College of Health Science, School of Medicine

Assessment of Emergency Medical Services Response Time and Associated Factors in Emergency Patient Transportation at Addis Ababa, Ethiopia 2019

By: Muluken Bafa (Bsc. Msc. Candidate)

A THESIS REPORT WILL BE SUBMITTED TO ADDIS ABABA UNIVERSITY, COLLEGE OF HEALTH SCIENCES, DEPARTMENT OF EMERGENCY MEDICINE IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR MASTERS OF SCIENCE DEGREE IN EMERGENCY MEDICINE AND CRITICAL CARE NURSING

June, 2019

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Declaration

I, the undersigned, declare that this is my original work and that all sources of materials used for this thesis are duly acknowledged.

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Acknowledgment

First of all I would like to acknowledge Arba Minch College of Health Sciences for sponsoring me to study Emergency Medicine and Critical Care Nursing.

I would like to thank Addis Ababa University, Department of Emergency Medicine for all their support to write this thesis and Addis Ababa University College of Health Sciences for financial support.

I would like to present my deepest gratitude to my Advisor Dr. Assefu Woldetsadik and Mr. Asmamaw Abebe for their valuable comments on my overall research process.

Last but not least, my special thanks go to for Ethiopian Red Cross Addis Ababa Branch Ambulance and First Aid Coordinator Sir. Nuzha Tsegaye and Addis Ababa city fire control Authority head Mr. Sisay Mamo and all the staffs who are helped me in data collection.

Table of content

Contents **page no**

List of tables

List of figure

List of Abbreviation and Acronyms

AA- Addis Ababa

ACS- Acute Coronary Syndrome

AHA- American Heart Association

ALS- Advanced Life Support

BLS- Basic Life support

CI- Confidence Interval

DERT- Delayed EMS Response Time

EDERT- Extra Delayed EMS Response Time

ECC- Emergency and Critical Care

EMS- Emergency Medical Service

EMCCN- Emergency Medicine and Critical Care Nursing

ERT- EMS Response Time/ Emergency Response Time

ESI- Emergent Severity Index

FEAPCA- Fire and Emergency Accident Prevention and Control Authority

FMoH- Federal Ministry of Health

IQR- Inter Quartile Range

LMIC- Low and Middle Income Countries

MPDS- Medical Priority Dispatch System

OR- Odds Ratio

PACS- Patient Acuity Category Scale

SERT- EMS Response Time

TEWS- Triage Early Warning Score

Abstract

Background: Emergency Response Time is an interval between call receipt and arrival of the first Emergency vehicle to the scene which should be less than 8 minute. As a result of the emerging significance of time-sensitive medical emergencies such as cardiac arrest, stroke, and acute myocardial infarction and nonmedical emergency like trauma, it has been the leading measure of Emergency Medical System performance quality in many countries. Despite its importance, little was studied about the ERT and associated factors. Therefore, this study aims to determine the Emergency Response Time (ERT) and identify associated factors in Addis Ababa, Ethiopia 2019.

Method: Facility based cross-sectional study design was conducted in Addis Ababa City Fire and Emergency Prevention and Control Authority and Red Cross Association ambulance service, from April 2019 to May 2019. Data was collected by observation and interview using structured checklist. Then it was cleaned, coded, entered in to EPI data v.3.1 and exported to SPSS version 25 statistical package for analysis. Descriptive statistics used in order to describe data and both bivariate and multivariable logistic regression used to examine associated factors. A factor with p-value < 0.05 was considered as statistically significant. Mean ERT, COR, AOR and 95% CI were used to report the finding.

Result: Among 345 study subjects three-forth were females with the mean age of 28.8 (SD$\pm$ 13). Labor was main reason 206 (59.7%) for seeking of ambulance. Only 47 (13.6 %) case had life threatening critical emergency.

This study determined mean ERT 11.40 (SD $\pm$ 6.5) and among study participants only 39.7 % participants had ERT < 8 minute. Distance to the scene > 6 km AOR 17.34 (7.16, 41.98), dispatch time interval >2 min AOR 15.79 (5.95, 41.93) and heavy traffic conditions AOR 16.33 (4.49, 59.43) are found to be the major determent factors of ERT. Age, level of consciousness, severity of the illness and weather condition were also shown significant association.

Conclusion and recommendation: The mean emergency response time interval was above the standard and the majority of the patients were transported under delayed ERT. Scene distance, dispatch time interval, heavy traffic condition, time of call, and has shown associations. Action like pre-allocation of ambulance, installing emergency communication device, drivers and public awareness creation and training to ambulance nurse should be done to decrease ERT.

