the practical evaluation as well as the ride along final assessment. The student who fail one of these tests will have to repeat the whole course.

#### **H- Incorporating Social Theory in the Ultrasound Course**

The ultrasound course will function within a larger framework. The framework will shape every aspects of the ultrasound course starting from the delivery of the course, choosing the instructors, course policies and protocols. Using social theories as a framework will help us accomplish our main vision and mission of the ultrasound course. According to Bandura (2000), self-efficacy theory refers to the ultimate personal judgement on the best strategies that an individual can implement aimed at dealing with a given prospective situation. Promoting self-efficacy in the classroom can help the students face difficult challenges with confidence and strength. Promoting self-efficacy in the classroom will help build up the student's self-confidence therefore their performance. The ultrasound course will use some strategy to promotes self-efficacy in the classroom. The application of self-efficacy and collective efficacy in the medical filed is very limited and it is not enhanced especially in simulation labs. Self-efficacy and collective efficacy must be embedded in the training and the education of medical personnel. thoughts and beliefs can have a negative or a positive impact on the perceptions of medical professionals in doing cardiopulmonary resuscitation. The positive thought and belief can play a huge role in the healthcare professional confidence and performance (Bandura, 1977, Pascual, Blanco & Torre-Puente, 2019; Watson, Chemers & Preiser, 2001). Social theories must be embedded in the ultrasound educational course. Below are the main ways to promotes social theories in the ultrasound course classroom.

- 1- The Teacher of the course must hold a high level of expectation in regard to the accomplishment of the student as well as verbally encourage the students in doing the ultrasound testing and imaging.
- 2- Making students self-assess and self-regulate against a goal or a protocol for example, creating a protocol of doing the ultrasound testing and then making the students do the ultrasound testing following the proposed protocol.
- 3- Encourage students to verbalize the process of the ultrasound imaging following the protocol provided.
- 4- The paramedics who were trained first by the emergency doctors can act as the peer modeling which can promote the student's self-efficacy in the ultrasound course.
- 5- Doing the ultrasound testing on each other can promote trust between the students.

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## Appendix A

### Consent form for Saudi Red Crescent Authority Paramedics and EMTs

DUQUESNE UNIVERSITY  
600 FORBES AVENUE ♦ PITTSBURGH, PA 15282

#### CONSENT TO PARTICIPATE IN A RESEARCH STUDY

**TITLE:**

Stakeholder perceptions of inherent barriers to the effective implementation of ultrasound in the prehospital setting between the Saudi Red Crescent Authority and the National Guard Hospital

**INVESTIGATOR:**

Researcher Abdulrazzaq H Alsulami, MS Ed., Doctoral Candidate, Department of Foundations and Leadership, Duquesne University, alsulamim2@duq.edu

**ADVISOR:**

Dr. Connie M. Moss, Ed.D., Director, Ed.D. in Educational Leadership, Department of Educational Foundations and Leadership, Duquesne University, 412-396-4038, [moss@duq.edu](mailto:moss@duq.edu)

**SOURCE OF SUPPORT:**

This study is being performed as partial fulfillment of the requirements for the doctoral degree in Department of Foundations and Leadership at Duquesne University.

**PURPOSE:**

You are being asked to participate in a research project that seeks to gain insight into the perceptions of stakeholder regarding the utility of and barriers to implementing ultrasound in the



prehospital setting between the Saudi Red Crescent and the Emergency Department of the National Guard Hospital. Information from the study will be used to generate a comprehensive report to aid decision-making and a feasible action plan.

In order to participate in the study, you must be a paramedic or EMT with the Saudi Red Crescent and be 18 years or older.

### **PARTICIPANT PROCEDURES:**

To participate in this study, you will be asked to complete a survey that will ask for your opinions regarding the potential implementation of ultrasound in the prehospital setting. You also be asked to provide basic demographic information. The survey should take approximately 25 minutes to complete. The survey will remain open until for 15 days from (September 10 to Sep 25)

These are the only requests that will be made of you.

### **RISKS AND BENEFITS:**

There are minimal risks associated with participating in this study, but no greater than those encountered in everyday life.

### **COMPENSATION:**

There will be no compensation for participating in this study. Participation in this project will require no monetary cost to you.

### **CONFIDENTIALITY:**

Your participation in this study and any personal information that you provide will be kept confidential at all times and to every extent possible.

Your name will never appear on any survey or research instruments. All written and electronic forms and study materials will be kept secure. Your response(s) will only appear in statistical data summaries. Any study materials with personal identifying information will be maintained for three years after the completion of the research and then destroyed.

### **RIGHT TO WITHDRAW:**

You are under no obligation to participate in this study. Because the survey is anonymous there is no way to remove your responses once you submit the survey. Once you complete the survey, you will have no way to retrieve your data or request that it be removed from the study.

**SUMMARY OF RESULTS:**

A summary of the results of this research will be supplied to you, at no cost, upon request.

**VOLUNTARY CONSENT:**

I have read the above statements and understand what is being requested of me. I also understand that my participation is voluntary and that I am free to refuse to participate, for any reason. On these terms, I certify that I am willing to participate in this research project.

I understand that should I have any further questions about my participation in this study, I may call Dr. Connie M. Moss at 412.396.4038 or email her at [moss@duq.edu](mailto:moss@duq.edu). Should I have any questions regarding protection of human subject issues, I may contact Dr. David Delmonico, Chair of the Duquesne University Institutional Review Board, at 412.396.1886 or email him at [delmonico@duq.edu](mailto:delmonico@duq.edu)

I understand that my submission of my completed survey is my consent.

