Supplementary file 2:

Three matrices of each study question of the qualitative study:

1- How Saudi paramedics respond to trauma patients?

Domains for each objective	Themes (with interviewees' ID)	Quotes of the themes and sub-themes
Exploring the Saudi paramedics respond to trauma patients	Challenges in Coordination When Responding to Trauma Patients A4; A6; A7; A8; A9; A10; A11; A12; A13; A14; A15; A16; A17; A18; A19; A20.	A4: sometimes there is no pre coordination with the receiving hospital and when we arrive, it took long time to treat the patient; sometimes we use long back board or splints and there is no alternatives in the hospital so we have to wait for that long time. A6: too many ambulances by the entrance with no coordination; you have to wait for device being used on the patients until they gave it back. A7: if there is no police in the scene, bad consequences may occur; if you leave without having all equipment in the hospital, it's impossible to get them later. A8: police in the scene can secure it and communicate with public rather than paramedic dealing with public especially in critical cases; we have distributed the cases on different hospitals with coordination in advance. A9: I have been to a number of trauma calls and there are no police or civil defense in the scene and we requested them many times; sometimes we arrive to hospital, and we surprised that there is no bed available for the patient, so we have to wait with our equipment being used on the patients.

		A10: most of the time we waited for LOKUS in cardiac arrest cases until they finish with it. A11: I believe when the ambulance called, police and civil defense should also request and dispatched, I remember one case that someone drowned in a well and we waited two hours for the divers to arrive although it was mentioned clearly when they asked for help. A12: we always arrive first and request for the police secure the scene for us and also we have to deal with the angry crowd; when we arrive to the hospital we were waiting for quite sometimes to be seen. A13: yes, I agree and sometimes there is no option and you just need to deal with the situation without police. Better to have unified response between police, civil defense, and ambulance. A14: first to arrive is ambulance and the scene is not secured. A15: sometimes it is difficult to secure the scene without the police; sometimes we use the long back board, and we wait for it and it take us sometime to clean and make it ready. Maybe it's better if there are some alternatives in hospital's store. A16: to be honest, not every time we arrive before the police, sometimes they arrive first, we just need to coordinate more often. A17: we try to be cooperative and leave them to use some devices such as LOKUS if the situation allows it.

		A18: sometimes the traffic gets bad because there is no police. A19: waiting for equipment in hospitals that something we faced sometimes in cardiac arrest cases or severe trauma cases, we have to wait until CT-scan is done. A20: coordinating with police and civil defense in very critical situation is very important; yes, we waited for equipment but not for long time.
	Accuracy of information and accessibility of the patients A1; A2; A3; A4; A5; A6; A7; A8; A9; A10; A11; A12; A13; A14; A15; A16; A17; A18; A19; A20.	A1: sometimes the crowd were agitated, and they might be aggressive towards you; we make sure before approaching the crush vehicle that the battery was off and police was around; sometimes, the caller might be still in contact with dispatch, so I can ask more information and the accident. A2: dealing with crowding and control the scene; we normally check if the scene is safe or not for us to approach the patient; information was not clear or incomplete. A3: dealing with multiple trauma patients and crowd can be demanding; it might be dangerous on patients to leave the scene unattended by police; information we received might not be accurate.

		A4: sometimes crowd in the scene they are not in safe area and might cause harm to them as well; we want to approach the scene without any concern on our personal safety. A5: people sometime gathering around the scene and taking pictures of the accident; securing scene especially in highways is very important for the safety of paramedics & patients; Location can be completely different from the information we received initially. A6: sometime family of the patient can be aggressive and demanding; the most important thing is the scene must be safe before approaching the patients; maybe the information were not clear so you do not know what to prepare for A7: crowding is difficult to deal with; sometimes if the scene is not secured by police, paramedics might be under pressure by public and they might be not completely safe; when I arrive the first one and realized more ambulances are needed might get me in awkward position. A8: the problem with crowding is sometimes may delay ambulance to reach to the scene and obstacle paramedics from performing their job. A9: crowding can impact the prehospital treatment negatively especially if it is a large crowd; it took long time to secure the scene, and when it was secure, we