Key words: ERT, Ambulance Response Time; Emergency Medical Services; Access to health care; time-to-treatment;

CHAPTER ONE

1. INTRODUCTION

1.1.Background

Modern emergency medical services (EMS) is the first level of health care response for out-of-hospital medical emergencies (1). A common principle in EMS is that faster response equates to better patient outcome, translated by some EMS operations into a goal of a response time of 8 minutes or less for advanced life support (ALS) units responding to life-threatening events (2).

EMS response time (ERT), defined as the interval between call receipt and arrival of the first EMS system vehicle to the scene which is considered 8 minute or less(1). See figure 1 below. A few countries set different, for example, England targets for ambulance services to respond for critical emergency calls in 7 minutes on average (3). New York City, commands a 10-minute, while some communities in California have moved response time standards to 12–15 minutes (4).

Now a days, the quality and timeliness of emergency medical service (EMS) care is receiving considerable public interest in different countries. The emerging significance of time-sensitive medical interventions for conditions such as cardiac arrest, stroke, and acute myocardial infarction has led to growing utilization of EMS care prior to hospital arrival. In fact, demand for EMS care internationally is increasing by as much as 12.5% every year, and this is placing renewed pressure on EMS performance targets (1).

EMS response time, moreover, remains a leading measure of EMS system performance quality in many developed countries (2). Although clinical quality indicators are increasingly being utilized to measure clinical performance (5), ERTs appear easier to acquire and measure, and may be less ambiguous to the lay public when compared to clinical measures(6). Some studies has also shown that shorter ERTs are associated with good clinical outcomes for key medical conditions(7,8). The ‘Golden Hour’ of trauma idea also recognizes the time-sensitive nature of trauma and suggests that the mortality and morbidity of trauma patients may be affected if definitive care is not given within the first hour of injury(7,9).

Despite disagreements on the exact time frame of treatment, there is a clear general consensus applicable to other time-sensitive medical emergencies: the faster the care is provided, the greater the chance of achieving better patient outcomes. Therefore, this study has determined ERT and

identified associated factors. So that, this study is very helpful to intervene on factors which were delayed ERT figure 1.

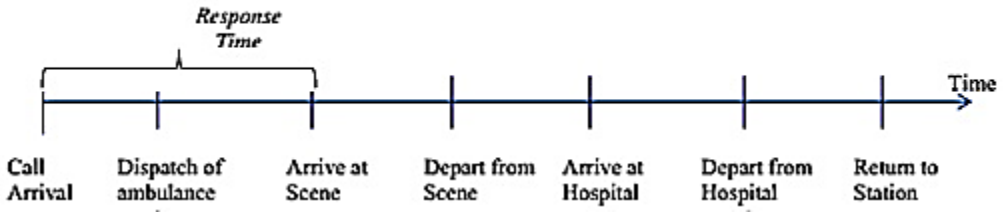

Figure 1: Time delay in different components of EMS responses

1.2.Statement of the problem

Ideally, emergency response times should be minimal for every Emergency call. However, certain emergency calls are known to be more time-sensitive than others. Cardiac incidents are recognized to be most time sensitive and most frequent (10). According to the data from American Heart Association (AHA), survival rates for cardiac arrest patients fall 7-10% for every untreated minute. In contrast, survival rates rise to 50–70%, if defibrillation done within 3–5 min of collapse.

"Time is brain" is a common term used in Emergency Medicine for stroke patients, emphasizing the irreversible loss of neurological tissue as a stroke progress (10). In each one minute delay in stroke patient's treatment, patients lose 1.9 million brain cells (11). WHO reported that time sensitive medical emergencies like stroke and MI has been increasing becoming the leading cause of mortality in the developing countries like Ethiopia (12,13).

Trauma is also the other time sensitive emergency. One of the most well-known principles in medicine is ''golden hour'' of trauma, which specifies that patients outcome are improved when patient is transported to a designated trauma center within an hour of injury. (9,14).

Even though a single study was available in our country, which is mainly focused on Epidemiology of Ambulance users, many research's which were done in other parts of the world display significant mortality and morbidity associated with ERT delay (15). According to WHO report, from trauma death alone, nearly 2 million lives could be saved in low- and middle-income countries by Timely emergency care (16). For critical medical incidents such as cardiac and neurological emergencies, a mere one minute delay in response time increases the mortality rate by 1 to 2% and increases hospital treatment costs by 7%(10).