\_\_\_\_\_ Date  
Participant's Signature

\_\_\_\_\_ Date  
Researcher's Signature



## Appendix B

### **Informed Consent for The Saudi Red Crescent Authority Administrator and Expert Physicians**

DUQUESNE UNIVERSITY  
600 FORBES AVENUE ♦ PITTSBURGH, PA 15282

#### **CONSENT TO PARTICIPATE IN A RESEARCH STUDY**

##### **TITLE:**

Stakeholder perceptions of inherent barriers to the effective implementation of ultrasound in the prehospital setting between the Saudi Red Crescent Authority and the National Guard Hospital

##### **INVESTIGATOR:**

Researcher Abdulrazaq H Alsulami, MS Ed., Doctoral Candidate, Department of Foundations and Leadership, Duquesne University, alsulamim2@duq.edu

##### **ADVISOR:**

Dr. Connie M. Moss, Ed.D., Director, Ed.D. in Educational Leadership, Department of Educational Foundations and Leadership, Duquesne University, 412-396-4038, [moss@duq.edu](mailto:moss@duq.edu)

##### **SOURCE OF SUPPORT:**

This study is being performed as partial fulfillment of the requirements for the doctoral degree in Department of Foundations and Leadership at Duquesne University.

##### **PURPOSE:**

You are being asked to participate in a research project that seeks to gain insight into the perceptions of stakeholder regarding the utility of and barriers to implementing ultrasound in the prehospital setting between the Saudi Red Crescent and the Emergency Department of the National Guard Hospital. Information from the study will be used to generate a comprehensive report to aid decision-making and inform a feasible action plan.

You are being asked to participate in the study, because you are an emergency doctor who has clinical and administrative duties at the National Guard Hospital or an administrator in an emergency medical stations with the Saudi Red Crescent and are over 18 years or older.

##### **PARTICIPANT PROCEDURES:**

To participate in this study, you will be asked to take part in a face to face interview with the researcher. With your permission your responses will be recorded. You will be asked for your opinions regarding the potential implementation of ultrasound in the prehospital setting. The Interview should take approximately 45 minutes to complete. These are the only requests that will be made of you.

**RISKS AND BENEFITS:**

There are minimal risks associated with participating in this study, but no greater than those encountered in everyday life.

**COMPENSATION:**

There will be no compensation for participating in this study. Participation in this project will require no monetary cost to you.

**CONFIDENTIALITY:**

Your participation in this study and any personal information that you provide will be kept confidential at all times and to every extent possible. Your name, title, positions, and affiliations will never appear on any reports or connected to their responses in any way. All written and electronic forms will be kept secure. All personal identifications such as (Name, Positions title, other possible personal identifications) in the audio recording will be removed before transcribing the data. The audio recording will be destroyed after five years from the data collection process. Your response(s) will only appear in statistical data summaries. Any study materials with personal identifying information will be maintained for three years after the completion of the research and then destroyed.

**RIGHT TO WITHDRAW:**

You are under no obligation to participate in this study. You are free to withdraw your consent to participate at any time by. Once the interview is completed, you will have the right to request your data to be removed in any time.

**SUMMARY OF RESULTS:**

A summary of the results of this research will be supplied to you, at no cost, upon request.

**VOLUNTARY CONSENT:**

I have read the above statements and understand what is being requested of me. I also understand that my participation is voluntary and that I am free to refuse to participate, for any reason. On these terms, I certify that I am willing to participate in a face to face interview and I allow myself to be recorded.

I understand that should I have any further questions about my participation in this study, I may call Dr. Connie M. Moss at 412.396.4038 or email her at [moss@duq.edu](mailto:moss@duq.edu). Should I have any questions regarding protection of human subject issues, I may contact Dr. David Delmonico, Chair of the Duquesne University Institutional Review Board, at 412.396.1886 or email him at [delmonico@duq.edu](mailto:delmonico@duq.edu)

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Participant's Signature

Date

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Researcher's Signature

Date

## Appendix C

### Face-to-Face Interview Guide for Administrators and Physicians

**Q1:** Which mode of prehospital transportation do you prefer? (choose one)

- Load and Go
- Stay and Play

Please explain the reasons for your choice:

**Q2:** Which of the following choices best describes your familiarity with the ultrasound machine?

- I have no familiarity with it.
- I have heard of it.
- I have seen it used.
- I have used it.
- I use it regularly.

**Q3:** Based on your familiarity with the ultrasound, what do you think will be the impact of equipping the Saudi Red Crescent ambulances with ultrasound equipment to diagnose trauma patients in the prehospital setting?

**Q4:** If an initiative to equip the Saudi Red Crescent with prehospital ultrasound was implemented, what role do you think the National Guard Hospital's Emergency Department would play?

**Q5:** What do you think would be the main barriers to the potential implementation of prehospital ultrasound at the Saudi Red Crescent? Why would these be barriers?

**Q6:** Which current policies and protocols in the Emergency Department at the National Guard Hospital might act as barriers to the implementation of prehospital ultrasound in the Saudi Red Crescent?

**Q7:** How does the paramedics' prehospital work contribute to or hinder the work of physicians and administrators in the Emergency Department at the National Guard Hospital?

**Q8:** How confident are you in the ability of the Saudi Red Crescents' paramedics and EMT's to learn to use an ultrasound and then accurately diagnose a trauma patient in the prehospital setting?

## Appendix D

### Survey Questions for Saudi Red Crescent Authority Paramedics and EMTs

**Q1:** Which mode of prehospital transportation do you prefer? (Choose one)

- Load and Go
- Stay and Play

Please explain the reasons for your choice:

**Q2:** Please choose the phrase below that best describes your familiarity with the ultrasound machine:

- I have no familiarity with it.
- I have heard of it.
- I have seen it used.
- I have used it.

**Q3:** Based on your familiarity with the ultrasound, what do you think will be the impact of equipping the Saudi Red Crescent ambulances with ultrasound machines to diagnose trauma patients in the prehospital setting?

**Q4:** If we implemented pre-hospital ultrasound in the Saudi Red Crescent, what role do you think the National Guard Hospital's Emergency Department would play?

**Q5:** What do you think would be the main barriers to the potential implementation of prehospital ultrasound in the Saudi Red Crescent? Please explain why these would be barriers.

**Q6:** Which current policies and protocols in the Saudi Red Crescent might act as barriers to the implementation of prehospital ultrasound?

**Q7 (Paramedics):** How does your work in the prehospital setting contribute to the work of the Emergency Room physicians at the National Guard Hospital?