		approach the patient and find him irritated and in very critical condition; sometimes, information were not clear from the caller. A10: some people might come to you and they would like to help, and some of them might distract you and start ordering to do this and that; making sure the scene is safe before entering; most of the time when we received the information from 911 were not complete or accurate compared to 997. A11: we are the first one to arrive and we don't know if the scene is safe or not; sometimes more than caller would like to report the accident and that might give you a false alarm about the situation. A12: crowding around the case can be an issue sometimes; sometimes the location is not accurate, once we arrived to first location, we have been asked to another location. A13: dealing with crowds can be difficult; we went to one of the cases and the scene was not safe and there too much crowd around the patient; sometimes we received the call without any information especially if it is from 911 compared to 997 where most of the times there is enough information. A14: one of the obstacles is dealing with crowd; highway accidents might be very dangerous; we received the call without any information about the patients.

		A15: normally, crowd will be around as first responders when we arrive to the scene; we become more aware of the fact that the information we received in the call might different in reality when we arrive to the scene. A16: police was around and secure the scene and that allow us to park the ambulance relatively close to the scene and approach the patients properly; sometimes we have been sent somewhere that no need for ambulance over there, and might took sometime to return to the station. Yes we noticed some information are not accurate. A17: sometimes the location is not accurate from the caller. A18: sometimes we try to avoid the crowds and try to limit their access to patients in order to minimize their impact on treatment; rarely when I come to scene without police there to secure it; sometimes the dispatch may not pass enough information about the case and may not inform police and civil defense about the case. A19: we arrived to the scene and there was no police to secure it, as consequence to that, another accident occur in the same location; sometimes we find difficulties in the description and information received from the caller. A20: sometimes I see crowding is a good thing because it can tells where the accident is; when I approach a location especially in traffic lights scenes, normally it

		was organized and secure by police; sometimes we received less information about the case.
	Handover issue A1; A5; A6; A7; A8; A9; A10; A11; A12; A13; A14; A15; A16; A17; A18; A19; A20.	A1: sometimes the handover may not be received properly by hospital staff A5: some hospital staff went directly to the patient and ignored me. A6: sometimes handover might take hours waiting in hospital. A7: we need to look for the staff to receive information about the patients. A8: sometimes we asked to wait for quite some time before receiving the handover. A9: might be lack of professionalism and medical respects in handover process. A10: sometimes when I start talking and give handover, some hospital staff are not interested in my handover. A11: sometimes we give the hospital heads up and when we arrive no one available to take handover. A12: it depends on the situation, sometimes, in critical cases, hospital staff relay on our vital signs and sometimes they do not. A13: sometimes I gave handover to a lot of hospital staff and sometimes no one interested in my handover. A14: it depends on the hospital and person in charge to either received the handover properly or not.

		A15: handover can be one of the difficult aspects in dealing with trauma patients, there is no unified system across hospitals in terms of handover. A16: I think handover process need improvements especially some hospitals might have a perfect system that can implement in different hospitals. A17: it depends on hospital staff, some of them might keep you waiting for long time, and some of them might received the handover in professional manner. A18: the issue with handover still going but becoming better now, sometimes I have to wait for long time and no one available to receive the handover. A19: some of them are just not interested in receiving your handover. A20: it depends on the personality, most of hospital staff would like to receive the handover in professional way.
	Care difficulties when treating trauma patients A1, A2, A3, A4, A5, A6, A7, A8, A9, A10, A11, A12, A13, A15, A16, A17, A18, A19, A20	A1: sometimes injuries can be superficial, and it is easy to deal with it; SRCA protocol considers seven patients or more a disaster and to request additional help; some cases can be very far and took long time to arrive. A2: sometimes I arrive to the scene and notice that there are more than one patient need immediate care. A3: I made the response to trauma case and when I approach the scene there are at least four critical patients need rapid transport. A4: sometimes we need to prepare all the necessary equipment such as C collar, crepe bandage etc....; I have to make sure that whether if I need additional help or not.