Different studies identified factors associated with ERT. Earlier studies have shown that both system-level and patient level factors can contribute to ERT, such as call-taking and dispatching

delays, whether conditions, traffic conditions, resource availability, system demand, case priority, as well as the patient's age, gender, severity of the illness and ethnicity(2,7). Several studies have demonstrated various methods of analyzing ERT, but few have incorporated information available at the time of ambulance dispatch(17). These study we have included dispatch time interval which was critical factor in ERT. A better understanding of the impact of these variables on ERT may help to improve both system efficiency and patient outcomes (18).

ERT is one of recommended method of measuring quality of EMS(19). Despite its importance, little was studied about the specific components of ERT and the factors that are associated with ERT delay (17). Currently, up to my search, there is no study available in Ethiopia which identified factors affecting ERT. This study assessed the magnitude ERT delay and factors associated with it. See figure 2 bellow.

1.3.Significance of the study

This study forwards important recommendations for decision making bodies in the Ministry of Health and other concerned external authorities about ERT. Especially for a countries like Ethiopia, who have been striving to improve their EMS systems, it is commanding to examine the factors that can impact EMS response times in order to identify effective interventions. Since this study examined the Emergency Response Time (ERT) and associated factors that can delay EMS response times in Addis Ababa, it helps to determine the quality of EMS service and to derive interventional measures that can potentially improve the ERT. This research will also be a reference for other African countries. It also helps to further development of research projects.

CHAPTER TWO

2. Literature review

Emergency Medical Services, more commonly known as EMS, is a system that provides emergency medical care. Once it is activated by an incident that causes serious illness or injury, the focus of EMS is arriving on time and providing emergency medical care of the patient(s) (20).

Many countries are developed their own response time standards to give EMS as fast as possible. For instance, NHS of England stated, All ambulance trusts to respond to 75 per cent of Category A calls within eight minutes and to respond to 95 per cent of critical emergency (Category A) calls within 19 minutes of a request being made for a fully equipped ambulance vehicle (care or ambulance) able to transport the patient in a clinically safe manner (3). NFPA 1710 declares Eight minutes (480 seconds) or less for the arrival of an advanced life support unit at an emergency medical incidents (21). But there are different factors which can hinder the achievement of this objective.

A few developed countries like USA and UK had near to achieve this response time standard. A published article in 2019, conducted in 2268 US counties (urban and rural), the median county response time was 9 minutes (IQR, 7-11) minutes (22). In contrast, a prospective national census of ambulance response times to emergency calls in Ireland revealed, thirty eight per cent of emergencies received a response within nine minutes (23). A study from Ghana, Greater Accra, extended the mean response time in to (16.9 ± 0.7) (24). here a great different exists between ERT in developed countries, however, they agreed that prolonged response time increases a chance of mortality (22–24).

2.1.EMS Response time and Mortality

Many studies conducted in different parts of the world not only revealed the importance of timely provision of pre-hospital care but also signified assessment of ERT. According to the confirmation from US study, there is a tangible effect in morbidity, mortality and treatment cost for every minute delay in ERT especially for deadly medical emergencies. For critical medical incidents such as cardiac and neurological emergencies, a mere one minute delay in response time increases the mortality rate by 1 to 2%. It also evidenced that reducing response times by only one minute on average would save thousands of lives per year in USA(25).

In addition to affecting mortality, healthcare costs for survivors are also very much impacted by response times. For time critical medical emergencies like stroke and ACS, which limit perfusion of the brain and heart, one minute of delay in response time rise up hospital treatment costs by 7%. A one minute quicker of ER for a cardiac emergency, is equal to 1,542 USD of reducing in hospital costs of a patient(25). A cohort study which is done in Scottish confirmed that Reducing ERT to 5 min for cardiac arrest patient could double the survival rate (26).

Every year, over five million people die in the world from injury, and a Millions more suffer lifelong disability and lost economic productivity(27). Improving trauma care access and quality can lower this burden significantly. The outcome of injury has a big difference between developing and developed countries. For example, in a low-income setting people with life-threatening but survivable injuries are six times more likely to die than in a high-income setting (28).If fatality rates from severe injury were the same in developing countries as in developed countries, nearly 2 million lives could be saved every year. Therefore, Timely emergency care saves lives(27).

