**SCHOOL OF PUBLIC HEALTH**

**COLLEGE OF HEALTH SCIENCES**

**UNIVERSITY OF GHANA**

# EMERGENCY RESPONSE TIME OF THE NATIONAL AMBULANCE SERVICE AND PRE-HOSPITAL TRAUMA SURVIVAL RATE FOR 2014 IN THE GREATER ACCRA REGION

**BY**

**MOHAMMED-NAJEEB MAHAMA**

**(10551718)**

**THIS DISSERTATION IS SUBMITTED TO THE SCHOOL OF PUBLIC HEALTH, UNIVERSITY OF GHANA, LEGON IN PARTIAL FULFILLMENT FOR THE AWARD OF THE MASTER OF SCIENCE (CLINICAL TRIALS) DEGREE**

**JULY 2016**

# DECLARATION

I, Mohammed-Najeeb Mahama , declare that except for other people's investigations which have been duly acknowledged, this dissertation is the result of my own original thought and hypothesis, and that this dissertation, either in whole or in part has not been presented elsewhere for another degree.

…… ……

MOHAMMED-NAJEEB MAHAMA DATE

(STUDENT)

……..... ……

DR. ERNEST KENU DATE

(ACADEMIC SUPERVISOR)

# DEDICATION

This dissertation is dedicated to my lovely mother madam Fati Mahama and the entire family.

# ACKNOWLEDGEMENT

I would like to give thanks to the Almighty Allah for taking me through the Master of Science Clinical Trial program. This dissertation would not be possible without the assistance of important people in my life. I would like to give my sincere thanks and gratitude to my supervisor Dr. Ernest Kenu for his support, encouragement and patience throughout the program. Special thanks also go to the Chief Executive Officer (CEO) of the National Ambulance Service, Prof. Ahmed Nuhu Zakariah, for giving me the platform to develop myself, and support throughout the program, and to the Operations Department of the service for assisting me with data extraction. Thanks to the deputy CEO, DR Joseph Atia Akamah for the support and motivations. Thanks to Christiana Achina Boatemaa, Michael K. Badu and Fati Mohammed for assisting me in organizing the work. Special thanks to my father Dr. Alhassan Mahama, mother Fati Mahama and to my Uncle Musah Ali Abubakar and his wife Safinata Foroko for giving me all the family support I need. Finally, I thank all trauma patients whose data was used for the study and Emergency Medical Technicians in Ghana for supporting me in diverse ways. Thank you all, may the almighty Allah bless you.

# ABSTRACT

**Background**

It is a common goal among emergency medical systems all over the world to respond as fast as possible to the scene of emergencies in order to improve patient outcome. The study was done to assess whether ambulance response time has an influence on pre-hospital trauma survival.

**Method**: A retrospective cross sectional study whereby data from trauma patients transported by ambulances belonging to the National Ambulance Service from January to December 2014 in the Greater Accra Region were reviewed. Chi squire test was conducted to test an association between emergency response time and pre- hospital trauma survival. Logistic regression was also used to determine if ambulance response time is a significant predictor of survival after controlling for age, sex, level of consciousness and types of injuries.

**Results**. Out of 20,236 patient transported in the region, 652 trauma patients were included in the study. The proportion of the patients who survived pre-hospital trauma was 98.8%. The proportion of patients who were responded to within 8 minutes response time is 36.7%. The mean response time of the patients was 16.9 minutes with standard deviation of 0.68 and confidence interval of 15.6 to 18.2. The median time for an ambulance to receive a call for an emergency through to the time the patient is handed over to the hospital was 82 minutes (transportation time). The median time spent in managing patients on the scene of emergencies was 17 minutes. Pre-hospital trauma survival was associated with response time, when it was modeled as a continuous variable with odd ratio of 0.95 and confidence interval of 0.92 to 0.98 and a p-value of 0.001 after adjusting for age, sex, level of consciousness and types of injuries.

## Conclusion

There is a high trauma patient's survival rate among victims of accident attended to by an ambulance in Ghana. The emergency response time in Ghana is twice higher than the national target of 8 minutes. The 90% of response times to the scene of emergencies within 8 minutes standard was also not achieved by Ghana. As response time to emergencies increases by one minute, the odds of dying from trauma in pre-hospital setting increased by 5%. In other words, there is a 95% chance of surviving pre-hospital trauma at every one-minute decrease in response time to an emergency scene.

Emergency response time should be reduced in order to improve survival at the scene of emergencies

## LIST OF ABBREVAITIONS

| | |
|---|---|
| ALS | Advanced Life Support |
| BLS | Basic Life Support |
| CEO | Chief Executive Officer |
| CPR | Cardio Pulmonary Resuscitation |
| EMT | Emergency Medical Technician |
| EMS | Emergency Medical Service |
| KATH | Konfo Anokyie Teaching Hospital |
| LMIC | Lower Middle Income Country |
| MMTU | Motor Transport Traffic Unit |
| NAS | National Ambulance Service |
| PCR form | Pre-hospital Care Form |
| RT | Response time |
| RRR | Right patient, Right treatment and Right time |
| USD | United States dollar |
| WHO | World Health Organisation |

## DEFINITION OF TERMS

| | |
|---|---|
| Arrival at location | The time the Ambulance gets to the scene of an emergency |
| Arrive at facility time | The time the Ambulance gets to the hospital with the patient |
| Base | Also known as the Ambulance Station |
| Call time to the station | The time the call made to request for the Ambulance Station |
| Case Handling time | It is the time from having access to patient to handing over to the hospital (Arrival at location, Patient contact, Depart scene, Arrive at facility, and time attended to) |
| Distance Traveled | The distance covered by the Ambulance during transport |
| Decapitation | When the head is cut off |
| Defibrillation | Delivering therapeutic dose of electricity to the heart |
| Dependent lividity | The pooling of blood in the body after the heart has stop beating |
| Dismemberment of body | To cut the body in to parts |
| Depart scene time | The time the ambulance takes off from the scene of an emergency |
| Response Time | The time from when an emergency call is received to when an the Ambulance arrives at the scene of emergency |
| Level of Consciousness | Patient mental status, whether they respond spontaneously(alert), verbal, pain, and unresponsiveness |
| Patient contact time | The time access of the patient is made, (treatment usually begins here) |
| Pre-hospital | Period of emergency medical service management of cases before transferring to the hospital |
| Putrefaction | It is the decomposition of organic matter. It is the fifth stage of death |

| | |
|---|---|
| Triage | Sorting out patients according to the degree of urgency for priority of treatment and transport |
| Time attended to patient | The time a transfer of patient is made to the hospital department |
| Trauma | Trauma is injury to a biological organism caused by physical harm from external source |
| Rigor mortis | Stiffening of joints and muscles of a body few hours after death |

# TABLE OF CONTENTS

# LIST OF TABLES

# LIST OF FIGURES

# CHAPTER ONE

# INTRODUCTION

## 1.1 Background to the Study

On May 9th 2001, the need for an ambulance service in Ghana became a reality when the Accra Sports Stadium disaster that claimed the lives of about 126 people in the country occurred. As a result of the unfortunate incident, the National Ambulance Service (NAS) was established with the core mandate of providing efficient and timely emergency medical care to the sick and injured in 2004. In 2011, the health institutions and facilities act was passed by parliament, which established the ambulance council to regulate it activities(ACT 829, 2011). With the motto, "timely care saves lives". NAS has expanded over time, from seven pilot stations to more than one hundred and thirty (130) stations from 2004 to 2015. Today, NAS provides pre-hospital emergency care, injury prevention, inter/intra hospital transfer, and disaster medical response to accident victims of either road traffic, domestic, or industrial emergencies and transport these victims from the scene of an incident to an appropriate health facility.

Pre-hospital Emergency Medical Service (EMS) is the first level of treatment given to patient suffering life threatening conditions by emergency medical technicians (EMT) and paramedics before they are handed over to the hospital. It is generally assumed that if emergency medical technicians and paramedics are able get to the scene of emergencies within a response time of eight minutes, there will be high chances of improving survival rate of the victims or reducing the rate of deaths at the scene.

Response time is the time from when an emergency call comes to the ambulance station until the actual time of arrival at the emergency scene by the ambulance crew. As stated in NAS 2014 annual report, it is one of the key performance indicators in the EMS delivery.

While, transportation time is the time starting from when a call is made to request for an ambulance until the time a victim is transferred to the hospital. Treatment and stabilization of patient condition is done in this period. Since definitive care is not administered in the ambulance, it is essential to expedite patient transport to the hospital**.**

In 1979, Eisenerg and colleagues found survival benefits with cardiac arrest patients who were responded to within a response time of 4 to 8 minutes. These patients had early defibrillation and early cardiopulmonary resuscitation (CPR) (Blanchard et al., 2011). From this study, many EMS systems worldwide including National Ambulance Service of Ghana adopted the 8-minute response time for advanced life support (ALS) and basic life support (BLS) units for responding to life threatening conditions (*NAS Annual Report*, 2013). In order to achieve this, the use of lights and siren has always been the case to pave way for the EMS crew in the ambulance to the scene of emergency and to the hospital (Blanchard et al., 2011). While countries such as the United States, England and Iran are able to respond to cases within eight-minutes, Ghana's average response time is seventeen (17) minutes. By April 2015, more than 75.6% of priority 1 cases ( life threatening ) were responded to within 8 minutes, while 72.4 % of priority 2 emergencies were responded to within the same time according to the Emergency Ambulance Services in England (*Annual Report*, 2015). This may not be a fair comparison because; these countries compared to Ghana do not use the same methods to estimate their national response times. While their calculations are based on the proportion of ambulance responses to the scene of emergencies within 8 minutes, Ghana is still using averages to do the estimation of response time to emergency scene.

In Africa, many resources are being invested into expanding EMS delivery to cover the underserved areas in order to meet the internationally set response time in the EMS delivery, which does not usually translate into success.

A study in South Africa reported that a response time target of 90% of all emergencies within 15 minutes was not achieved despite a high increase of 150% in ambulances (Stein et al., 2015). Likewise, in Ghana, the average response time of 8 minutes was not achieved after the gradual expansion of the NAS between 2004 and 2013.

NAS expanded its 23-ambulance stations to more than 120 stations in 2012 with an average response time of seventeen (17) minutes, which is two times higher than the national 8 minutes response time target.

Trauma is defined as bodily injury resulting from the application of an external physical force (Hamilton, et al 2011). It ranges from motor vehicle crashes, falls, gunshot wounds, burns and blunt assault. It is the leading cause of death between 15 to 45 years group (Ogunmola et al., 2013). Most trauma cases occur in the pre-hospital settings in the developing countries. The lives of the active members of these communities in the developing countries are being lost due to delay in responding to victims on the accident scene.