		A5: when I approach the crushed vehicle, my main concern is how to stabilize the patient properly and move him without any further injuries. A6: the patient was psychologically collapsed when he realized that another passenger is dead, so my job was trying to calm the patient and assess his situation because he might have some injuries as well. A7: the patient with declining the transfer and I was trying to convince him and I even asked my colleague to talk to him and changed his mind. It is difficult to control the scene and convince the patient; sometimes we deal with burns, accidents, fights and lots of different types of trauma. A8: we responded to trauma call and it was a bus had 47 passengers crushed in check point. We immediately realize we need additional help; too many cases in short time can be stressful and sometimes patients relative can be demanding. A9: the patient does not speak neither Arabic nor English and it was difficult to communicate with him. A10: trauma can be different types and that can be challenging. A11: the patient was quite old and we couldn't understand him or his family, because they live in the mountains and they have different accent; it depends on the types of injuries which can be difficult sometimes. A12: the patient had dilated pupils and unresponsive, we thought the patient had coma, and then we realize the patient might had head injury. Then we decide to transport the patient immediately.

		A13: we arrived to the scene and waited around five to seven minutes, then the location has been changed and it was seven minutes away, when we arrived to the new location, it was crowded with almost more than 40 individuals around the case, when we approached the case, there was a very strong smell, later we know it was Acid and we start CPR on one of the cases by using LOKUS and the other one we gave him oxygen and transport both of them to the hospital. A15: we responded to a high mechanism severe injury, we stabilize one of the patients and start the transporting process to the hospital. En route, the patient started to become delirious and asked me to stop the ambulance because he would like to play football with his friends. After couple of days, we knew that the patient was announced dead in ICU; there are a number of calls and there is no enough teams to cover all cases and sometimes the respond can take long time because the caller is far from the station. A16: we respond to a trauma call, there was a number of casualties but all of them were minor injuries. A17: sometimes you have to open airway and start an IV line while your colleague parking the ambulance and bring other equipment. A18: sometimes we need the people standing around to help us transfer the patients to the ambulance but we afraid that might cause further injury to the patient; dealing with a number of patients can be challenging sometimes. A19: there was a fuel leak in the scene, and we were trying to move the patient from the danger area. A20: by focusing on calls, we can see some of them do not need the whole ambulance service, and some of them are critical and need immediate intervention;

		sometimes we deal with 1 call per hour which can be very exhausted, and less quality of care provided to patients.
	Confidence and readiness A1, A2, A3, A4, A5, A6, A7, A8, A9, A10, A11, A12, A13, A14, A15, A16, A17	A1: in the beginning it was difficult, with more exposure and responding to trauma calls, the confidence start to build up. A1: I have to be physically and mentally ready A2: I have reached high level of confidence when dealing with trauma cases; I have to be ready for trauma cases, I normally try to prepare myself especially before the trauma cases. A3: when I receive the trauma call, I hope the best and prepare for the worse. A4: confidence comes from skills and information as well as the tools that available; I have to do the routine check before starting the shifts. A5: I tend not assure the patients about the situation 100% , although might be confidence with my diagnosis; normally, I prepare the trauma equipment before starting the shift. A6: Ambulance should be ready before starting the shift. A7: I am doing this job for over seven years now and am confident enough and that can be improve with practice; I normally keep the medication bag by myside because the ambulance can get very hot especially in the summer.