**Q8:** How confident are you in your ability to learn to use the ultrasound to accurately diagnose a trauma patient in the prehospital setting?

**Q9:** How confident are you in the ability of the paramedics and EMTs in the Saudi Red Crescent to learn to use an ultrasound and then accurately diagnose a trauma patient in the prehospital setting?

#### Demographic Information:

1. Which type of certificate do you hold?

- EMT Basic
- EMT Intermediate
- Paramedic

2. How many years of experience do you have with the Saudi Red Crescent?

- Less than 2 years
  - 3 to 5 years
  - 6 to 8 years
  - 9 to 11 years
  - 12 to 15 years
  - more than 15 years
3. How frequently have you transported a trauma patient to the National Guard Hospital?
- Never
  - 5 to 10 times
  - 11 to 20 times
  - 21 to 50 times
  - 51 to 75 times
  - 76 to 100 times
  - more than 100 times



## Appendix E

### Interview Transcript (Administrator One)

**Researcher:** This the first interview with one of the Saudi Red Crescent administrators. first of all, thank you for agreeing to conduct this interview as you know this is a huge opportunity to discuss the potential implementation of the ultrasound in the prehospital setting. Let's start by the first question, as you know there are two different modes of transportation which are load and go and stay and play which one you prefer and why?

**SRCA Administrator:** I think as a mode of transportation, I will choose the load and go mode, but this really depends on the case itself.

Researcher: How so?

**SRCA Administrator:** Our job in the prehospital setting is to determine the severity of the injuries and based on that we can determine which mode of transportation suits the patient's condition for example, if the patient in critical condition I prefer to transport the patient as soon as possible.

**Researcher:** So, you are saying that in case the patients are in critical condition, fast transportation is the key!

**SRCA Administrator:** Yes, we transport the patient as soon as possible and en route we provide the necessary medical intervention that the patients need, and this is how we work in the Saudi Red Crescent

**Researcher:** Could you tell me why did you chose this specific mode of transportation?

**SRCA Administrator:** I think load and go is the best method in transporting the patient, we can use this method in case the patient need an immediate surgical intervention, as you know there is the golden hour aspect where patients need to get to the hospital in a period of one hour.

**Researcher:** Lets go the second questions, which of the following choices best describes your familiarity with the ultrasound machine?

Have you heard of it, seen it, used it in the past or did you use it in a regular basis?

**SRCA Administrator:** I have seen it used more than once in the Emergency Department when we drop off patients.

**Researcher:** Based on your familiarity with the ultrasound, what do you think will be the impact of equipping the Saudi Red Crescent ambulances with ultrasound equipment to diagnose trauma patients in the prehospital setting?

**SRCA Administrator:** I think it will have a good impact if we equipped the SRCA with the ultrasound

**Researcher:** Why do you think it will have a good impact?

**SRCA Administrator:** Doing the ultrasound on trauma patients is very helpful because you will be able to diagnose and effectively assess the patients for any hidden injuries.

**Researcher:** If an initiative to equip the Saudi Red Crescent with prehospital ultrasound was implemented, what role do you think the National Guard Hospital's Emergency Department would play?

**SRCA Administrator:** I think the hospital will be ready.

**Researcher:** In what way?

**SRCA Administrator:** The hospital will know the condition of incoming patients such as, if the patients have any internal bleeding the hospital will prepare in advance the appropriate resources.

**Researcher:** What kind of resources that the hospital will prepare if we diagnose the patients with the ultrasound?

**SRCA Administrator:** If the patients are suffering from internal bleeding, I think a surgical intervention. Also, the hospital will know the patient's condition because we already diagnosed the patient by using the ultrasound.

**Researcher:** Alright, let's talk about the barriers, what do you think would be the main barriers to the potential implementation of prehospital ultrasound at the Saudi Red Crescent? Why would these be barriers?

**SRCA Administrator:** I do not think there will be any barriers, but we have to make sure that the ultrasound is portable, small in size and can have a strong persistence since we work in various environmental conditions.

**Researcher:** Let's think about one barrier that can significantly hinder our ability to implement the prehospital ultrasound, what do you think that will be?

**SRCA Administrator:** I think the barrier that could hinder our ability is how paramedics can use the ultrasound, I believe we need an extensive training.

**Researcher:** From an administrative perspective, which current policies and protocols in the Emergency Department at the National Guard Hospital might act as barriers to the implementation of prehospital ultrasound in the Saudi Red Crescent?

**SRCA Administrator:** I do not think there are any current policy or protocol that can act as a barrier, I think they have to be collaboration between the Saudi Red Crescent and the National Guard Hospital in terms of implementing the ultrasound.

**Researcher:** How does the paramedics' prehospital work contribute to or hinder the work of physicians and administrators in the Emergency Department at the National Guard Hospital?

**SRCA Administrator:** I think there are a lot of collaboration between the paramedics at the SRCA and the emergency physicians. Our work must be based on effective case assessment, so it can be easy for the physicians to do their job.

**Researcher:** In what way the job of the paramedics can contribute to the physicians?

**SRCA Administrator:** Our work contributes to the physicians in doing the right medical intervention in the prehospital setting such as stop the bleeding, stabilizing the patients and diagnoses.

**Researcher:** Alright, in what way do you think our job as paramedics can hinder the work of the physicians?

**SRCA Administrator:** If the patients were not assessed properly and no effective medical intervention was made.

**Researcher:** How confident are you in the ability of the Saudi Red Crescents' paramedics and EMT's to learn to use an ultrasound and then accurately diagnose a trauma patient in the prehospital setting?

**SRCA Administrator:** Today, I think they have a shortage in training, I think if we made them involve in extensive training programs, I will be confident in their ability to learn to use the ultrasound.

**Researcher:** Thank you so much for giving me this time to conduct this interview as you know this is really an interesting subject that can really contribute in saving lives.

**SRCA Administrator:** Thank you Researcher, this has been an amazing opportunity and we hope to see these devices soon in the ambulance.