Road traffic accident (RTA) is the leading cause of deaths in trauma cases and therefore is of great interest to the researcher. It has unfortunately earned the name "the neglected disease of modern society" since much attention has not been given to it. In 1966, the National Academy of Sciences published a "white paper" report entitled "*Accidental Death and Disability: The Neglected Disease of Modern Society",* which measured the magnitude of traffic-related death and disability while clearly describing the weaknesses in the pre-hospital care in the United States ("NATIONAL SCOPE OF MODEL," 2007). This happened many years ago, today the United States has a very robust EMS system compared to Ghana. The North Dakota Department of health has been collaborating with

the national ambulance service of Ghana, by way of proving training to NAS personnel on emergency preparedness.

WHO has advocated strongly for countries to develop basic trauma care systems to address the disproportionate amount of death and disability from trauma in sub-Saharan Africa (Mould et al., 2013). Putting in place EMS system to respond in a timely manner to the scene of emergencies has the potential to improve patient's survival rate.

In Sub-Saharan Africa, EMS is still struggling to grow. South Africa, Ghana and Kenya represented Africa in the pre-hospital care systems survey in thirteen lower middle-income countries (LMIC). The study reported that EMS in these three countries were still underdeveloped, and are unable to meet local needs (Mould et al, 2013).

Taxis, mini buses ("troro"), horses, bicycles, private cars and all forms of transportations are still used to convey victims of trauma by untrained persons to the hospitals. Sixty percent (60%) of South Africans use their own means to get to the emergency center and 59.3% of referred obstetric patients self-transported by taxis (Mould et al., 2013).

EMS needs to play an important role by responding in a timely manner to reduce the negative effect of trauma in communities worldwide. With EMTs and paramedics on the scene, they will be able to provide wide range of emergency life saving measures including the following, bleeding control, airway management, fluids and cardio pulmonary resuscitation, splinting of fractures, spinal immobilization, good lifting techniques and many more. This can be achieved by implementing the "RRR" of trauma in an emergency care; thus to transport the Right patient, to the Right hospital, at the Right time. This ensures that care providers make clinical decisions taking into account the right patient, to the right hospital, at the right time (Ogunmola et al., 2013).

Writing in the World Journal of Surgery in July 2014, Yeboah *et. al* stated that a high proportion of trauma fatalities could have been prevented by decreasing pre-hospital delays, and ensuring adequate networks to significantly reduce mortality.

Most of the research done to assess relationship between emergency response time and survival is usually on cardiac arrest patients. When it comes to trauma survival and how it is related to emergency response time, the evidence is limited. Through the literature search, there was no study found within Africa that directly assessed ambulance response time and pre-hospital trauma survival. Among the few studies found were done in the developed countries. Such is the Alabama study, which assessed the effect to trauma deaths due to delay. They concluded that Based on their analysis, increased EMS pre-hospital time appears to be associated with higher mortality rates in rural setting (Phelan et al., 2008).

Considering the importance in responding to emergencies in a timely manner, the unwanted effect of trauma deaths and the uncertainty with any association between these factors in Ghana, it gave the researcher no choice than to explore them.

### 1.2 Problem statement

Each year, many of the 1.2 million lives lost globally due to trauma could be saved if rapid and competent pre-hospital services were available at the crash scene(Bigdeli et al., 2010)

Longer response times to emergencies may lead to preventable deaths and affect trauma patient survival. It is assumed that the sooner the Ambulance reaches the scene of an emergency, the greater the chances of survival. Delay in transporting patients, mishandling of trauma victims by untrained persons, inadequately trained staff contributes to high mortality of 36% in Ghana as compared to 6% in the USA(Oduro, 2015).

In 2012, the number of Ambulance Stations was increased from 24 to 121 stations in Ghana. This increase was to help reduce the response time to meet the internationally accepted response time of eight-minutes (8 minutes) and to improve on patient's survival. After the increment, the response time target of 8 minutes was still not achieved (*NAS annual report*, 2013).

Although huge amount of resources are being used to help reduce response time in Ghana, it is still not clear to us how the response time influences the pre-hospital trauma survival. This study seeks to examine whether there is a relationship between emergency response time and pre-hospital trauma survival.

### 1.3 Justification

It is a common believe among EMS systems that, faster response time has the potential of saving lives. However to design EMS systems to meet these response time targets has a huge economic burden on every nation. In order to plan and to use the limited resources of the nation productively, there is the need for a research to be conducted to justify why policies involving substantial amount resource worth investment. With this study, the relationship of Ghana's response time and her pre-hospital trauma will be made known. That will help inform the future developers of response time policies.

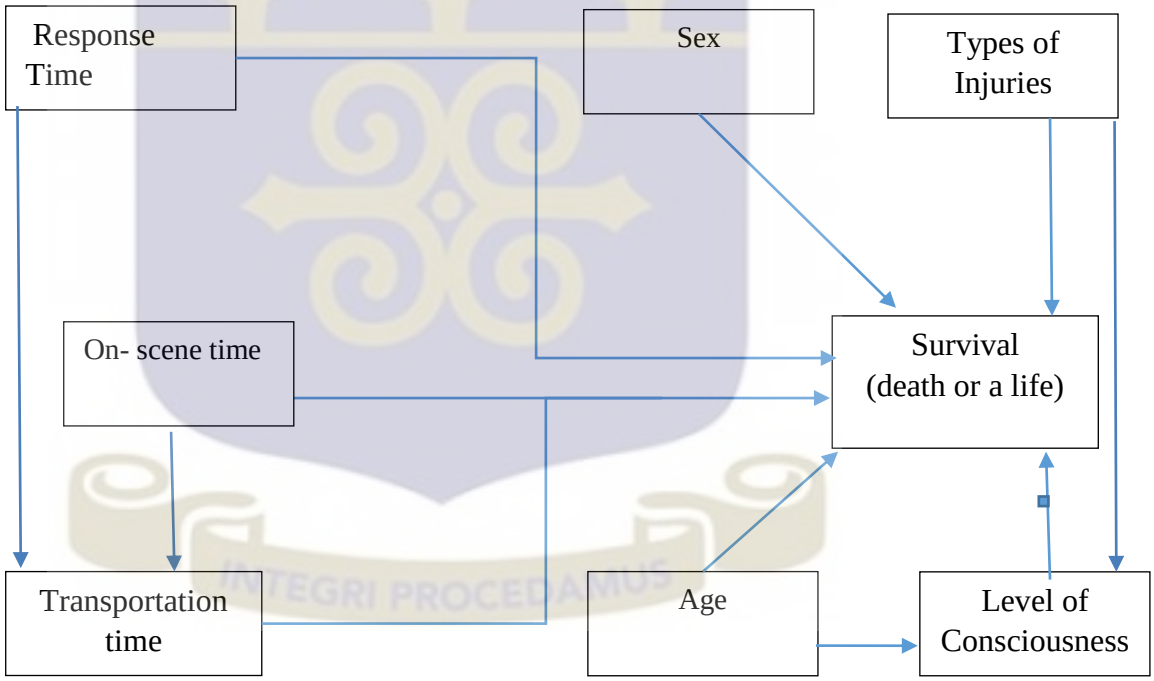
There have been many calls by the public for the need for research to investigate in to response time and deaths from trauma situations such as road traffic accidents and other disasters in the country. However, in most cases, the only time people get answers to their request is when we are faced with such a disaster and expects are called to give their opinions. This research will serve as a reference to interested persons.

Again, majority of the guiding principles of EMS in Ghana are adopted based on research done outside the African continent, which is sometimes not very compatible with the reality of prevailing conditions in Ghana. With this study, the Ghanaian patient population will be assessed in order to reflect the country's situation. That will help to put in place response time policies based on the local experiences.

In addition, this study will pave way for further research to be conducted in the area of emergency response time and patient outcomes.

### 1.4 Conceptual framework

**Figure 1 factors that influences pre-hospital survival**




The conceptual framework is based on how the following factors influence each other. Emergency response time, transportation time, time spent on scene, age, types of injuries and level of consciousness has the potential of influencing pre-hospital trauma survival. These factors can increase or decrease the chances of survival of trauma patients within

the pre-hospital setting. Likewise, age can directly have influence on the level of consciousness depending on whether you are a child adult or an elderly person. The elderly and children tend to be vulnerable during accident compared to the youth. This is because, either their body systems are not yet fully developed or their body systems are degenerating depending on which category you belong to. The types of injuries have the ability to influence the level of consciousness and pre-hospital trauma survival. The type of injuries also has the potential of influencing the level of consciousness and trauma survival.

Delay in response time and time spent on the scene can cause delay in the transportation time, with may affect patient survival.

## 1.5 Study objectives

### 1.5.1 General objective

To determine the relationship between pre-hospital survival of trauma patients and emergency response time

### 1.5.2 Specific objectives

- To estimate the proportion of patients who survived pre-hospital trauma
- To determine the average emergency response time in Greater Accra Region
- To determine the proportion of pre-hospital trauma emergency cases that was responded to within eight minutes
- To estimate the median case handling time in the region
- To assess whether emergency response time is related to pre-hospital trauma survival

### 1.6 Research question

Is there a relationship between emergency response time and pre-hospital trauma survival rate?

# CHAPTER TWO

# LITERATURE REVIEW

## 2.1 The Concept of EMS Response Time

EMS is a system that provides emergency medical care to life threatening condition patients. A comprehensive EMS system should always be ready twenty-four hours a day to respond to all types of emergencies in a timely manner. Management of trauma patients is supposed to start at the scene of the emergency by first aiders or first responders before the arrival of the ambulance crew. In many countries, the police and fire services are given first responder training to compliment EMTs and paramedics on the field to ensure timely response. Such trainings are not given to them in Ghana. The public is also required to have some level of first aid training to supplement the system, since timely response is a shared responsibility. The national ambulance service, the hospital emergency departments and other private ambulance services render emergency care in country.

There are two main types of pre-hospital emergency medical service systems in the world, which are the Anglo-American and Franco-Germany EMS systems. Countries around the world choose one of these systems to provide quality pre-hospital care and transport to patients (Page, 2013). The Franco-German system, which is also known as "stay and play", is a physician-EMS-based system that allows physicians and EMTs to evaluate and treat a patient at the emergency scene. In this system, patients are usually taken to the hospital or clinic if further evaluation is needed. By contrast, the Anglo-American model popularly known as "scoop and run" consists of ambulances with emergency medical technicians and paramedics trained in basic, intermediate and advanced life support (Page, 2013).