A study conducted on Pre-hospital time intervals in trauma patient transportation by emergency medical service is the: association with the first 24-hour mortality, Response time, scene time, transport time, and total out of hospital time were all associated with mortality in bivariate analysis (P = 0.02, 0.01, <0.001, and 0.001, respectively). In multivariate regression analysis, transport time was associated with 24-hour mortality (P < 0.001, OR [95% CI]: 1.20 [1.16- 1.24])(5). A research conducted in response time and health outcome, Columbia University, New York, USA, displayed that response times significantly affect mortality and the likelihood of being admitted to the hospital, but not procedures or utilization within the hospital (29).

Even though a few research's did not show association on 8 min EMS response time on decreasing mortality, they did not suggest that rapid EMS response is undesirable or unimportant for certain patients, but they requested further research on the topic(2,19).

2.2.Factors affecting response time

Some research's also showed factors affecting response time. The median ERT was 10.6 minutes, according to study conducted in Melbourne, Australia on assessment of Factors Influencing the Timeliness of ERT from July 2009 to June 2014. This study classified factors into System level factors and patient-level factors. System level factors independently associated with the 90th percentile ERT were distance to scene, activation time, turnout time, case upgrade, hour of day,

day of week, workload in the previous hour, ambulance skill set, priority zero case (e.g., suspected cardiac or respiratory arrest), and average hospital delay time in the previous hour. Patient-level factors which are shown significant association with ERT were age, gender, chief medical complaint, and severity of complaint (31). Similar study conducted in trauma incidents in Singapore show that factors like, weather, traffic and place of incident were found to be significant(7).

In a population-based observational study conducted to assess prolonged on scene interval in Japan: displays the median on-scene time for all patients was 17 min (IQR 13–23). There was a strong correlation between on-scene time and the number of phone calls to hospitals from emergency medical service (EMS) personnel ($p<0.001$). In multivariable logistic regression, the number of phone calls to hospitals from EMS personnel, intoxication, minor disease and geographical area were associated with on-scene times over 30 min. Age, gender, day of the week and time of the day were not associated with on scene times over 30 min (32).

Another study on the views of emergency care providers about factors that extend on-scene time intervals, majority (92%) participants agreed that extended time on-scene may negatively affect patient outcome. There are a number of environmental, clinical and systemic factors that emergency care providers indicate have the potential to extend on-scene time intervals(33).

Other study which was done in South Africa, Results indicated that both the emergency vehicle location and response system design factors had a significant effect on response time performance, with more decentralized vehicle location having a greater effect (34).

Retrospective chart review research conducted on Epidemiology of Ambulance utilization in Addis Ababa showed that, majority of the patients transported via ambulance are for pregnancy and related complications followed by general medical illness and injury respectively. And 87.6% of transportation are inter facility transfers. Around 9.6% had severe bleeding and CPR was done in less than 1% of the patients. The mean dispatch to scene time interval was 10.1 min, and mean scene to facility time interval was 17.2 min. only one out of ten injured patents have had response time less than 9 min (15). But the study did not show associated factors for prolonged response time.

Although most similar studies had applied retrospective study design, this study has assessed prospectively. Because associated factors for ERT delay were not recorded and also primary data

is more preferable as well as accurate. Deferent studies used diverse type of patient severity classification system.

For instance, a research from Melbourne Australia which was done 2015, had used Medical Priority Dispatch System (MPDS). MPDS has 3 coding system from Code1 (emergent case) to Code 3 (non-urgent case) and code 0 for died (31). Other study from Singapore had applied Patient Acuity Category Scale (PACS). This scale ranging from priority 1 to priority 4 in accordance to the severity of patients and PAC 0 is for dead (7). UK Armed Forces patient severity prioritization system also used in some studies. This system grades casualties from Priority 1 (most urgent) to Priority 4 (expectant, i.e. likely to die) (35).

In this study we used Emergent Severity Index (ESI) which has 5 level triage system. Because it has high level of inter observer agreement, adaptive, clear and easy to use. Moreover, ESI is widely applied model in Ethiopia.