**Researcher:** It will be, Thank you.

## Appendix F

### Interview Transcript (Administrator Two)

**Researcher:** This is the second interview with one of the Saudi Red Crescent administrators, thank you so much for agreeing to participate in this study as previously explained to you the consent form and the confidentiality agreement. Per your consent we will record this interview.

**SRCA Administrator:** Absolutely, thank you for giving me this chance to participate in this study.

**Researcher:** Let's start by the first question, as you know there are two types of the transportation mode, which mode you prefer to use?

**SRCA Administrator:** I prefer using the stay and play mode.

**Researcher:** Can you explain to me why did you choose this specific type of transportation mode?

**SRCA Administrator:** It is because the Saudi Red Crescent is well prepared with capable paramedics, EMTs and resources to diagnose and treat the patients on the scene.

**Researcher:** Let's talk about the ultrasound, which of the following choices best describes your familiarity with the ultrasound machine?

**SRCA Administrator:** Our familiarity with the ultrasound is very limited, I have seen used in the emergency department.

**Researcher:** Based on your familiarity with the ultrasound, what do you think will be the impact of equipping the Saudi Red Crescent ambulances with ultrasound equipment to diagnose trauma patients in the prehospital setting?

**SRCA Administrator:** The impact of the ultrasound will be good but the need to implement it in the ambulance is not a priority because even if you diagnose the patients by using the ultrasound, you cannot really treat the patients, the ultimate treatment is the hospital. The only benefit of using the ultrasound, it can save time for the hospital in terms of diagnoses.

**Researcher:** From an administrative point of view, do you think it is going to be difficult to implement the ultrasound in the ambulance?

**SRCA Administrator:** I do not think it will be difficult, I view the application of the ultrasound as something useful but not necessary. Also, the ultrasound is more useful in the emergency department than the ambulance?

**Researcher:** So, you are saying that the ultrasound is more effective in the emergency department?

**SRCA Administrator:** Absolutely

**Researcher:** If an initiative to equip the Saudi Red Crescent with prehospital ultrasound was implemented, what role do you think the National Guard Hospital's Emergency Department would play?

**SRCA Administrator:** I think the ultrasound application in the ambulance will be beneficial to the emergency department in terms of early diagnoses and save time for the patient in the emergency department.

**Researcher:** What do you think would be the main barriers to the potential implementation of prehospital ultrasound at the Saudi Red Crescent? Why would these be barriers?

**SRCA Administrator:** The barriers as it follows

First barrier: the ultrasound machines needs a huge space inside the ambulance as you know the space of the back of the ambulance is small. If we can find small and portable ultrasound devices that will work inside the ambulance.

Second barrier: paramedics needs extensive training on how to effectively use the ultrasound. As you know, the current curriculum of the paramedics and EMTs do not have the ultrasound as a teaching target.

The third barrier: environmental factors can play as a barrier to the implementation of the ultrasound such as ambulance movement.

**Researcher:** You mentioned a very important point that paramedics were not trained on how to use the ultrasound and it was not included in their curriculum right?

**SRCA Administrator:** Yes, the paramedics and the EMTs curriculum do not have anything regarding the ultrasound or how to use it.

**Researcher:** Let's talk about the barrier of the ultrasound from an administrative point of view, what do you think will be the main barrier of the potential implementation of prehospital ultrasound?

**SRCA Administrator:** From an administrative point of view, I think the benefit from the ultrasound is minimum compared with its high cost. I believe with this kind of high cost we can relocate those money to the most important things that really matters in the SRCA.

Researcher: Such as?

**SRCA Administrator:** We can hire more staff.

**Researcher:** Alright, which current policies and protocols in the Emergency Department at the National Guard Hospital might act as barriers to the implementation of prehospital ultrasound in the Saudi Red Crescent?

**SRCA Administrator:** There is a problem with all the hospitals in Saudi Arabia not only the National Guard hospital which is the confidence in the paramedic's ability to conduct appropriate diagnoses not to mention a diagnosis done by the ultrasound. If a patient diagnosed by using the ultrasound and was transported to the hospital, the first thing the hospital will do is to redo the test because there is no confidence in the prehospital health professionals.

**Researcher:** So, do you think this the only barrier in terms of policies and protocols.

**SRCA Administrator:** It is not all about the confidence issue, there is also another issue, the SRCS and the hospital are separate organizations and there is no collaboration between them. Let me be clear, the doctor in the emergency department wants to cover their back and they will redo the ultrasound, there is no way they can depend solely in the paramedic's assessment. I think that we need a unified protocol between the SRCA and the hospitals, so we can know the practicality of doing the ultrasound.

**Researcher:** How does the paramedics' prehospital work contribute to or hinder the work of physicians and administrators in the Emergency Department at the National Guard Hospital?

**SRCA Administrator:** It will help the physicians and administrators in the Emergency Department at the National Guard Hospital if we effectively assess and diagnose the patient accurately. It will hinder their ability if we did not conduct an appropriate patient assessment and we did not diagnose the patient accurately by using the ultrasound.

**Researcher:** Alright, last question I know I take a lot of your time.

**SRCA Administrator:** No at all.



**Researcher:** How confident are you in the ability of the Saudi Red Crescents' paramedics and EMT's to learn to use an ultrasound and then accurately diagnose a trauma patient in the prehospital setting?

**SRCA Administrator:** The paramedics and the EMTs in the Saudi Red Crescent are well prepared and they are doing a good job in the prehospital setting. Knowing something new such as the ultrasound needs a lot of time a effort and training, so they can master it. I cannot say whether the paramedics will achieve the high level of skill and knowledge of the ultrasound because that depends on the individual.

**Researcher:** Are you confident in their ability to learn to use the ultrasound?

**SRCA Administrator:** If they undergo an extensive training, yes, I am confident.

**Researcher:** Thank you so much for this amazing and knowledgeable interview.

**SRCA Administrator:** You are welcome, thank you for your effort to enrich the medical community with such valuable research.