Ghana practices the Anglo-American system. Physicians are usually not part of the ambulance crew. The system is based on managing and expediting patient movement to the appropriate health facility.

Reducing the response time would potentially decrease morbidity and improve survival of trauma patients. However, the statistical benefits associated with EMS responding to emergencies in a timely manner to provide care and stabilize patient's condition remains an unanswered question (Blackwell, 2002).

In the 2001 Global Burden of Disease Project, it was reported that about 45% of deaths and 36% of disability-adjusted life-years were potentially addressed by EMS in LMICs (Mould et al., 2013). If they had robust EMS systems in place, some of the preventable deaths that occurred within countries would been saved.

According to the second edition of Disease and Mortality in sub-Saharan Africa, the region has the highest mortality level in the world (Mould et al., 2013). High mortality rate in the world being Africa only remind us about the urgency in putting up systems to address the situation. Pre-hospital emergency care could be one of the many systems that would ensure that the gap between patient and health care is narrowed. Most African countries do not have EMS systems in place. Those that have it are not able to meet response time targets.

In South Africa (SA), national response time targets of 90% of life threatening incidents in urban areas should be responded to within 15 minutes. However, this was not met even after increment in the number of ambulances (Stein et al., 2015).

Many people die on the roads through accidents in the world. In Ghana, the national road safety report of 2007 in Ghana reported that at least six people are killed every day in RTA, and that most of them are from the following five regions: Ashanti, Eastern, Greater Accra, Central and the Western (Coleman, 2014).

The Greater Accra Region has become infamous for topping the list of cities in Ghana for trauma disaster. On June 3rd 2015, the twin disaster of gasoline and rain floods on flames claimed the lives of about 127 people in the country as reported by Wikipedia.

**2.2 Pre-hospital trauma survival**

Trauma survival depends on whether you die or you live in an accident situation. In order to improve on survival, it is necessary for various governments to develop pre-hospital emergency system to respond 24 hours a day to victims of trauma. This can help save lives and improve on survival. Accidents are unpleasant occurrences, and its greatest impact on humanity is death. Failure to put the right policies in place will lead to more people dying at the scene of accidents needlessly.

Road traffic accident and its related deaths are a major public health problem in developing countries which causes more than 90% of the victims who sustain various disabilities lose their lives (Gopalakrishnan, 2012).

The World's possible first RTA occurred in 1896 (Gopalakrishnan, 2012). Everybody said, "This should never happen again." A situation people were concerned about and taught it was absurd for such a thing to happen again. However, it is quite normal today.

As many as 1.2 million lives were lost due to crashes year after year and 50 million people are injured (Gopalakrishnan, 2012). If the trend should continue, the number of deaths

due to road traffic accidents and the number people injured in the world will increase by more than 60% by 2020

In lower middle income countries (LMIC) where a lot of deaths occur in the Pre-hospital setting, there is no adequate emergency systems in place to respond to accident as compared to the advanced word (Bigdeli et al., 2010).

Road traffic injuries are a growing public health issue, more than half the people killed in traffic crashes are the youth aged between 15 and 44 years who are often the bread winners of the families (WHO, 2004).

Majority of the world's population do not have access to pre-hospital trauma care. In many countries, appropriate EMS system do not exist, few victims of RTA hoped to be treated and transported to the hospital facilities from the scene of emergency by an ambulance. Transport is usually provided by relatives, untrained bystanders, taxi drivers, truck drivers, or police officers usually resulting in victims dyeing needlessly at the scene or during the first few hours following injury (WHO, 2004).

Deaths from severe injury occur within one of the following phases of trauma; the first phase occurs immediately or quickly after serious and severe injuries over few minutes or during the sub-acute phase which usually occurs within several hours after the event mostly as a result of the life threatening condition (Lennart et al., 2011).

EMS is well developed in Europe and America than it is in African, where many trauma deaths occur in the pre-hospital setting. Crashes are inevitable in every region. However, the difference is how best the ambulance crew can reach to victims of RTA in a timely manner to initiate appropriate patient management measures as well as quality transport to the facility. The situation is not peculiar to Africa, in Europe, 50% of deaths from RTA

occur within a few minutes after crash or during transport to the hospital, 15% at the hospital within 4 hours of the crash and 35% after 4 hours, this to tell us that, they also die through accidents in the pre-hospital setting. However, they have been able to put up an organized pre-hospital system that demonstrated reduction in morbidity and mortality of RTA victims (Taiwo, 2009).

In lower middle-income countries (LMIC), insufficient emergency medical care leads to majority of the trauma deaths. Deaths usually occur either at the scene of crash or during transport to the hospital (WHO, 2004). Report from (WHO, 2004) indicates that, 60% of RTA deaths in Iran occurs at the crash scene or during transport to the hospital. It means many of the victims could be saved if we had ambulances with trained personnel to respond to the scene of emergencies in a timely manner (Lennart and Bogg, 2011).

The Ministry of Road and Highways repot on fatal accident in the year 2008 presented to the Indian parliament a data that shows that, as many as 119,860 people died due to road traffic accidents that year, while data for 2009 accidental deaths were reported to be 126,896. The figure increased to 133,938 in 2010, which is about 5.5% higher than the previous year's deaths. This is an indication of an increase in trend that is frightening, if left unchecked the situation could get worse in future (Gopalakrishnan, 2012).

As many as 130,000 people died on Indian roads, making India infamous for topping the list of road deaths across the world while China has managed to reduce the number of road deaths from over 100,000 to 90,000 (Gopalakrishnan, 2012).

Statistics shows that in Brazil, 30 000 people die every year in road accidents. Of these, 44% are between 20 and 39 years of age, and 82% are men (WHO, 2004). Majority of the victims died either on the emergency scene or during transport to health facility.

The African continent bears a large burden of deaths and disabilities from emergency conditions such as traumatic injuries, natural disasters, burns, domestic violence, among others (WHO, 2004).

The World Health Organization (WHO) reports that Africa has the highest mortality rate from road traffic crashes (32.2 per 100,000 population), almost double the number in North America (Lennart Bogg and, 2011).

In Ghana, 1,323 road users were killed in 2013, according to the report from the Motor Transport and Traffic Unit (MTTU) of Ghana Police Service. Out of this figure, the Greater Accra Region accounted for 55% of the deaths occurred a few minutes after crash.

A study published in 2002 reported that 8.6% of all deaths recorded at Komfo Anokye Teaching Hospital Mortuary were as a result of injuries and 80% of those deaths occurred within pre-hospital setting (Oduro, 2015)

A study at KATH consisting of 1,004 patients transported to the facility, 14.8% arrived at the accident and emergency unit by ambulance while 77.6% of them used their own means (38% private cars, 38% taxis). Patients who were transported to the unit by the ambulances were those with severe injuries (Mould et al., 2014).

On 16th February 2016, on the Kintampo road in Ghana over 60 people died and many more were injured when a metro mass bus failed brakes and collided head on with a tomato truck. Such incidents in Ghana are no longer rare (GhanaWeb, 2016)

A cross sectional study in Ghana was conducted between 2001 and 2011 on road traffic accident cases. It was to inform the authorities on the need to ensure sanity on the roads where one hundred and fifty thousand nine hundred and forty nine (150,949) RTA victims were reviewed and analyzed. There were 96,888 (64.19%) passengers and 40975 (35.81%)

pedestrians involved, of this 21,283 (14.14%) were fatality cases while 129,666 (87.95%) suffered various degrees of injuries. The study suggested that males have 1.5 times higher risk of RTA than females. The conclusion was that**,** RTA is a threat to lives and properties and every effort must contribute to salvage the situation (Amo, 2014)

A study was conducted to identify the place the timing of death following injury with access to and quality of local trauma services, and opportunities to improve trauma outcomes from April 2001 to March 2006. They collected data through Hospital database by selecting major trauma cases and interviewing front line care providers. Majority of trauma deaths (82%) occurred in the pre-hospital. Patients who arrived alive to the hospital have low hospital mortality (1.0%). The investigators concluded that, improving trauma outcomes requires addressing issues of delay to emergency medical services (Simons et al., 2010).

**2.3 The relationship between pre-hospital trauma survival and response time**

A lot of work has been done in this area in the developed world; among them are those who find statistical significance and those who did not find any as such. However, none of the study rejects the fact that there is a clinical benefit in responding fast to the emergency scene.

Many injuries might have been prevented or reduced in terms of intensity by timely pre-hospital trauma care. Without timely and pre-hospital care, many people who would have survived at the scene or en-route to the hospital may die. Most deaths in the first hours after injury are the result of airway compromise, respiratory failure or uncontrolled bleeding (WHO, 2004)

In order to reduce the morbidity and mortality, emergency medical care should begin as early as possible at the scene of an emergence and on the way and to the hospital. Prompt and effective pre-hospital transport is important for an effective care.(WHO, 2004)

Emergency response time to the scene is an important benchmark to measure the quality of service provided by emergency medical service (EMS) agencies. A suggested target response time of 8 minutes for at least 90% of emergency responses has become the guideline for many EMS providers (Doig et al., 2012)

In the World Journal of Surgery published in July 2014, Yeboah et al found that, a large proportion of trauma fatalities could have been prevented by decreasing pre-hospital delays and providing adequate networks to increase survival. In trauma emergencies, victims die largely due to excessive bleeding. Controlling of bleeding could lead to many lives being saved (Oduro, 2015).

On May 7 2008, an 18-month old toddler died in Calgary, Canada after it took an ambulance 40 minutes to get to the scene. Elijah Luck went into medical distress and a call was made for an ambulance. The ambulance delayed and after waiting 30 minutes for the ambulance, the parents made another call for another ambulance, which arrived after six minutes later. Upon arrival at Alberta Children's Hospital, the baby was pronounced dead (Nikodemus, 2013).

Urban response time in South Weston Metropolitan County with a population of 620,000 was found to be associated with myocardial infarction survival rate. The benefit of survival was within 5 minutes of response time. (Nikodemus, 2013)

A study in Ontario Canada concluded that for a survival rate to be improved, ambulance response time should be reduced (Nikodemus, 2013).

A study at the Komfo Anokye Teaching Hospital indicates that delay in transporting patients to the accident and emergency department account for 26.3% of referral cases becoming highly technical and sophisticated demanding attention at the accident and emergency unit (Nyame & Boateng, 2014).

Washington determined survival rate to be increased by 2.1% without intervention by reducing response time to provide advanced life support (Nikodemus, 2013).