2.3.Conceptual frame work of the study

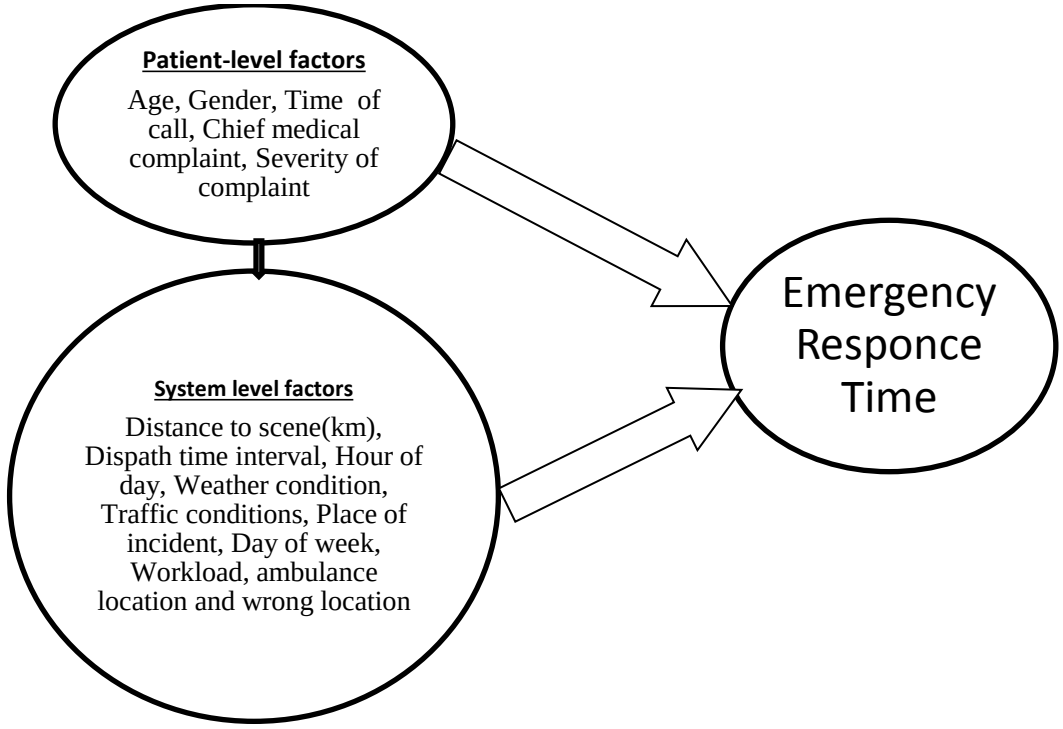

Figure 2: Figure developed conceptual framework of the factors affecting EMS Response time

CHAPTER THREE

3. Objectives

3.1.General Objective

- ✓ To determine the Emergency Response Time (ERT) and identify associated factors in emergency patient transport at Addis Ababa, Ethiopia 2019.

3.2.Specific Objectives

- ✓ To determine Emergency Response Time in emergency patient transport at AA.
- ✓ To identify system-level factors associated with ERT in emergencies patient transport at Addis Ababa.
- ✓ To identify patient-level factors associated with ERT delay in emergencies patient transport at Addis Ababa.

CHAPTER FOUR

4. Methods and Materials

4.1.Study Area and Period:

The study was conducted from April 2019 to May 2019 in Addis Ababa, which is the capital and largest city of Ethiopia as well as the country's commercial, manufacturing, and cultural center. Addis Ababa is the diplomatic capital of Africa. More than 92 embassies and consular representatives cluster in the city where the Organization of African Unity and the UN Economic Commission for Africa have their headquarters (23). It is located in central Ethiopia at an elevation of about 2440 m (about 8000 ft) above sea level on a plateau that is crossed by numerous streams and surrounded by hills. The city contains 10 sub-cities. In the city there were 37 hospitals, 29 health centers, 136 health stations, 78 health posts and 359 private clinics.

Regarding in Pre-hospital care, it has been predominantly given by Fire and Emergency accident prevention and control authority (FEAPCA), Ethiopian Red Cross Society and Tebita Ambulance and Pre-Hospital Emergency Medical Service (TAPHEMS). FEAPCA has a 3 digit phone number for free calling and it has 8 branches in different sub cities, containing 40 fire trucks 33 ambulance and one Training center. TAPHEMS is First private ambulance and emergency training company in Ethiopia. Currently it has 4 digit paid call number, 3 Dispatch Centers, 11 BLS and 3 ALS Ambulances and more than 37 Staff. Ethiopian Red Cross has 3 digit free calling center, 4 dispatch centers, 7 ambulances, 64 volunteers and 4 nurses.

4.2.Study design:

Facility-based cross-sectional design was used.

4.3.Source population:

All Addis Ababa city residents with emergency condition.