		A8: the most important thing is that it reducing the stress and with practice, confidence can be build up slowly; I keep the medication and fluids handy and away from heat exposure. A9: I like responding to trauma calls, and am doing it for long time and responding to different types of injuries; in summer, I take medication bag and fluids out of the ambulance. A11: I tend to have my own tools and equipment that I keep ready before the calls. A12: I am good with trauma cases and I feel confident enough and also working with colleagues can create more cooperation and confidence. A13: the experience is there and also practice and increase the level of confidence; agree, I normally check all equipment before starting the shifts. A14: yes, am confident enough; you have to be mentally and physically ready to receive the calls. A15: I normally respond to long distance call and that might eliminate the station time, so I have to prepare the ambulance right after each call. A16: I was working in area that had a lot of trauma cases and that build my confidence level. A17: there is enough confidence and once you arrived to the scene, the patient is your responsibility.

2- How Saudi paramedics acquire their relevant knowledge?

Domains for each objective	Themes (with interviewees' ID)	Quotes of the themes and sub-themes
Identify the methods of acquiring relevant knowledge among Saudi paramedics	Independent approaches to acquire knowledge A1, A2, A3, A4, A5, A6, A7, A8, A9, A10, A11, A12, A13, A14, A15, A16, A17, A18, A19, A20	A1: courses can be helpful; simulation mimicking some trauma scenarios can be helpful; one of the things that you can do to obtain more knowledge about trauma is reading academic journals. A2: let's say specialized courses; for example training based on simulation and development; books can be helpful too; let's say reviewing the protocol help performing in good way A3: continuous learning and courses. A4: mandatory courses can help update our knowledge; of course, reviewing the protocol can be help effectively. A5: courses are important; you supposed to start reading yourself in books and journals; reviewing the protocol can be helpful. A6: mini courses and specialized courses are important to update our trauma knowledge; the protocol is detailed and mentioned different cases in an expanded information.

		A7: every three years, you have to attend specific courses and obtain certain skills in SRCA; I remember there was a new device that I didn't the training related to it and I learn how to use through a colleague of mine; debriefing and discussion after the case can last to 45 minutes which can be very helpful sometimes. A8: I notice lots of collegues are discussing and debriefing cases. A9: PHTLS course can be very helpful in updating our information; I think it's better if there is a website of all protocol aspects and information; sometimes I feel like it's not enough to discuss the case, I might read some articles and review the protocol. A10: I think we should review the protocol every now and then. A11: in order to activate the American board, there are a minimum of 100 hours of continuous training and courses can be helpful in achieving this number; where I work, occasionally, I have to spend around 30 minutes of simulation based on real scenarios to improve my skills and information. A12: some courses had updates that can be helpful; I believe it depends on individuals to set up a plan and schedule for reading continuously; I agree, sometimes when I discuss the case with my colleagues, I will always remember it for the future.

		A13: for example, like in hospital, they have simulation and the trauma team responding like the real case; discussing the case with colleagues and reviewing the protocol can be very helpful. A14: courses one of the aspects that keep information updated; a paramedic should practice to master his/her skills and update their information. A15: there are some courses that valid for four years and can be cheap, in the same time that can be effective in updating information; sometimes, courses can be very expensive so it's better to read books and journals; I feel like when I handover the case to the hospital, that I have done everything I could and eager to learn new skills and ideas; sharing information about case and techniques with colleagues can be very helpful. A16: sometimes we discuss some cases among ourselves to learn from each other. A17: development hours and continuous learning through courses are important. A18: courses, or maybe just try to revise your information every now and then. A8: when you someone in front of you lecturing or discussing some trauma cases, I found that very helpful since college; I think reading textbook with practice can be very helpful; practice with information that I had can be very helpful; agree and

		would like to add that reviewing a website that had information alongside with discussion can be helpful. A19: reading and watching some YouTube videos can improve practice; discussion is good, and also sometimes I went to websites and articles to review the technique and skills. A20: Reading with practice can help you understand the skills; it considered very good to discuss the case with your colleagues in order to improve your skills.