Ambulance response time within 8 minutes was not associated with improved survival to hospital discharge after controlling for several important confounders, such as severity of injury (Doig et al., 2012), however, the study does not deny the fact that there is a survival benefit in responding early to the scene of emergencies.

Injury is a major cause of death and disability worldwide. Injury control strategies focus on preventing or minimizing the severity. To achieve this, timely EMS should be activated.

The prompt provision of emergency care and rapid transport of injured victims from the scene of injury to a healthcare facility can save lives, reduce the incidence of short-term disability and dramatically improve long-term outcomes (WHO, 2004)

Considerable amount of damage may be reduced by ensuring that severely life-threatening patients receive simple but life sustaining care within minutes of injury. Bystanders, community volunteers and other citizens should be trained to handle victims (WHO, 2004).

The following studies below either demonstrated statistical significance or failed to do so. A study conducted in a metropolitan county of a population 620,000 of to determine the effect of current response times on survival in an urban EMS system. They were required

to respond to 90% of life threating cases within 10:59 minutes response time for over six months period. Results: Five thousand, four hundred twenty-four transports were reviewed and out of these, 71 patients did not survive (1.31%; 95% CI= 1.04% to 1.67%). They were no significant difference in median response time between those who survived and those who did not. Mean response time for survivors was 6.4 minutes and non-survivors were 6.8 minutes with p-values of 0.10. Further, there was no significant difference between observed and expected deaths with p –value of 0.14. However, mortality risk was 1.58% for patients whose response time exceeded 5 minutes, and 0.51% for those whose response time was under 5 minutes with p – value of 0.002. The mortality risk curve was generally flat over response time intervals exceeding 5 minutes. The study concluded that, in emergency calls where response times were less than 5 minutes were associated with improved survival compared to calls where response times exceeded 5 minutes(Thomas H. blackwell, 2002)

A study was carried out in Denver was done to measure the effect of 8-minute response time on the outcome of non-traumatic cardiac arrest patients in EMS while controlling for a number of potentially important confounders, including level of illness and severity. A retrospective cohort was used to review data from patients transported to a single urban county teaching hospital from January 1, 1998, to December 31, 1998. Out of 34,111 calls involving emergency response, 11,078 patients (32%) were transported to the study institution and 10,382 (94%) had response time data available. Out of these, 9,559 patients (92%) had data available to categorize them into groups. A survival benefit was identified for response times of 4 minutes and the study concluded that an emergency response time within 8 minutes was not associated with improved survival after controlling severity of injuries. However, a survival benefit was identified when the response time was within 4 minutes for patients with high risk of mortality (Pons et al., 2005).

A one-year prospective cohort study was also conducted to determine whether an 8-minute EMS response time was associated with mortality in urban all-ALS EMS system of a million population. Out of 7760 unit responses 1,865 (24%) were responded to within 8 minutes while among patients with a response time of greater than 8 minutes, 7.1% died, compared to 6.4% of patients with a response time within 7 minutes. The analysis suggested that, there might be a small survival benefit of response times within 7 minutes (Blanchard et al., 2012).

A systematic review was done to assess the relationship between emergency response time and the outcome of pre-hospital cardiac arrest. Observational studies were identified by a search of PubMed and ISI databases to 30 January 2014. Primary outcome was survival to discharge. In every 1 minutes delay in response time the odds of surviving a cardiac arrest is decrease by 0.91. The survival odds ratio decreased along as response time increases, when response time less than 7 minutes. The study concluded that, emergency response time is an important risk factor for the outcome of cardiac arrest in adults and made a recommendation that; EMS team must arrive as soon as possible to the site of the event(Zhu et al, 2015)

A study to assess pre-hospital time and its effects on fatality rates in rural vehicular crashes Alabama. Over a 2-year period from January 2001 through December 2002, data were collected from EMS Patient Care Reports and police crash reports for the entire state. A total of 45,763 police crash reports were linked to EMS Patient Care Reports. Of these, 34,341 (75%) of them sustained trauma in rural settings while 11,422 (25%) in urban settings. Seven hundred and fourteen mortalities were identified, of which 611 (1.78%) occurred in rural settings and 103 (.90%) occurred in urban settings with p-value of 0.0001. When mortalities occurred, the mean EMS response time in rural settings was 10.67 minutes and 6.50 minutes in urban settings with p-value of 0.0001. When

mortalities occurred, the average pre-hospital time in rural settings was 42.0 minutes and 24.8 minutes in urban settings with *p-value of 0*.0001. This suggest that, EMS response time for rural crashes with survivors was 8.54 minutes versus an average of 10.67 minutes with mortalities with *P* –value of 0 .0001. The study concluded that, based on this statewide analysis crashes, increased EMS pre-hospital time appears to be associated with higher mortality rates in rural settings (Phelan et al., 2008)

**2.4 Median transportation time**

Time has always been important to out-of-hospital emergency care. It is recommended that trauma patients be transported using the most expedient and appropriate means. Transportation time starts from when a call is made to request for an ambulance to the time the patient is handed over to the health facility. In pre-hospital trauma, it is synonymous with golden hour principle, whereby it is expected that all trauma patients reach to the theater room within one hour from the time of accident. The term "golden hour" is usually attributed to R. Adams Cowley, founder of Baltimore's famous Shock Trauma Institute. In a 1975 article, when he stated that "the first hour after injury will largely determine a critically-injured person's chances for survival" without providing evidence to support his statement (Rogers, 2014).

The golden hour principle is taught to EMTs and paramedics because it is assumed that a maximum time interval of one hour from the time of injury to surgical intervention will improve the outcome of trauma patients (Lerner et at., 2003).

There is another school of thought that suggests that golden hour findings came about from the US-Vietnam War, in which the survival rate in medical facilities was increased by 2% over previous wars to 97.5%, where the average time to definitive care was reduced from an average of five hours to one hour (Lerner et al., 2003).

A study in Western New York found that patient age, injury severity score, and revised trauma score all were significant predictors of trauma patient mortality. Total out-of-hospital time was not associated with mortality (Lerner et al., 2003).

Another study was conducted in Pakistan to assess the outcomes as a result of hospital transfer and delays in trauma patients. Data in Trauma Registry gathered from 1998 to 2005 was reviewed and out of 978 patients, 303 (30.9%) of them reached the emergency room within an hour transport. The average time from injury occurrence to arrival in the emergency room was 4.7hrs. The study did not find statistical significant difference in mortality between patients who were presented within 1hr and above 1hr of response times (Khan et al., 2009).

**2.5 Time spent on scene**

In trauma situations, it assumed that a maximum of 10 minute should be spent in managing and loading the patient in to the ambulance at the scene of emergency known as the platinum 10 minutes guideline taught in the field of para-medicine**.** To spend more than 10-minute managing patient could lead to what is called, splinting to death. This whole principle is termed as the platinum 10 minutes guideline. It is closely linked to the Vietnam War just like the golden hour principle.

A study in the US Army suggests that, the first 10 minutes are a key in determining whether the wounded warrior will live or die. Soldiers and medics are trained to abide by that principle. They concluded that, if the platinum 10-minute chain were broken, it would decrease the chances of solder survival and that the necessary steps must be taken to ensure the training and equipment to get casualties stabilized in that first 10 minutes to ensure confidence of good medical care to the fighters (Bukowski, 2006).

A systematic review performed from MEDLINE, Embase and the Cochrane Library from inception to May 19th, 2014. Studies reporting on pre-hospital time intervals for emergency medical services (EMS), the results demonstrated a decreased in odds of mortality for the undifferentiated trauma patient when response-time or transfer-time were shorter. On the contrary increased in on-scene time and a total pre-hospital time were not associated with increased odds of survival for this population. The researchers further suggested that rapid transport does seem beneficial for patients suffering penetrating trauma, in particular hypotensive penetratingly injured patients and patients with a traumatic brain injury. The study concluded that shorter transport time is beneficial for patients suffering neuro-trauma and the haemo-dynamically unstable penetratingly injured patient. For haemodynamically stable undifferentiated trauma patients, increased on-scene-time and total pre-hospital time does not increase odds of mortality (Zhu et al., 2015).

# CHAPTER THREE

# METHODS

## 3.1 Study design

A retrospective Cross sectional study was used to review pre-hospital trauma patient's data for a period of January to December 2014. These were pre-hospital care forms (PCR forms) from trauma patients responded to by following fourteen (14) Ambulance Stations in the Greater Accra Region; Ridge hospital, Accra Airport, Weija, Tema, Accra City, Ashiamang, Teshie, Atomic, Dodowa, Pantang hospital, Mamprobi, La General hospital, Accra Sports Stadium, and Ada Ambulance Stations.

## 3.2 Study area

The Greater Accra Region is the smallest amongst the 10 administrative regions in terms of area. It occupies a total land surface of 3,245 square kilometres or 1.4 per cent of the total land area of Ghana. Its capital is Accra, which is also the capital of the republic of Ghana. In terms of population, it is the second most populated region after the Ashanti Region, with a population of 4,010,054 in 2010, accounting for 15.4 per cent of Ghana's total population.

The political administration of the region is through the local government system. Under this administrative system, the region is divided into 16 districts namely, Accra Metropolitan Area, Tema Metropolitan Area, Adenta municipal, Ga East Municipal, Ga East Municipal, Ga West Municipal, Ga South Municipal, Ga Central Municipal, Ashiamang Municipal, La Nkwantanang District, Ledzokuku-Krowor Municipal, Dangme West District, Dangme East District, La Dade Kotopon District, Nimgo Prampram and Ada West. Each District, Municipal or Metropolitan Area, is administered by a Chief Executive, representing the central government but deriving authority from an Assembly

headed by a presiding member elected from among the members themselves.

The major ethnic groups are the Akan (39.8%), Ga-Dangme (29.7%) and Ewe (18%). The Ga people however form the largest single sub-ethnic grouping, accounting for 18.9 percent. The region was chosen because of its heavy traffic situation, which makes it difficult for movement of Ambulances to the scene of emergencies. Reports from NAS claim to have fourteen Ambulance station making 62.5% coverage of service (Accra Airport , Accra city (Makola), Amasaman, Ashiamang, Atomic, Dodowa, La General, Lekma, Accra Sports Stadium, Ridge, Tema, and Weija) with an average response of 1358 cases annually in the region.

### 3.3 Variable

#### 3.3.1 Dependent variable (Outcome variables)

- Pre-hospital trauma survival

That is to determine whether patients transported by the national ambulance service arrived alive or died at any point in delivering their service.