4.4.Study population:

All patients with emergency condition calls to either Addis Ababa fire and Emergency accident prevention and control or Ethiopian Red Cross Society.

4.5.Study unit: Emergency patient transported by ambulance.

4.6.Inclusion criteria:-

All Emergency calls who need immediate ambulance service

4.7.Exclusion Criteria:-

- Calls from outside AA
- False calls

4.8.Sample size determination

Total sample size was determined by using the following formula; n=

$$\frac{(\mathbf{Z\alpha/2})^{\mathbf{2}}\mathbf{P}(\mathbf{1}-\mathbf{P})}{d^2}$$

n= $(1.96)^2$* (0.598*0.402) /0.05*0.05= **369**

Where:

- n-is minimum sample size(number of ambulance calls to be followed)
- p-is estimate of the prevalence rate for the population which is (0.598) so 1-p is 0.402. prevalence of 59.8% taken study in epidemiology of ambulance utilization in Ethiopia (15).
- d-is the margin of sampling error tolerated 5%
- Zα/2 is the standard normal variable at 95% confidence interval which is 1.96 3.8416*.240396=0.9235050527/.0025= **369**

With a 10% non-response rate which is 37, the total sample size will be 406 Ambulance calls.

4.9.Sampling procedure

Dispatch centers were selected by using simple random technique. Proportionate allocation of sample size has done based on last years the same month case flow. All emergency calls fulfill the inclusion criteria in five dispatch center (four from Fire and one from Red Cross) were included in the study. All functional ambulance was used from Fire and Red Cross. Finally, all respective patients who meet inclusion criteria during study period was studied. To assess daily variability in ERT and to increase the number of patient night shift and weekend calls were assessed.

4.10. Variables

4.10.1. Dependent Variable –

- ✓ Emergency Response Time (ERT)

4.10.2. Independent variables

- ✓ **Socio-Demographic factors:** Sex, age, level of education, chief medical complaint, Disease/injury type and severity of complaint.
- ✓ **System level factors** distance to scene, activation time, turnout time, dispatch time interval, hour of day, day of week, workload in the previous hour/s, weather, traffic conditions on the roads, wrongly locating of ambulance, and place of ambulance at the time of call and Place of incident (disease).

4.11. Data Collection Tool and procedure

Data was collected by adopted, structured and pretested check list by trained data collectors from April 1- May 29/2019. Data collection tool was adopted from the research conducted in Australia and Singapore and some variables like ambulance location were added (7,31). Thorough one day training was given to data collectors on data collection tools. Pretest has done in 5% sample size Fire Authority kality brunch and check list modification has done accordingly. Then after, by using English version check list 26 diploma holders as data collector and one supervisors was used for data collection.

Data collection procedure starts when ambulance crew activated from dispatch center. During on the way to scene, the data collectors observe and register time intervals, traffic condition and weather condition. Then, interviewee of the patient or patient relative (in case of pediatrics and unconscious patient) has been taken place in ambulance during transportation of a patient to hospital. Physical examination has also done to classify severity of illness and determine level of consciousness.

Data cleaning and precautions has been taken while collection to ensure data quality and to avoid most common mistakes committed during data collection.

4.12. Data Quality control

Checking data consistency and completeness and data entry had been done in daily basis. Moreover, principal investigator made supervision on the data collection process. To check the accuracy and validity of the check list, pre-testing of the check list has done on five percent (5%)

of the actual sample prior to the actual study period. After pretesting some modification has done on the check list. The check list had been checked for completeness and consistency in daily basis. The collected data was cleaned, coded and entered to EPI data version 3.1.

4.13. Data analysis

Data was coded, entered in to EPI data v.3.1 and then exported to SPSS version 20 statistical package and analyzed. Data cleanup was performed by checking frequencies, accuracy, outliers, and consistencies and missed values and variables. A descriptive statistical analysis was used to show the characteristics of survey participants. The mean, Midian and standard deviations of unit activation interval, turnout interval, response interval, time at the scene transport interval and hospital interval was calculated.

ERT classified in to dichotomous variable by and 8 minute has taken as a cut of pint. Binary logistic regression was computed to identify factors associated with ERT. The crude and adjusted odds ratios with their corresponding 95% confidence intervals was computed. Variables which have p-value less than 0.25 in bivariate analysis was taken in to multivariable analysis. The results has presented in text, graphs and tables based on the type of data.