**Researcher:** As a health provider this the least thing I can do, thank you again.

**SRCA Administrator:** You are welcome.

## Appendix G

### Interview Transcript (Administrator Three)

**Researcher:** This the third interview with one of the Saudi Red Crescent administrators, thank you so much for agreeing to participate in this study as previously explained to you the consent form and the confidentiality agreement. Per your consent we will record this interview. Alright, let's start by the first question as you know there are two types of transportation mode which one you prefer?

**SRCA Administrator:** First of all, my consent to participate in this study is a duty in order to enhance the Emergency Medical Services in the kingdom. Regarding your question, I prefer the load and go as a mode of transportation.

**Researcher:** Can you tell me, why did you choose this type of mode?

**SRCA Administrator:** Because the patients time is very critical in giving any medical intervention. Therefore, Fast transportation is the key in our work.

**Researcher:** Which of the following choices best describes your familiarity with the ultrasound machine?

**SRCA Administrator:** I have seen it used in the emergency department.

**Researcher:** Based on your familiarity with the ultrasound, what do you think will be the impact of equipping the Saudi Red Crescent ambulances with ultrasound equipment to diagnose trauma patients in the prehospital setting?

**SRCA Administrator:** I think it will have a positive impact on the patient condition.

**Researcher:** How so?

**SRCA Administrator:** In diagnosing trauma patient

**Researcher:** Do you think the Saudi Red Crescent will significantly benefit from the implementation of the ultrasound?

**SRCA Administrator:** Absolutely they will.

**Researcher:** Alright, if an initiative to equip the Saudi Red Crescent with prehospital ultrasound was implemented, what role do you think the National Guard Hospital's Emergency Department would play?

**SRCA Administrator:** A collaboration between the SRCA and the National Guard Hospital is a must, we need to put a protocol together to determine how the paramedics can effectively use the ultrasound and how the hospital will react if they received a patient who already has been diagnosed with the ultrasound.

**Researcher:** So, do you personally support a collaboration between the SRCA and the National Guard Hospital in the future?

**SRCA Administrator:** Not only me, I think the SRCA will have no problem to collaborate with any hospitals to ensure that patients can have the ultimate medical intervention both in the prehospital setting and in the hospital.

**Researcher:** from an administrative perspective, what do you think would be the main barriers to the potential implementation of prehospital ultrasound at the Saudi Red Crescent? Why would these be barriers?

**SRCA Administrator:** The barriers can be associated with the technology of the ultrasound; I think it needs a consistent maintenance. In addition, the device is expensive, and the paramedics will have the responsibility of the device if it gets lost.

**Researcher:** Alright, let's say that a paramedic lost the ultrasound on the scene unintentionally, is he going to be held responsible for the device?

**SRCA Administrator:** Not only the ultrasound but all the devices are within the responsibility of the paramedics, if it gets lost or stolen, they are obligated to pay the cost of these devices. As you know, in the beginning of each shift they are a form that the paramedics must filled out in order to know when and which devices were in the possession of each paramedic.

**Researcher:** Which current policies and protocols in the Emergency Department at the National Guard Hospital might act as barriers to the implementation of prehospital ultrasound in the Saudi Red Crescent?

**SRCA Administrator:** The National Guard Hospital has it is own policies and protocols, I am do not think there will be any barrier inside the hospital that can hinder the implementation of the ultrasound. But as I have said before, we must have a collaboration with them.

**Researcher:** Let me give you an example, if a paramedic diagnosed a trauma patient by using the ultrasound, the paramedic transferred the patient to the National Guard Hospital, what are the barriers that the paramedic might face in the Emergency Department?

**SRCA Administrator:** It depends on the paramedic who transferred the patient and also, depends on the physicians who received the patients. The paramedic might have no familiarity on how to properly perform the ultrasound which can hinder the ability of the physicians to assess the patient in an accurate way. In general, we need to make a unified protocol about when and how we can use the ultrasound. Also, we want to monitor the application of the ultrasound form both sides.

**Researcher:** You mentioned that we need to monitor the application of the ultrasound, can you elaborate more on that?

**SRCA Administrator:** We can monitor the diagnostic accuracy of the paramedics and whether this device is effective in uncovering internal bleeding or not. I think a protocol in itself will not do any good but if we put a protocol and monitor the effectiveness of the ultrasound application that will increase the chance of a successful implementation of this device in the ambulance.

**Researcher:** How does the paramedics' prehospital work contribute to or hinder the work of physicians and administrators in the Emergency Department at the National Guard Hospital?

**SRCA Administrator:** our work really contributes with the physicians in many ways such as case assessment, early diagnoses and early medical intervention.

**Researcher:** In what way, do you think paramedics work can hinder the physicians?

**SRCA Administrator:** I do not think the paramedics work can hinder the physicians in any way. In the contrary, paramedics treat patients on the scene and also, transport them to the hospital as soon as possible.

**Researcher:** Last question I promise, how confident are you in the ability of the Saudi Red Crescents' paramedics and EMT's to learn to use an ultrasound and then accurately diagnose a trauma patient in the prehospital setting?

**SRCA Administrator:** I am confident, but the paramedics must undergo an extensive training before its implementation.

**Researcher:** Thank you so much for this amazing interview as I have learned from you.

**SRCA Administrator:** You are welcome, as I have said before this is a duty and I belief in this research as a way to enhance our emergency services.

## Appendix H

### Interview Transcript (Administrator Four)

**Researcher:** This the fourth and the last interview with one of the Saudi Red Crescent administrators, thank you so much for agreeing to participate in this study as previously explained to you the consent form and the confidentiality agreement. Per your consent we will record this interview. Alright, let's start by the first question as you know there are two types of transportation mode which one you prefer?

**SRCA Administrator:** I prefer the load and go mode.

**Researcher:** Can you explain to me, why did you choose the load and go as a mode of transportation?

**SRCA Administrator:** I believe that all cases need a fast transportation rather than wasting time in doing medical intervention on the scene. If the patient is in critical condition, then we have to transport the patient to the hospital so soon as possible because the ultimate treatment for the patient is in the hospital not in the prehospital setting.

**Researcher:** You said that in critical patient's fast transportation is the key right?

SRCA Administrator: Yes

**Researcher:** What about non-critical patients?

**SRCA Administrator:** In non-critical patients we can use the stay and play as a mode of transportation since there are no life-threatening condition that can affect the patients if we stayed along time in the scene.