#### 3.3.2 The independent variables:

The PCR forms for each patient was reviewed and the following independent variables were either extracted or estimated.

1. Sex ( male or female)
2. Age ( in years )
3. Response time ( in minutes)
4. Transportation time (in minutes)
5. On-scene time (time spent on scene, in minutes)

6. Level of consciousness (indicated on the form per the following levels prior to transport, whether the patient's state was "Alert", "respond to Verbal", "Painful stimuli", or "unresponsive").
7. Types of injuries ( was classified according injuries to the following parts of the body, head, limbs, multiple trauma, body trunk, neck and no obvious injuries)

### 3.4 Sample

The study sample was taken from a registry provided by NAS, which transported to various health care facilities in the Greater Accra Region of Ghana.

### 3.5 Case definition,

Any trauma patients transported by national ambulances service in the in the Greater Accra Region to any hospital within the region within January to December 2014

### 3.6 Study population

All trauma cases transported to various hospitals by the fourteen Ambulance Stations for 2014 in the Greater Accra region were considered.

### 3.7 Sample size

Records from 646-trauma patients transported by NAS from January 2014 to December 2014 within the Greater Accra Region were used for the study.

### 3.8 Sampling method / procedure

Pre-hospital Care Forms filled for each patients transported to a health facility by EMTs were sent to the operation department of NAS Head Office in Accra after recording them in to their daily occurrence books in the ambulance stations. It was at this point that the

researcher collected the data. Research assistants were trained to assist in the extraction of the data. Certain stations were also visited to confirm and clarify inconsistent data on certain forms from their occurrence books at the stations.

Data extraction was done according to the following variables below:

- The time the emergency call was made to the station
- The time the ambulance departed to scene,
- The time it arrived at scene time,
- The time it departed the scene to the health facility
- The time it arrived at the health facility
- The time the patient was handed over to the health facility.
- In addition patient characteristics such as age, sex, type of injury were also extracted

The above information was then transferred in to an excel spreadsheet to estimate the following variables: Response time, transportation time and time spent on scene.

Response time was estimated by deducting time of arrival of the ambulance to the scene of an emergency from the time a call is made for the emergency.

Transportation time was estimated by deducting the time the patient was handed over to the facility from the time the call was made to the station.

On-scene time was estimated by deducting the time the Ambulance departed the scene of the emergency from the time it arrived the scene.

### 3.9 Inclusion Criteria

Records of patients who sustained pre-hospital trauma and were directly responded to by the National Ambulance Service as well those who were picked by private or commercial vehicle to clinics and were subsequently transported to an appropriate hospitals by an ambulance belonging to NAS in the Greater Accra Region were included in the study. In Ghana, most people do not wait or call an ambulance when accident occurs; they offer their help by conveying victims to the hospital.

### 3.10 Exclusion Criteria

Data from patients with ineligible records that were difficult to decipher were excluded and all pre-hospital trauma (stable) cases that were transported for diagnostic purposes such as X-ray and CT scan in the region were as well excluded.

## 3.11 Ethical considerations

The study protocol was reviewed and approved by the Ghana Health Service Ethical Review Committee of the Research and Development Division of the Ghana Health Services. In addition, permission was sought from the National Ambulance Service to use their data for the conduct of the study. Patient names and other information that would lead to the identity of any patient were not extracted. To assure confidentiality, the data was kept under lock and key on the researcher's personal computer.

### 3.12 Data collection instrument

The PCR forms were the main tools for data extraction. They contain patient demographic information, such us name, sex, and age, disease or injury information, patient management information as well as times for various stages of transport. Equipment such

as Personal computers, software's and research assistants from the operations department of the National Ambulance Service were used in the extraction of the data. Some Ambulance stations were also visited to review their daily occurrence books for clarifications and further extraction of data, this act was highly supported by the personnel on duty.

### 3.13 Data Processing and Analysis

All analyses were done using the Stata Version 13. Data were stratified in to response time of (<8 vs. ≥8) to described patient characteristics such us gender, level of consciousness, body parts involved, age groups and survival.

The proportion of patients who survived pre-hospital trauma as well as the proportion of pre-hospital trauma cases that was responded to within eight minutes was estimated. Bivariate analysis was conducted to determine which variables were associated with survival. Chi square test was used to determine relationship between independent variables (response time in to the following categories <4 vs. ≥4, <8 vs. ≥8 and <17 vs. ≥17, on-scene time in to <10 vs. ≥10, transportation time in to <60 vs. ≥ 60, level of consciousness, type of injuries and age) and dependent variable (pre-hospital trauma survival) at 0.05 significance level. Binary logistic regression was conducted to test the association between response time and pre-hospital trauma survival while adjusting for age, sex, level of consciousness and types of injuries. Logistic regression results were presented as to odds ratio and 95% confidence intervals with significance set as p-value < 0.05.

### 3.14 Limitations of the study

It was not possible to determine the exact response time, since the exact time the accidents occurred are almost impossible to be recorded. Sometimes accidents do occur long before the attention of the service is drawn to it. In a situation like that, there will be a vast difference between the time a call was made to request for the ambulance and the actual time the incident occurred. Response time would have been appropriately estimated by deducting the time the ambulance arrived at the scene from the time the accident occurred. We did what was real, by deducting the time the Ambulance arrived at the scene from the time the call was made for the ambulance.

Distances corresponding to various transport times were also not recorded on the PCR forms, which made it virtually impossible for us to factor in an important possible predictor like distance in the study. The study would have been more informative if we had been able to determine how distance traveled affects response time and pre-hospital trauma.

Triage system, which is used to sort patients into various levels of severity of condition and tag them per the degree of seriousness of injuries for prioritization and treatment, were not part of data collected in NAS. However, the data collected was based on the level of consciousness, which indicated whether the initial state of patient's consciousness was Alert, respond to voice, painful stimuli or unresponsive. We assessed how the level of consciousness could potentially influence the level of pre-hospital trauma survival.

Copies of PCR forms filled by EMTs for patients they managed were not left at the hospitals to become part of patient's records. Likewise, there was also no system in place to monitor and determined the outcome of the patients they handed over to the hospitals. Though the study would have wish to explore the outcome of the trauma patients

transported to the hospitals and factor that into the study, it was not possible. The effect of response time on trauma survival has the potential to manifest later on in life. We explored response time and survival based on the records of the NAS.

# CHAPTER FOUR

# RESULTS

## 4.1 Description of data

Twenty thousand two hundred and thirty six patients were transported by the 14 Ambulance stations of the National Ambulance Service from January to December 2014, and from among them were 652 trauma cases who were eligible for the study. From the PCR forms reviewed the following data points were missing, 96 of the forms did not indicate the level consciousness, 9 of the forms did not also indicate the body parts involved and 20 of the forms did not indicate the age of the patients. All other variables had a complete data as displayed in figure 2 below.

## 4.2 Description of patient characteristics

The mean age of the patients transported was 33 years. Of the 632 patient's records available, 65.7% of them were within the age group 15 to 44 years. Of all the patients, 68.8% of them were male and 6.7% of the victims had their level of consciousness as unresponsive. The mean response time was 16.9 minutes with standard deviation of 0.68 and confidence interval of 15.6 to 18.28. The minimum response time was 1minute and the maximum was 151-minute. The median time spent on the scene in managing patients was 17 minutes with range of 1 to 150 minutes.

The study further found that 12.5% of the patients who were responded to beyond 8 minutes time did not survive pre-hospital trauma. Of all the patients, 98.8% of them survived pre-hospital trauma and of all the responses, 36.7% of them were within 8-minute response time. None of the characteristics was significantly associated with response time apart from patient's survival. Table 1 shows details of patient characteristics.