4.14. Ethical Considerations

Ethical clearance was obtained from AAU, College of Health Science, School of Medicine, Department of EM. Support letter was obtained before data collection from each selected organization. Informed consent had been taken from the study participants. Privacy and confidentiality was maintained throughout the study period; each check list was coded without any personal identification.

4.15. Dissemination of result

This study will be presented to Department of Emergency Medicine, College of Health Science, Addis Ababa University. The result of the study will be reported to Ministry of Health, Ethiopian Society of Emergency Professionals, Addis Ababa Fire and Emergency Prevention and Control, Ethiopian Red Cross Society and to those governmental and non-governmental organizations that potentially could benefit from the study outcome. The finding of the study will be published in relevant scientific and popular journals as appropriate.

4.16. Standard and Operational Definitions

Standard Definitions

Activation interval is the time between call receipt and dispatch of the ambulance crew (31).

Turnout interval is defined as the time between dispatch of the ambulance crew and vehicle mobilization (31).

Dispatch interval is the time between call receipts till ambulance mobilization of EMT crew. Simply Activation interval + Turnout interval (17).

Response time interval is defined as the time from call receipt to the arrival of the first ambulance on scene. The response time interval includes both the activation and turnout intervals, in addition to the time taken from vehicle mobilization to arrival at scene (7).

Time Critical Emergencies is an emergency which is a time critical life/limb threatening event requiring immediate intervention or resuscitation (9)

Operational Definitions

False call a call made to dispatch center with no medical reasons.

Bad weather condition includes windy, cloudy, and rainy weather conditions.

The places of incident were classified into four categories:(7)

Road included all accidents that happened on the roads, regardless of whether these accidents were traffic related.

Home referred to incidents that occurred in residential areas, such as home injuries and sports/recreational accidents which happened in and around residential areas.

Commercial included commercial buildings, business areas, educational institutions, health & medical care facilities, hotels, places of worship, and sports & recreation facilities.

Others included open spaces, parks, beaches, transport facilities such as railway/subway stations, and cemeteries.

Traffic conditions

Light no traffic crowdedness and the ambulance can travel without restriction

Moderate there is traffic crowdedness and the ambulance can travel with minimum restriction and

Heavy high traffic crowdedness and it is difficult for the ambulance.

Severity of the illness categorized into four

Category (ESI)-1 Life Threatening (RED) a time critical life threatening event requiring immediate intervention or resuscitation.

E.g. Respiratory failure, facial, neck, chest injuries, severe hemorrhage, neck injuries, unstable vital signs (shock), coma with airway obstruction, severe respiratory distress, convulsions, chest pain with unstable VS, Severe GI bleeding orange

Category (ESI)-2 Emergency (ORANGE) Potentially serious conditions that may require rapid assessment and urgent on-scene intervention and/or urgent transport.

E.g. pending respiratory failure, altered Consciousness without airway obstruction, moderate trauma with Stable vital signs,

Category (ESI)-3 Urgent (YELLOW) An urgent problem (not immediately life threatening) that needs treatment to relieve suffering and transport or assessment and management at the scene with referral where needed within a clinically appropriate timeframe.

E.g. Injuries to the Lower genitourinary tract, peripheral nerves and vessels, splinted fractures, soft tissue lesions,

Category (ESI) - 4 Less-Urgent (GREEN) Problems that are less urgent but require assessment and possibly transport within a clinically appropriate time frame.

CHAPTER FIVE

5. Result

5.1.Socio demographic characteristics

A total of 359 emergency calls were completed the check list and included in the analysis. Fourteen respondents were excluded from the analysis for gross incompleteness and inconsistency of responses, making a response rate of 93.49%

Among 345 study subjects about three-forth were females. Majority of the study participants 208 (60.3 %) were in the age group 16 to 30 years with a mean age of 28.8(± 13). Two hundred forty-three (70.4 %) study subjects were Married. Majority of ambulance users 215 (62.3%) were Orthodox religion followers, followed by Muslim 71 (20.6%).

Regarding caller address except Red Cross (10.4%), each dispatch centers had shared comparable amount which was in the range of 20 – 25 %. Laboring mothers were the major users of ambulance transportation accounting 206 (59.7%) figure 3.