**Researcher:** Alright let's talk about the ultrasound can you tell me, which of the following choices best describes your familiarity with the ultrasound machine?

**SRCA Administrator:** I have heard of it

**Researcher:** So, based on your familiarity with the ultrasound, what do you think will be the impact of equipping the Saudi Red Crescent ambulances with ultrasound equipment to diagnose trauma patients in the prehospital setting?

**SRCA Administrator:** I think the impact will positive if we implement the ultrasound in the Saudi Red Crescent.

**Researcher:** Can you tell me in what way it will be positive?

**SRCA Administrator:** giving the necessary and the appropriate medical intervention to the trauma patients. Also, early diagnoses will have major impact on the patient's welfare.

**Researcher:** If an initiative to equip the Saudi Red Crescent with prehospital ultrasound was implemented, what role do you think the National Guard Hospital's Emergency Department would play?

**SRCA Administrator:** I think the National Guard Hospital will receive the patients who were diagnosed with the ultrasound in more rapid way. Also, the hospital will get informed about the patient condition prior to the arrival of the patient which can give the hospital the opportunity to prepare the appropriate resources such as the operation room.

**Researcher:** Let's talk about the barrier, what do you think would be the main barriers to the potential implementation of prehospital ultrasound at the Saudi Red Crescent? Why would these be barriers?

**SRCA Administrator:** I think the main barrier that I would think of is that this device needs a sterilization, so patients cannot acquire any infectious diseases.

**Researcher:** Do you think there will be any barrier other than the sterilization?

**SRCA Administrator:** I do not think there will be any barrier to the implementation of the ultrasound other than the sterilization of these devices.

**Researcher:** Let's take this issue for an administrative point of view, what do you think the barrier would be?

**SRCA Administrator:** we need to come up with a protocol on how to use the ultrasound and when and it has to involve many different agencies.

Researcher: Such as?

**SRCA Administrator:** All hospitals in the region.

**Researcher:** Which current policies and protocols in the Emergency Department at the National Guard Hospital might act as barriers to the implementation of prehospital ultrasound in the Saudi Red Crescent?

**SRCA Administrator:** I am not familiar with any policies or protocols inside the National Guard Hospital but a collaboration between the two agencies is the key for a successful implementation of the ultrasound.

**Researcher:** Alright, how does the paramedics' prehospital work contribute to or hinder the work of physicians and administrators in the Emergency Department at the National Guard Hospital?

**SRCA Administrator:** The paramedics contributes in assessing the patient's condition and provide the necessary medical intervention.

**Researcher:** Is there any way it can hinder the physicians work?

**SRCA Administrator:** yes, it can hinder if the paramedics give inaccurate information about the patient condition to the physicians.



**Researcher:** How confident are you in the ability of the Saudi Red Crescents' paramedics and EMT's to learn to use an ultrasound and then accurately diagnose a trauma patient in the prehospital setting?

**SRCA Administrator:** I am very confident in them as you know there are a lot of capable paramedics working today with the Saudi Red Crescent who have many resources available in their disposal. The emergency medical services in Saudi Arabia is better than before.

**Researcher:** Can tell me, what are the things that get improved in the Emergency Medical Services?

**SRCA Administrator:** The ambulance services are more effective than before as we worked on improving the response rate. We provided many medications that the paramedics use on daily basis. Also, paramedics become more engaged on getting new courses that helped them increase the level of their knowledge and skills.

**Researcher:** As you know that GPS are not in use in the ambulance, you mentioned that the response rate is improved, can you tell me the average time that the ambulance needs to get to the patients.

**SRCA Administrator:** Yes, there is no GPS, but we have medical direction where it can help in getting to the patients. I think we need 15 minutes maximum to arrive.

**Researcher:** Do you think that will be a barrier in the implementation of the ultrasound?

**SRCA Administrator:** I do not think it will be a barrier.

**Researcher:** But you the services will be delayed?

**SRCA Administrator:** if it is a critical patient, we will transfer the patient to the nearest hospital. If it is non-critical patient, delay transportation is appropriate since there is no harm done to the patients.

**Researcher:** Alright, thank you so much for this interview.

**SRCA Administrator:** You are welcome.

## Appendix I

### Interview Transcript (Emergency Physician One)

**Researcher:** This is the first interview with one of the emergency physicians who has an extensive experience both in the hospital and in the prehospital setting. First of all, thank you for agreeing to participate in this study, let's start by giving us a brief overview about the positions that you are currently holding.

**Emergency Physician One:** I am an emergency consultant. My training was focused on the Emergency Medicine and then I specialized in the Emergency Medical Services program in Canada. I held a lot of positions as I started with the director of the emergency medical services department in the National Guard Hospital. The Emergency Medical Services department is a huge facility that have more than 100 working paramedics and EMTs with an average of 1500 to 2000 emergency calls per month. The emergency vehicles we have at this facility is a range between 30 to 40 ambulances. I am currently working as the head of the emergency dispatch center in the ministry of health which oversees the emergency transportations cases between hospitals around the kingdom.

**Researcher:** As I know you have a tremendous experience both in the hospital and in the prehospital setting and that the reason why I chose to conduct this research interview with you. I want to start by asking you about the mode of transportation as you know there are two ways to transport the patients to the medical facilities, which mode of transportation you prefer and why?

**Emergency Physician One:** I think that both modes are beneficial in a distinctive way let say if we have a cardiac arrest patient where you need to do CPR I think using the stay and play is a

priority here until the heart start beating again or the patient code comes to an end. Now let's discuss the trauma patients and which mode of transportation is more preferable, I think in trauma cases the treatment is not going to happen on the scene or in the emergency department, the ultimate treatment will be on the table of the surgeon in the operation room that what justifies using the load and go in trauma patients. But even in some cases in trauma patients we can use the stay and play mode such as if the patients are suffering from bleeding and you need to stop it or you want to put a tourniquet and I believe this is the only case we you have to use the stay and play in the trauma patients.