**Figure 2. Flow chart on sample size and missing data**

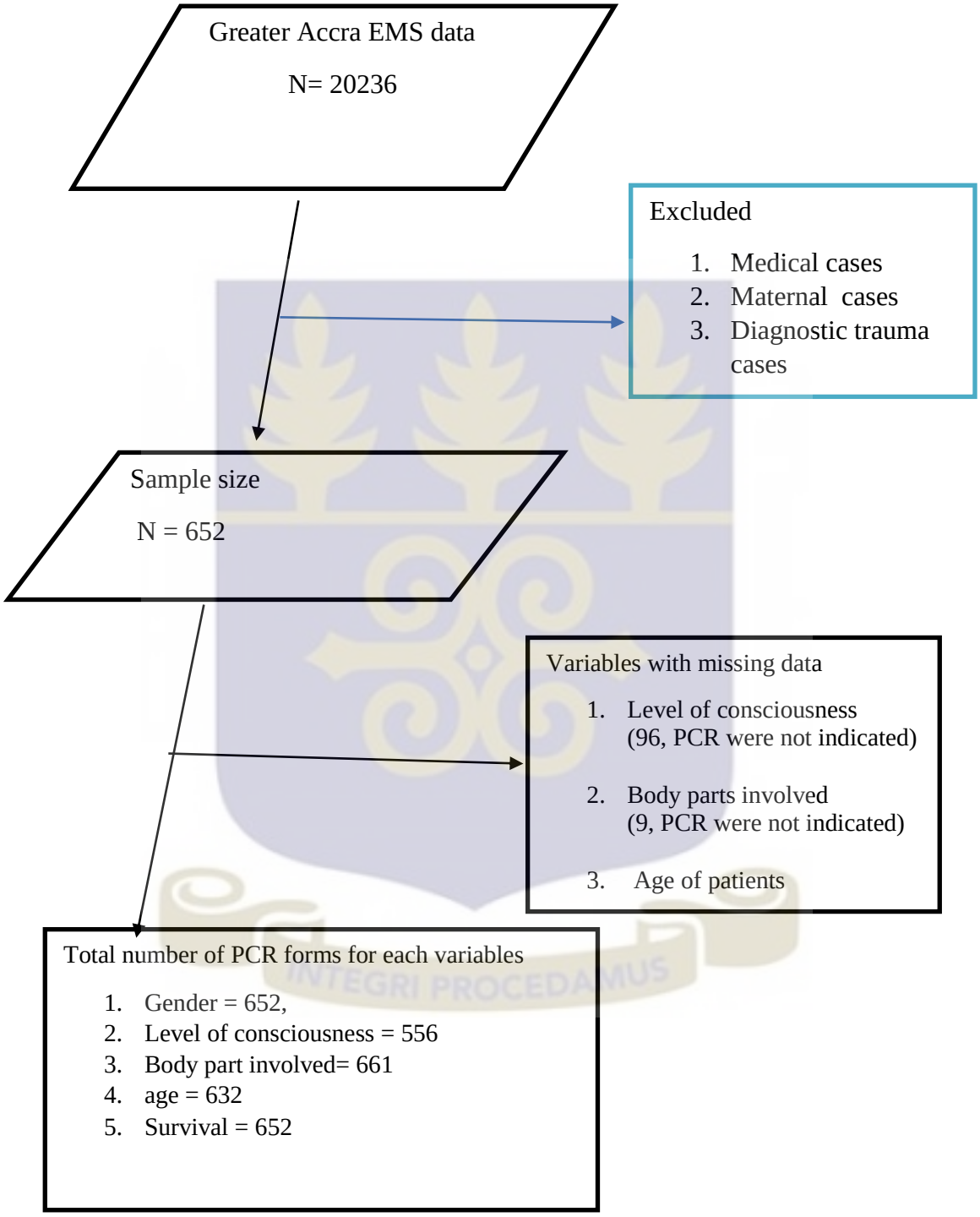


**Table 1 Characteristics for trauma patients Based on the 8 Minute Response Time Criterion**

| Variable | < 8 minutes | >8 minutes | P value |
|---|---|---|---|
| Gender (total) | 239 | 413 | 0.311 |
| Female | 69(33.8%) | 135(66.2%) | |
| Male | 170(38.0%) | 278(62.0%) | |
| | | | |
| Level of consciousness | 200 | 356 | 0.211 |
| Alert | 179(37.5%) | 299(62.6%) | |
| Verbal | 4(25.0%) | 12(75.0%) | |
| Pain | 9(36.0%) | 16(64.0%) | |
| Unresponsive | 8(21.6%) | 29(78.4%) | |
| | | | |
| Body parts involved | 221 | 390 | 0.887 |
| Head | 60(36.8%) | 103(63.2%) | |
| Limbs | 77(38.0%) | 126(62.1%) | |
| Multiple trauma | 22(33.3%) | 44(62.7%) | |
| Body trunk | 16(30.8 %) | 36(69.2%) | |
| No obvious injuries | 35(34.7%) | 66(65.3%) | |
| Neck injuries | 11(42.3%) | 15(57.7%) | |
| | | | |
| Age- mean | | | 0.121 |
| >15 | 37(43.6%) | 48(56.5%) | |
| 15 to 44 years | 157(37.9%) | 258(62.2%) | |
| 45 to 59 years | 18(26.5%) | 50(73.5%) | |
| >60 years | 20(31.3%) | 44(68.8%) | |
| | | | |
| Survival | 239 | 413 | 0.269 |
| Dead | 1(12.5%) | 7(87.5%) | |
| Alive | 238(37.0%) | 406(63.34%) | |

Test of association between patients' characteristics and response time. P-values < 0.05 were considered significant.

The following results were also noted, among 37 patients, whose level of consciousness was unresponsive, 86.5% of them survived pre- hospital trauma while 13.5% of them did not. Of all the patients responded to within 8 minutes response time, 99.95 of them survived. Out of the trauma patients, 99.8% of them who have their response times within 17 minutes survived trauma. Among patients whose injuries were not obvious, 99% of them survived trauma within the pre-hospital setting. Among patients who were managed at the scene for more than 10 minutes, all of them survived. The median transportation time for patients was 82 minutes with minimum of 5 minutes and maximum of 552 minutes. Among patients whose transportation time was more than 60 minutes, 99.2% of them survived. Most of the patients who did not survived were above 60 years (3.1%) compared to the other age groups. Chi square test results showed significant relationship between trauma survival and the following variables, level of consciousness, response time as a continuous variable and 17 minutes response time, with trauma survival. The other independent variables were not significantly associated with survival. Table 2 indicates more details.

**Table 2 Univariate analysis between trauma survival and independent variables**

| Variables | Pre-hospital trauma Survival | | P values |
|---|---|---|---|
| | Died | Alive | |
| Level of consciousness | | | <0.0001 |
| Responsive | 3(0.6%) | 516(99.5%) | |
| Unresponsive | 5(13.5%) | 32(86.5%) | |
| Response time | | | 0.209 |
| <4 minutes | 0(0.0%) | 155(100%) | |
| >4 minutes | 8(1.6%) | 489(98.4% | |
| Response time | | | 0.269 |
| < 8minutes | 1(0.4%) | 238(99.6%) | |
| >8minutes | 7(1.7%) | 406(98.3%) | |
| Response time | | | 0.003 |
| <17 minutes | 1(0.3%) | 422(99.8%) | |
| >17 minutes | 7(3.1%) | 222(97.0%) | |
| Types of injuries | | | 1.00 |
| Obvious | 7(1.8%) | 502(98.7%) | |
| No obvious | 1(1.0%) | 100(99.0%) | |
| Time spent on scene | | | 0.183 |
| < 10 minutes | 0(0.0%) | 197(100%) | |
| >10 minutes | 5(1.2%) | 415(98.8%) | |
| Transportation time – median | | | 1.00 |
| <60 minutes | 3(0.9%) | 371(99.2%) | |
| >60 minutes | 2(0.8%) | 235(99.2%) | |
| Age groups | | | 0.175 |
| >15 | 1(1.2%) | 84(98.8%) | |
| 15 to 44 | 3(0.7%) | 412(99.3%) | |
| 45 to 59 | 1(1.5%) | 67(98.6%) | |
| >60 | 2(3.1%) | 62(96.9%) | |

Test of association between predictor and pre-hospital trauma survival. P-values <0.05 were considered significant.

Binary logistic regression was used to analyze response time and pre-hospital trauma survival and the odds ratio was 0.96 with confidence interval of 0.95 to 0.95. Level of

consciousness, age, sex, and types of injuries were controlled for and the adjusted odds ratio was 0.95 with confidence interval of 0.918 to 0.979 as displayed in table 3. As response time increases by one minute, the adjusted odds of surviving a pre-hospital trauma is reduced by 95% times compared to dying.

**Table 3 Logistic Regression Analyses to Model Emergency Response Time as a Predictor for pre-hospital trauma Survival**

| Variables | Odds ratio | 95% CI | P value |
|---|---|---|---|
| Response time | 0.96 | (0.95 - 0.98) | <0.001 |
| | Adjusted results | | |
| Response time | 0.95 | (0.918 - 0.979) | 0.001 |
| Age groups | | | |
| >14 | Ref. | | |
| 15-44 | 2.17 | (0.074- 64.124) | 0.652 |
| 45- 59 | 1.32 | (0.030 - 59.76) | 0.15 |
| 60+ | 0.67 | (0.020 -22.19) | 0.826 |
| Sex | 3.99 | (0.409 - 38.824) | 0.234 |
| Level of consciousness | 121.27 | (8.419-1746.78) | <0.0001 |
| Types of injuries | 2.95 | (0.179- 48.702) | 0.450 |

Logistic regressing analysis between predictor variables and pre-hospital trauma survival.

P-values < 0.05 were considered significant

# CHAPTER FIVE

# DISCUSSIONS

There was no study conducted to assess the relationship between Ghana's emergency response time and it pre-hospital trauma survival at the time of this study, all studies in relation to that were outside the African continent. The study was done in consultations with and assistance from stakeholders in the country especially NAS. The initial part was descriptive and the later part focuses on determining any relationships.

Our findings suggest that, 98.8% of the cases transported to various facilities in the Greater Accra Region by NAS survived pre-hospital trauma. This goes ahead to give an indication that, the interventions put in place by the EMTs could possibly contribute to this high survival rate, as suggested by WHO in their 2004 report. The WHO report states that, without timely pre-hospital care, most trauma patients would have died at the scene or on their way to hospital due to airway compromise, respiratory failure or uncontrolled bleeding. A study in Israel also support our findings by observing a decrease in death rate in hospitalized trauma patients from 1997 to 2001 and attributed it to the implementation of strong trauma systems. Pre-hospital medical care was one of the components identified as a contributory factors to the reduction(Peleg et al., 2004). With the EMTs on the scene, they will be able to perform BLS skills such as controlling bleeding, oxygen administration, splinting and so on to contribute to high patient survival. If these patients were to be transported by commercial or private vehicles, which are not designed for that purpose, coupled with unskilled good Samaritans, it could have led to the undesirable outcome.

Our study also reported the average emergency response time for the region to be 16.9 minutes with a standard deviation of 0.68, confidence interval of 15.6 to 18.3 and a range

of 1 to 150 minutes. This finding is very similar to the national average of 17 minutes recorded in NAS, 2013 annual report. Response time calculations are still based on estimating the mean response time in Ghana, however, many countries has resulted to calculating the proportion of ambulances that were able to respond to cases within 8 minutes known as fractal response time. In line with that, a suggested target response time of 8 minutes for at least 90% of emergency responses has become the guideline for many EMS providers (Doig et al., 2012). This is to prevent extreme values from skewing the mean response time in their direction. By using the proportion approach to determine Ghana's emergency response time, we estimated that, 36.7% of the ambulances were able to respond to emergencies within 8 minutes. We also applied the same principle by calculating the proportions of response that were within 17 minutes and it was 68.7%.this finding suggest that a response time target of 90% of all emergency cases has not been met in the Greater Accra Region.

A study in South Africa also reported that a response time target of 90% of all emergencies within 15 minutes was nothing achieved despite over 100% increase in ambulances (Stein et al., 2015) however in England as at April 2015, more than 75.6% life threatening were responded to within 8 minutes (*EMERGENCY AMBULANCE SERVICES IN ENGLAND*, 2015). These higher response times in Ghana recorded are possibly due the traffic situation Accra. To drive an ambulance through the traffic-laden city involves a lot of maneuvering. Moreover, many road users do not obey traffic regulations or are ignorant of the road traffic regulations. This could be a contributory factor to the delay in the emergency response time. However, this cannot be an excuse to relax in an effort to meet national response time target. Since the clinical benefits of timely response cannot be disputed.

The median transportation time was reported to be 82 minutes with a range 5 to 552 minutes, that is, after an incident occur; it will take an ambulance approximately 82 minutes to get patient through to the hospitals. In trauma management, it is believed that the first one hour after trauma incident is crucial to the patient getting to the emergency department in the hospital in order to improve patient outcome. This principle is usually termed as the golden hour guideline.