3- what are the factors that influence application of knowledge when responding to trauma patients?

Domains for each objective	Themes (with interviewees' ID)	Quotes of the themes and sub-themes
Explore the factors that influence application of knowledge when responding to trauma patients	Current needs to improve care for trauma patients A1, A2, A3, A4, A5, A6, A7, A8, A9, A10, A11, A12, A13, A14, A15, A16, A17, A18, A20	A1: sometimes you must know exactly what you are doing especially under pressure and you need to take decision whether to stay in the scene or consider rapid transport; public need to understand what paramedics are capable of and to let them do their job without any interference. A2: I think it's ideal to have someone else in the cabinet since now it's only two of us, one driving and the other one back in the cabinet looking after the patient by his own.

		A3: I think we need more health care provider in each team, one technician in each team might make a difference. A4: sometimes when we request additional help, they may take long time because there are enough units to cover multiple responses. A5: air ambulance can help in some situation but we still need more ground ambulance units to cover most of the calls; don't focus on side stuff and focus mainly on the patient. A6: avoid underestimating the situation of the patient; you must be calm and plan all your steps when you approaching the patients. A7: it's not fair to have one paramedic treating a critical case in the cabinet; ignore the noise that surrounding you, and focus on treating your patient, and if you multiple casulaties, you need to request help as soon as possible; performing initial assessment help you plan your next steps and how to act accordingly. A8: there is sort of burnout among some paramedics to be honest; we need more workforce, currently, there are lots of calls unattended because we don't have enough units to cover them all; sometimes people request ambulance service just to transfer a stable old patient to his appointment in the hospital; don't let outside factors influence your focus on the patients; there is lack of public awareness in terms of emergency medical services system.

		A9: sometimes you received the call, you must think of the situation is bad, and that's why you receive the call; you have to review your information in a regular basis and might consider self-reading and attending some courses might be helpful. A11: I have responded to trauma call which car crush of family and some of them were already dead, the memory and the scenery still with me until this day. It was so stressful I felt like I had a burnout; prepare yourself, embrace and deal with the pressure, and you don't need to be panic about the situation. A12: patients need time to treat and look after, so you might need spend more time in the scene. A13: always remember to have a systematic approach and focus on ABC at the beginning and carry on from there. A14: the workforce in field limited and vulnerable. There is no enough number of paramedics, maintenance of vehicle and equipment need to up to date; in my opinion, the main point is to focus on patient and take your time in diagnosis and treatment. A15: in my opinion, I think we need to increase the number of paramedics and increase the number of units. We received high volume of calls and cover them all because you need time and focus in each response and each call; we as

		paramedics might suffer from overwhelming pressure, but when we are out for a call, we need our minds and focus only on the patients; we need to raise awareness among people in terms of the critical cases and how paramedics are dealing with them. A16: I think if the team consists of three paramedics instead of two, that can be very helpful, two in the cabinet and one driving the vehicle, especially in critical cases; treat all patients the same and give all patients the the time that they need. A17: I think the other responders such us police and civil defense personnel can be helpful at helping us perform some of the rescue techniques; don't be in rush while treating the patient and trying to leave the scene quickly; people need to build trust in emergency medical services system. A18: yes, I agree, we need to increase the number of paramedics in the field because we need to give enough time for each patient; you are the master of the situation, if the patient needs some time in the scene, you may want to stay there for more time. Alternatively, if the patient in critical situation and need to be in hospital as soon as possible, you may want to consider the rapid transport strategy. A20: it is easy to get burnout while being a paramedic working in the field, therefore, you have look after yourself and focus on three main things: nutrition, exercise, and sleep; I have heard that there is a universal standard in terms of working hours among paramedics and we need to take into consideration, breaks and timeout.

		That can only be achieved by increasing the number of paramedics; calling an ambulance must be taken seriously and people need to know exactly when to request an ambulance.