**Researcher:** I think I know the answer of this question, but I am going to ask it anyway, which of the following choices best describes your familiarity with the ultrasound machine?

**Emergency Physician One:** Using the ultrasound in the emergency department is more important to us than our stethoscope

**Researcher:** Do you think it is an important tool to implement in the Saudi Red Crescent?

**Emergency Physician One:** If we talked about how many car accidents we have in the country, I think it is very important and it will make a huge difference because the hospitals will know that the patients on the scene have a FAST positive which can confirm he or she has an internal bleeding which we can send the patients to a facility that has a trauma center. Also, the hospitals can prepare the right resources that the patients' needs. If the patients have not been diagnosed with an internal bleeding meaning he or she has a negative FAST that also will help us on triage. But I think the fear of implementing the ultrasound in the ambulance is if we lost time doing the ultrasound on the expense of the patient care.

**Researcher:** Based on your familiarity with the ultrasound which you have stated the regularity of using it in the emergency department, what do you think will be the impact of equipping the Saudi Red Crescent ambulances with ultrasound equipment to diagnose trauma patients in the prehospital setting?

**Emergency Physician One:** I think in some cases the impact will depend on the location of the accident and how fast the transportation is, let say if we have an accident near the National Guard Hospital and the patients does not have a file with our hospital if the patients have a positive FAST that means we have to transport the patients to our hospital even if the patients does not have a file with our hospital. Also, if the patient has a negative FAST, we can transport the patients to the hospital where he has his file in.

**Researcher:** that is a very good point, let's move on to the next question so you had previously worked with the National Guard Hospital If an initiative to equip the Saudi Red Crescent with prehospital ultrasound was implemented, what role do you think the National Guard Hospital's Emergency Department would play?

**Emergency Physician One:** The Emergency Department will play a role on the supervision of the ultrasound scans at first and we might put a protocol to train the paramedics, so they can read the ultrasound scans accurately. Also. We need to recognize how much scans are needed so the paramedics can become more skilled in doing the scans.

**Researcher:** What do you think would be the main barriers to the potential implementation of prehospital ultrasound at the Saudi Red Crescent? Why would these be barriers?

**Emergency Physician One:** The cost of the machines, the ultrasound devices are not cheap. The ultrasound devices are sensitive to everything such as fall so there is a need for a consistent maintenance. Also, making sure that the paramedics know how to use the ultrasound and

effectively diagnose the patients. The ultrasound images in the prehospital setting can be blocked by the sun so we need to take this into a consideration.

**Researcher:** Do you think the ultrasound needs an extensive training?

**Emergency Physician One:** The ultrasound course that we give to the doctors is a three days course and I do not think the paramedics needs more than three days to comprehend and master the skills of the ultrasound imagining.

**Researcher:** Alright, so since you were an emergency physician, which current policies and protocols in the Emergency Department at the National Guard Hospital might act as barriers to the implementation of prehospital ultrasound in the Saudi Red Crescent?

**Emergency Physician One:** That is a good question, we currently suffering from the radiology department, so they can depend fully on our ultrasound scan in the emergency department especially in critical patients. So, we need to make sure that a trust between those relevant departments is secured for future corporation not only between the hospitals department but also between the Saudi Red Crescent and hospitals around the kingdom.

**Researcher:** How does the paramedics' prehospital work contribute to or hinder the work of physicians and administrators in the Emergency Department at the National Guard Hospital?

**Emergency Physician One:** I do not think that the work of any paramedics can hinder the ability of the Emergency doctors in any way. I think our big problem is the culture between the paramedics and the Emergency doctors. We do not blend together neither we know each other's. I think we have to establish strong relationships with them as I did in my previous work. I had created many professional and personal relationship with the paramedics in the Saudi Red Crescent. Let me give an example, the grocery owner must trust the supplier guy because he is the one who will bring the goods if there no trust between them how can the owner deal with

him. This relationship is like the relationship between the paramedics and the Emergency doctors if there is no trust between them there will not be a productive collaboration between them. I think what we need is alliance between the Saudi Red Crescent and hospitals around the kingdom.

**Researcher:** Alright, how confident are you in the ability of the Saudi Red Crescents' paramedics and EMT's to learn to use an ultrasound and then accurately diagnose a trauma patient in the prehospital setting?

**Emergency Physician One:** There are a lot of courses that teaches the ultrasound and paramedics attend those courses all the time. I am confident that some of the paramedics have the ability to learn to use the ultrasound. We need to ask ourselves, are all of the paramedic s willing to learn how to use the ultrasound? Is there will be a resistance in accepting the ultrasound as a diagnostic tool? The paramedics might say that you are adding a new skill and I did not get paid for. I am confident that all paramedics have the ability to do the ultrasound and use it effectively if we put it as a priority. Now, there are a lot of improvement in the Emergency Medical Services especially in the Saudi Red Crescent Authority. If we are going to implement the ultrasound without any barriers or consequences, we have to put together a strategic implementation plan.

**Researcher:** Let me ask you a question and I promise it will be the last one, if a paramedic transported a patient who were diagnosed by using the ultrasound and the scans were FAST positive, Is the Emergency Department will allow the patients to go directly to the operation room?

**Emergency Physician One:** In the whole world, there is no single patients who can go from the back of an ambulance and be sent directly to the operation room. The Patients needs to be

stabilized in the Emergency department first. Let me say this, if a paramedics called me from the scene and told me that I have a trauma patient who has been diagnosed by the ultrasound and has a FAST positive, trust me, I will be so happy because now with this valuable information I can prepare the right resources that are in my disposal, I can activate the trauma team in the hospital also, I can ask the surgeons to prepare the operation room and order some blood. Finally, there a huge benefit of implementing the ultrasound in the prehospital setting.

**Researcher:** Alright, this has been a productive interview, thank you for giving us the time to explore this issue in a more detail's way.

Emergency Physician One: you are welcome, good luck.