The underlying tenet is that an injured patient has 60 minutes from the time of injury to receive definitive care, after which morbidity and mortality increases significantly(Rogers, 2014). In our test of association, transportation time was however not significantly associated with pre-hospital trauma survival with a p-value of 1. This is similar to the 2012 German study by Kleber et al, they found similar results of no significant survival advantage for trauma patients with shorter pre-hospital transportation times, it was also supported by studies conducted in Canada, the United States, and Italy(Rogers, 2014). Another study was conducted in Pakistan to assess the trauma outcomes as a result of hospital transfer and delays in transport time of 4.7hrs from an injury occurrence to arrival in the emergency room. The study did not find statistical significant difference in mortality between patients who were presented within 60 minutes and those above 60 minutes of response times (Khan et al., 2009) which was similar to our findings. This is not to say that, it is not important to reduce transportation times, since statistical significance cannot be mistaken for clinical significance.

The median time spent on scene managing trauma patients was 17 minutes with range of 1 to 180 minutes. The study recommended that patients should be managed for a maximum of 10 minute in a trauma situation known as platinum ten-minute guideline. Spending more than ten-minutes on the scene can lead to splinting patient to death. It is necessary to initiate transport and continue with treatment on the way to the hospital. However, we did

not find the 10-minute time spent on scene guideline to be to be associated with trauma survival with a p-value of 0.18. A study contrary to ours done in the US Army rather suggests that, the first 10 minutes are a key in determining whether the wounded warrior will live or die. Soldiers and medics are trained to abide by that principle. They concluded that, the first 10 minutes is crucial in the management of patients, when the platinum 10 minutes is violated, it decrease the chances of solder survival (Bukowski, 2006). Our findings were also supported by a study done by Zhu et al, which concluded that for haemodynamically stable undifferentiated trauma patients, increased on-scene-time and total pre-hospital time does not increase odds of mortality (Zhu et al., 2015).

Our results further suggest that, response time, as a continuous variable is associated with pre-hospital trauma survival. As response time increases by one minute, the odds of surviving in a pre-hospital trauma situation reduces by 95% times compared to dying after adjusting, for age, sex, types of injuries, and various levels of consciousness. When we applied our test of association to response time of within 4 minutes, we did not find it to be associated with pre-hospital trauma survival with p-value of 0.209. This is contrary to a study by Pons et al, which reported that response time of 4 minutes was associated with the survival of patients in critical conditions, and suggested that survival benefit may be in that region. We agree to that in principle, it is essential to respond as quickly as possible to emergency scenes, since you may only need a minute to survive depending the degree of seriousness of your condition.

Response time of 8 minutes standard was not also significantly associated with trauma survival in our study (p-value 0.311). We rather observed 17-minute response time to be associated with trauma survival with a p-value of 0.003. Ghana's current response time is 17 minutes, what that mean to us is that, by reducing or increasing the 17 minutes response time , it has the potential to improve or reduce pre-hospital survival. Through our

literature search, we did not find any study that directly assessed 17-minute response time with survival.

Our results further suggest that, the level of consciousness is significantly associated with pr-hospital emergency survival. As the level of consciousness increases, the odds of surviving a pre-hospital trauma increases by 121 times compared to dying. In other words, the odds of an unresponsive patient dying are increased by 121 times compared to recovering.

This is similar to a study in Germany that concluded that patients with Glasgow comma score of 3 (unresponsive patients) has a poor outcome and even with treatment only 5% of them has good recovery(Nijboer, 2009).

It is usually difficult to determine who is truly dead at the scene of an emergency especially when there are no obvious signs of death such as decapitation, rigor mortis, dependent lividity, dismemberment of body and putrefaction. Until they see these signs, the ambulance crew is required to resuscitate and transport all patients in the same manner. This is due to the complex nature of diagnosing death, and the fact that, only qualified physicians are required to do so. It is possible that some of the unresponsive patients were already dead before the arrival of the ambulance crew to the accident scenes. There was also a study done in Columbia that supports this suggestion. The objective of their study was to identify the place and the timing of death following injury with access to and quality of local trauma services, and opportunities to improve trauma outcomes from a period of April 2001 to March 2006. They determined that majority of trauma deaths (82%) occurred in the pre-hospital. Patients who arrived alive to the hospital have low hospital mortality (1.0%). The study concluded that, improving trauma outcomes requires

addressing issues of delay to emergency medical services (Simons et al., 2010). Our high survival percentage is possibly due to the EMS system.

In a systematic review conducted to assess the relationship between emergency response time and out of- hospital cardiac arrest, researchers found that in every 1 minutes delay in response time the odds of surviving a cardiac arrest is decrease by 0.91. The survival odds ratio decreases along as response time increases, which is very similar to our findings, we had 95-times decrease in the odds of surviving pre-hospital trauma as response time increases by one minute. These results were obtained when response time was regarded as a continuous variable. They came to a conclusion that, emergency response time is an important risk factor for the outcome of cardiac arrest in adults and made a recommendation that; EMS team must arrive as soon as possible to the scene of the event (Zhu et al., 2015).

Another study by Doig and colleagues, 2012 also confirms our findings in their study by suggesting that, response time standard of within 8 minutes was not associated with improved survival to hospital discharge after controlling for several important confounders, such as severity of injury, age and Sex. Likewise, our study also found response time guideline of 8 minutes not to be associated with survival; however, association was rather with 17 minutes response time.

# CHAPTER SIX

# CONCLUSION AND RECOMENDATIONS

## 6.1 Conclusion

About 98.8% of trauma patients transported by the national ambulance service survived pre-hospital trauma. There is a high trauma patient's survival rate among victims of accident attended to by an ambulance in Ghana. The wide spread of ambulance stations will further improve this figure.

The emergency response time in Ghana is twice higher than the national target of 8 minutes. The 90% of response times to the scene of emergency within 8 minutes standard was also not achieved by Ghana.

The golden hour principle in EMS has not been achieved in Ghana. There is a delay in getting patient through to the emergency department. Ambulances are taken more than one hour to get to the scene of an emergency and to treat and transport trauma patients to the health facility. Even though the study did not find the golden hour principle to be associated with trauma survival, we still entreat EMS providers to expedite transport for clinical benefits.

Emergency response time as a continuous was associated with pre-hospital trauma survival after controlling for several important variable such us level of consciousness, age, sex, level of consciousness and types of injuries. As response time to emergencies increases by one minute, the odds of dying from trauma in pre-hospital setting increase by 5%. There is a 95% chance of surviving pre-hospital trauma at every one-minute decrease in response time to an emergency scene. When response time was within 4 minutes, we did not find it to be associated with pre-hospital trauma survival. Likewise, the 8-minute response time guideline was also not associated with trauma survival. However, when

response time was 17 minutes, it was associated with pre-hospital trauma survival. In general, there is a survival benefit in reducing Ghana's emergency response time.

### 6.2 Recommendations

A similar study should be conducted prospectively by NAS, taken in to account patient stay at the hospital.

There is the need for the NAS to open more ambulance stations to cover to the whole region and Ghana at large.

Ghana's emergency response time should be reduced in order to increase survival at the scene of emergencies

Ghana's response time calculation should be based on the proportions of ambulance responses within 8 minutes. That is, NAS should be edged to achieve 90% of all emergency responses to the scenes within 8 minutes standard.

# REFERENCES


Bigdeli, M., Khorasani-zavareh, D., & Mohammadi, R. (2010). Pre-hospital care time intervals among victims of road traffic injuries in Iran . A cross-sectional study.

Blanchard IE1, Doig CJ, Hagel BE, Anton AR, Zygun DA, Kortbeek JB, Powell DG, Williamson TS, Fick GH, I. G. (2012). Emergency medical services response time and mortality in an urban setting ., *16*(1), 1–2. http://doi.org/10.3109/10903127.2011.614046.

Blanchard, I. E., Doig, C. J., Hagel, B. E., Anton, A. R., Zygun, D. A., Kortbeek, J. B., … Innes, G. D. (2011). E mergency m edical s ervices r esponse t ime and m ortality. http://doi.org/10.3109/10903127.2011.614046

Bukowski, M. C. W. (2006). P LATINUM 10, (August), 11–15.

Coleman, A. (2014). Road Traffic Accidents in Ghana : A Public Health Concern , and a Call for Action in Ghana , ( and the Sub-Region ), (November), 822–828.

Doig, C., Hagel, B. E., Williamson, T., Blanchard, I. E., Doig, C. J., Hagel, B. E., … Innes, G. D. (2012). Emergency Medical Services Response Time and Mortality in an Urban Setting, (August 2015). http://doi.org/10.3109/10903127.2011.614046

*EMERGENCY AMBULANCE SERVICES IN ENGLAND*. (2015).

Gopalakrishnan, S. (2012). No Title, *1*(2), 144–150. http://doi.org/10.4103/2249-4863.104987

Hamilton, H., Hamilton, H., Hodge, S. D., & Hodge, S. D. (2011). Trauma , Emergency Medicine , And The Golden Hour, *1609*, 25–38.

Health, M. of. (2011). The health istitutions and facilities, ACT 829 (pp. 23 – 29).

Khan A1, Zafar H, Naeem SN, R. S. (2009). Transfer delay and in-hospital mortality of trauma patients in Pakistan. Khan A 1 , Zafar H, Naeem SN, Raza SA. Author information, 95.

Lennart Bogg and, H. H. (2011). trauma care.

Lerner, E. B., Iv, A. J. B., Dorn, J. M., & Wu, Y. B. (2003). Is Total Out-of-hospital Time a Significant Predictor of Trauma Patient Mortality ?, *10*(9). http://doi.org/10.1197/S1069-6563(03)00313-0

Mould-millman, C. N., & Rominski, S. (2014). African Federation for Emergency Medicine African Journal of Emergency Medicine Ambulance or taxi ? High acuity prehospital transports in the Ashanti region of Ghana Ambulance ou Taxi ? Le transport pre ´ hospitalier des patients gravement malades dans la re ´ gion d ' Ashanti au Ghana. *African Journal of Emergency Medicine*, *4*(1), 8–13. http://doi.org/10.1016/j.afjem.2013.04.004

Mould-millman, N., Sasser, S. M., & Wallis, L. A. (2013). Prehospital Research in Sub-Saharan Africa: Establishing Research Tenets, 1304–1309. http://doi.org/10.1111/acem.12269

*National Ambulance Service Anual Report*. (2013).

NATIONAL SCOPE OF MODEL. (2007).

Nijboer, J. M. M. (2009). No Title, (June).

Nikodemus, M. (2013). Reducing Ambulance Dispatch Time.

Oduro. (2015). Special articles improving emergency care in ghana * Brief history of Emergency Medicine prac- tice in Ghana Ghana road traffic accident mortality sta- The Ghana Emergency Medicine Collabo- rative, *4*(1), 23–29.

Ogunmola, J. O., Oladosu, Y. O., Drolamoyegun, M. A., & Drayodele, L. (2013). Mortality Pattern in Adult Accident and Emergency Department of a Tertiary Health Centre situated in a Rural Area of Developing Country ., *5*(2), 12–15.

Page, C. (2013). Analysis of Emergency Medical Systems Across the World by.

Peleg, K., Aharonson-daniel, L., Stein, M., Kluger, Y., Michaelson, M., Rivkind, A., … Group, I. T. (2004). Chapter 1 Increased Survival Among Severe Trauma PatientsThe Impact of a National Trauma System FREE. http://doi.org/10.1001/archsurg.139.11.1231.Text

Phelan, H., Gonzalez, R. P., D, M., Cummings, G. R., & N, R. (2008). Does increased emergency medical services prehospital time affect patient mortality in rural motor vehicle crash ? A statewide analysis Does increased emergency medical services prehospital time affect patient mortality in rural motor vehicle crashes ? A . *AJS*, *197*(1), 30–34. http://doi.org/10.1016/j.amjsurg.2007.11.018

Pons, P. T., Haukoos, J. S., Bludworth, W., Cribley, T., Pons, K. A., & Markovchick, V. J. (2005). Paramedic Response Time : Does It Affect Patient Survival ?, 594–600. http://doi.org/10.1197/j.aem.2005.02.013

Rogers, F. B. (2014). T he G olden H our in T rauma : D ogma or M edical F olklore ?, *9*(1), 11–13.

Simons, R., Brasher, P., Taulu, T., & Lakha, N. (2010). O riginal a rticle a Population-Based Analysis of Injury-Related Deaths and Access to Trauma Care in Rural-Remote Northwest British Columbia, *69*(1). http://doi.org/10.1097/TA.0b013e3181e17b39

Stein, C., Wallis, L., Chb, M. B., Adetunji, O., Medicine, E., Sciences, H., … Africa, S. (2015). Meeting national response time targets for priority 1 incidents in an urban emergency medical services system in South Africa : More ambulances won ' t help, *105*(10), 840–844. http://doi.org/10.7196/SAMJnew.8087

Taiwo, J. (2009). Pre-hospital care in nigeria : a country without emergency medical services, *12*(march), 29–33.

Thomas H. blackwell. (2002a). Response Time Effectiveness : Comparison of Response, 288–295.

Thomas H. blackwell, J. . S. K. (2002b). Response Time Effectiveness : Comparison of Response, 288–295.

Thompson Amo, S. M. (2014). the epidemiology of Road Traffic Accident (RTA) in Ghana from 2001-2011.tle, *11*(9), 269–275.

WHO. (2004). World report on road traffic injury prevention.

Zhu, BF; Chen, HL1; Shen, JH; Xing, JL; Chen, J. (2015). The relationship between emergency response time and out-of-hospital cardiac arrest prognosis : A meta-analysis, *22*(6), 2015.

# NATIONAL AMBULANCE SERVICE

# PREHOSPITAL CARE REPORT, FORM 1

## DISPATCH INFORMATION

**Dispatch Date** _____ **Ambulance Station #** _____

**Exact location of patient on arrival** _____

**Station received call from:**
- ○ Control Room
- ○ Hospital/Clinic
- ○ Patient/Relative
- ○ Other: _____

**Patient location type (check one only):**
○ Hospital/clinic ○ Roadside ○ Farm
○ Residential ○ Commercial ○ Other: _____

**If call is for referral, reason for referral is:**
○ Higher level of care
○ Diagnostic Study (○ CT scan ○ MRI scan ○ X-ray ○ Labs ○ Ultrasound)

**Response Times:**

| | |
|---|---|
| _____ | Call to station |
| _____ | Depart from base |
| _____ | Arrival at location |
| _____ | Patient contact |
| _____ | Depart scene |
| _____ | Arrive at facility |
| _____ | Depart facility |
| _____ | Arrive at facility |
| _____ | Time attended to |
| _____ | Depart to base |
| _____ | Arrival at base |
| _____ | Back in service |

**Comments** _____

## PATIENT INFORMATION

**First Name** _____ **Sex** ○ M ○ F

**Last Name** _____ **Age / Date of birth** _____

**Insurance #** _____

**Insurance Company** ○ NHIS ○ Other, specify: _____

## CLINICAL INFORMATION

**Chief complaint or Reason for transport** _____

Describe symptoms _____

Body parts involved _____

When symptoms began _____

Contributing events _____

Medical Problems _____

Recent Medications _____

**Source of information (check all that apply)** ○ Patient ○ Relative ○ Doctor ○ Nurse ○ Friend ○ Bystander

**Case type (check all that apply)** ○ Medical ○ Trauma ○ Maternal ○ Paediatric ○ Psychiatric

## PHYSICAL EXAM AND VITAL SIGNS

**PRIMARY ASSESSMENT:**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Airway** | ○ Normal | ○ Abnormal, action taken → | ○ Head-tilt chin-Lift | ○ Jaw thrust | ○ Suction | ○ Other | |
| **Breathing** | ○ Normal | ○ Abnormal, action taken → | ○ Nasal cannula | ○ Face mask | ○ Nonrebreather | ○ Bag Valve Mask | |
| **Circulation** | ○ Normal | ○ Abnormal, action taken → | ○ Direct pressure | ○ Elevate limb | ○ Elevate legs | ○ Tourniquet | ○ CPR ○ AED |
| **Neurologic** | ○ Normal | ○ Abnormal, action taken → | ○ Glucose check | ○ Oral glucose | ○ Oxygen | ○ Elevate head of stretcher 30-degrees | |

**VITAL SIGNS** (if unable to obtain a specific vital sign, write "UTO" in that box):

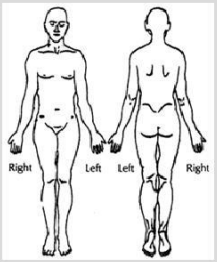
| Time | BP | Pulse Rate | Resp Rate | $SpO_2$ | Temp ($^{O}C$) | A—V—P—U |
|---|---|---|---|---|---|---|
| : | / ○ Nml ○ Abnl | ○ Nml ○ Abnl | ○ Nml ○ Abnl | % ○ Nml ○ Abnl | ○ Nml ○ Abnl | ○ ○ ○ ○ |
| : | / ○ Nml ○ Abnl | ○ Nml ○ Abnl | ○ Nml ○ Abnl | % ○ Nml ○ Abnl | ○ Nml ○ Abnl | ○ ○ ○ ○ |
| : | / ○ Nml ○ Abnl | ○ Nml ○ Abnl | ○ Nml ○ Abnl | % ○ Nml ○ Abnl | ○ Nml ○ Abnl | ○ ○ ○ ○ |

| TIME | ACTIONS TAKEN FOR ABNORMAL VITAL SIGNS |
|---|---|
| : | |
| : | |

**SECONDARY ASSESSMENT** (detailed examination of affected body areas):

**Write abbreviation on adjacent diagram:**

**A**=abrasion/scratch
**Av**=avulsion
**B**=burn
**C**=cut/laceration
**D**=deformity
**E**=ecchymosis/bruise
**P**=pain/tenderness
**S**=swelling/hematoma




## PATIENT HANDOFF

**Patient condition** Improved Unchanged Deteriorated Expired en route

**Receiving facility name** _____

**Department** A&E Center Other, specify: _____

**TO BE COMPLETED BY RECEIVING DOCTOR OR NURSE ONLY:**

**Receiving provider name** _____ **Signature** _____

**EMT #1 is the EMT completing this form**

**EMT #1 Name** _____

**Signature** _____

**Date & Time** _____

## GHANA HEALTH SERVICE ETHICS REVIEW COMMITTEE

*In case of reply the number and date of this Letter should be quoted.*

*My Ref. GHS/RDD/ERC/Admin/App*
*Your Ref. No.*

Research & Development Division
Ghana Health Service
P. O. Box MB 190
Accra
*Tel: +233-302-681109*
*Fax + 233-302-685424*
*Email: Hannah. Frimpong@ghsmail.org*

11th March, 2016

Mohammed-Najeeb Mahama
University of Ghana
School of Public Health
Legon, Accra

**ETHICS APPROVAL - ID NO: GHS-ERC: 59/12/15**

The Ghana Health Service Ethics Review Committee has reviewed and given approval for the implementation of your Study Protocol titled:

**"Emergency Response Time of the National Ambulance Service and Pre-Hospital Trauma Survival Rate for 2014 in the Greater Accra Region"**

This approval requires that you submit yearly review of the protocol to the Committee and a final full review to the Ethics Review Committee (ERC) on completion of the study. The ERC may observe or cause to be observed procedures and records of the study during and after implementation.

Please note that any modification without ERC approval is rendered invalid.

You are also required to report all serious adverse events related to this study to the ERC within three days verbally and seven days in writing.

You are requested to submit a final report on the study to assure the ERC that the project was implemented as per approved protocol. You are also to inform the ERC and your sponsor before any publication of the research findings.

Please note that this approval is given for a period of 12 months, beginning 11th March, 2016 to 10th March, 2017. However, you are required to request for renewal of your study if it lasts for more than 12 months.

Please always quote the protocol identification number in all future correspondence in relation to this approved protocol

SIGNED.....

PROFESSOR MOSES AIKINS
(GHS-ERC VICE-CHAIRPERSON)

Cc: The Director, Research & Development Division, Ghana Health Service, Accra

1

**UNIVERSITY OF GHANA**
DEPARTMENT OF EPIDEMIOLOGY AND DISEASE CONTROL
SCHOOL OF PUBLIC HEALTH

Ref. No.:.....

4th April, 2016

National Ambulance Service
P.O. Box MB 423
Accra

Dear Sir/Madam,

**LETTER OF INTRODUCTION – MOHAMMED-NAJEEB MAHAMA**

We wish to introduce to you, ***Mohammed-Najeeb Mahama***, an MSc Clinical Trials student in the Department of Epidemiology and Disease Control of the School of Public Health, College of Health Sciences, University of Ghana, Legon.

He is conducting a research on ***"Emergency Response time of the National Ambulance Service and Pre-Hospital Trauma Survival Rate for 2014 in the Grater Accra Region."***

It will be appreciated if you could provide him with the necessary support to undertake his research work in your institution.

We thank you for your cooperation.

Yours faithfully,

for Dr. Patricia Akweongo
*Head*

*CC:* School Administrator

COLLEGE OF HEALTH SCIENCES
P. O. Box LG 13, Legon, Accra, Ghana.
• **Telephone:** +233 (0) 289 109 008 • **Email:** sph-epdc@ug.edu.gh • **Website:** www.publichealth.ug.edu.gh