## Appendix J

### Interview Transcript (Emergency Physician Two)

**Researcher:** This is the second interview with an emergency physician who is a current emergency consultant in the National Guard Hospital, first of all, thank you for agreeing to participate in this research. Let's begin with the first question, as you know there are two types of the transportation mode in the prehospital setting, which mode of prehospital transportation do you prefer and why?

**Emergency Physician Two:** Thank you Researcher for this interview and I hope my answers will be helpful to answer your research questions. Regarding the first question, I will choose the load and go as the prefer option to transport trauma patients to the hospital. I think depends on the Saudi Red Crescent status today using the load and go is the safest route of transportation because stay and play mode needs a lot of experiences and better protocols in order to deal with the patients on the scene. I do not think we are in a state where we can use the stay and play as a mode of a transportation, so I prefer using the load and go for a safest way to transport trauma patients to the hospital.

**Researcher:** Alright, if you may choose the phrase below that best describes your familiarity with the ultrasound machine?

**Emergency Physician Two:** we use the ultrasound in a regular basis.

**Researcher:** Based on your familiarity with the ultrasound, what do you think will be the impact of equipping the Saudi Red Crescent ambulances with ultrasound machines to diagnose trauma patients in the prehospital setting?

**Emergency Physician Two:** The prehospital setting in Saudi Arabia is undergo a major shift for the better and I think implementing the ultrasound will have a positive impact on the patients' health. I do encourage teaching the paramedics on how to use the ultrasound.

**Researcher:** Dr. Ali, you said that the impact of equipping the Saudi Red Crescent will be positive, can you tell me in what way?

**Emergency Physician Two:** The ultrasound implementation in the prehospital setting will help me as a physician in preparing the right resources especially if the paramedics told me that we have a patient who has been diagnosed with positive FAST. In addition, it will help determine the appropriate medical facility that the patients need. Also, there are some evidence that using the ultrasound in the prehospital decrease the mortality rate.

**Researcher:** Alright Dr. Ali, if we implemented pre-hospital ultrasound in the Saudi Red Crescent, what role do you think the National Guard Hospital's Emergency Department would play?

**Emergency Physician Two:** The National Guard Hospital will dispatch the appropriate medical teams that the patients need. Let's say if a trauma patient was diagnosed by using the ultrasound in the ambulance and the paramedics told us that the patients is FAST positive as an emergency doctor, I will make sure that the appropriate medical team will be dispatched prior to the patient's arrival. We also, might come up with a protocol that will allow trauma patients that were diagnosed by the ultrasound in the ambulance to go directly to operation room.

**Researcher:** Let's talk about the barrier, what do you think would be the main barriers to the potential implementation of prehospital ultrasound in the Saudi Red Crescent? Please explain why these would be barriers.

**Emergency Physician Two:** Do you mean in the perspective of the emergency department?

**Researcher:** Both the SRCA and the Emergency Department

**Emergency Physician Two:** The Emergency Department in the National Guard Hospital does not have barriers in terms of implementing the ultrasound in the Saudi Red Crescent. We have capable professionals to deal with the ultrasound in a matter of fact we have three physician's consultant who has an extensive training in the ultrasound. On the other hand, I think the Saudi Red Crescent is undertaking a major shift in their services. I think the barriers in the Saudi Red Crescent are focused on training the paramedics on how to effectively perform the ultrasound and the ultrasound devices itself and how accurate is it to diagnose trauma patients. Also, the movement of the ambulance can be a barrier. Since the ultrasound has been implemented in other emergency systems around the world I believe we can find a way to implement the ultrasound in the prehospital setting.

**Researcher:** Alright Dr. Ali, let say that a paramedic brings to you a trauma patient who was diagnosed by the ultrasound, do you think there is a barrier that the paramedic might face in the emergency department in the National Guard Hospital.

**Emergency Physician Two:** I do not think there will be any barriers that paramedics might face in our department.

**Researcher:** What about barriers in the National Guard Hospital in terms of policies and protocols?

**Emergency Physician Two:** In terms of policy and protocols, first there is no patient either medical or trauma can come to the emergency department in the National Guard Hospital until the medical director know in advance everything about the patient's conditions and the eligibility of the patients to be treated in the hospital. Second, I think the barrier in our hospital that I can reflect on today is that there is no specific emergency door that the Saudi Red Crescent or any other emergency vehicles can solely use. Today in the emergency department, we have one door that

both walking, and patients transferred by emergency vehicles can use together which can lead to overcrowdings. In the next year, we are planning to move to another building where we will have two emergency entrances that walking patients can use it separately from patients transferred by emergency vehicles.

**Researcher:** Alright, how does the paramedics' prehospital work contribute to or hinder the work of physicians and administrators in the Emergency Department at the National Guard Hospital?

**Emergency Physician Two:** We can divide the answer of this questions into two parts.

First, how it can help? And this is the usual thing that we see in the emergency department, paramedics brings patients to our emergency department with clear and organized medical intervention and case endorsement. Second, how it can hinder? If the paramedics could not give us information about the patients prior to his arrival. Also, if the paramedics did not do the right intervention to the patients where sometimes we see it in our hospital. In additions, the personal belongings of the patients usually get lost when transferred by the ambulance where we have to come up with a clear protocol on how to handle the belongings of the patients.

**Researcher:** Alright, this is the last question Dr. Ali, how confident are you in the ability of the Saudi Red Crescents' paramedics and EMT's to learn to use an ultrasound and then accurately diagnose a trauma patient in the prehospital setting?

**Emergency Physician Two:** To be honest, this is really a difficult question to answer, I know the paramedics who are studying in the college of the applied medical sciences since I am the dean of this college, I am confident in their ability to learn how to use the ultrasound. I really cannot judge the paramedics in the Saudi Red Crescent since I am not involved with them, but I think with proper training we can implement the ultrasound effectively.

**Researcher:** Since you are the dean of the applied medical sciences, is the ultrasound within the curriculum of the emergency medical services program?

**Emergency Physician Two:** I do not think it is there, but this is something that we should look at it in the future.

**Researcher:** Thank you Dr. Ali for this productive interview.

**Emergency Physician Two:** You are welcome, best of luck Dr Maher.