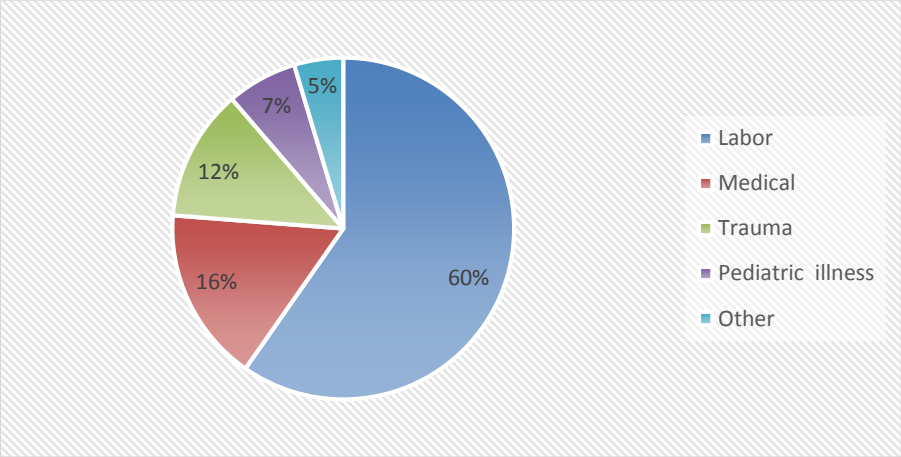

Figure 3: Pie chart of category of illness its proportion among study participants at Addis Ababa, 2019

Only 47 (13.6 %) cases had life threatening critical emergency, who needed immediate resuscitation or intervention. And 76 (22 %) of Ambulance calls were less urgent conditions. Around 75 % of the clients were Alert and 22 (6.4%) were unresponsive for both verbal and pain stimuli.

Health facility was the leading (60.9 %) place of call, and home call was the second one occupying one quarter of all calls table 1.

Table 1: Socio demographic characteristics study participants among study participants at Addis Ababa, 2019 n=345

Variable	Category	Frequency	Percent
Sex	Male	88	**25.5**
	Female	257	**74.5**
Age group (years)	< 15	30	**8.7**
	16-30	208	**60.3**
	31-45	76	**22.0**
	>45	31	**9.0**
Marital status	Single	102	**29.6**
	Married	243	**70.4**
Religion	Orthodox	215	**62.3**
	Protestant	54	**15.7**
	Muslim	71	**20.6**
	Other	5	**1.4**
Address	Arada	85	**24.6**
	Bole	74	**21.4**
	Qera	78	**22.6**
	Wingate	71	**20.6**
	Red cross	36	**10.4**
Severity of the illness/ injury	Category 1	47	**13.6**
	Category 2	126	**36.5**
	Category 3	96	**27.8**
	Category 4	76	**22.0**
Level of consciousness	Alert	257	**74.5**
	Verbal	38	**11.0**
	Pain	28	**8.1**
	Unresponsive	22	**6.4**
Place of call	Road	41	**11.9**
	Home	89	**25.8**
	Commercial	5	**1.4**
	Health facility	210	**60.9**
Total		345	**100%**

5.2.Distribution of patients' characteristics and by ERT

The mean response time was 11 minutes and 40 seconds. Less than forty percent of the participants had ERT < 8 min.

Female tent to have 6 sec quicker mean response time than male, while 108 (42 %) of females had fast ERT but males had only one third. Age < 15 years were the largest proportion of fast ERT and age group >45 scored the list extra delayed response interval. Singles had shown better mean response interval and larger proportion on fast ERT than married.

Address of call shown variability, Red Cross had only 11 (30.6%) Short ERT, in contrast Wingate had 34 (47.9%). Medical cases had shown a better mean ERT (0:09:49) and proportion of fast response 24 (42.1%). Two hundred six (59.7%) of labour calls had extra delayed ERT.

Table 2: Distribution of patient characteristics by ERT interval among study participants at AA, 2019

Variable	Variable category	Mean ERT h:mm:ss	Emergency Response Time interval		Total No (%)	Variable category %
			< 8 min No (%)	> 8 min No (%)		
Sex	Male	0:11:44	29 (33.0%)	59 (67.1%)	88	**(25.5%)**
	Female	0:11:38	108 (42.0%)	148 (58.0%)	257	**(74.5%)**
Age group	0-15	0:11:55	14 (46.7%)	16 (53.4%)	30	**(8.7%)**
	16-30	0:11:33	92 (44.2%)	116 (55.7%)	208	**(60.3%)**
	31-45	0:11:59	23 (30.3%)	53 (69.8%)	76	**(22.0%)**
	>45	0:11:22	8 (25.8%)	23 (74.2%)	31	**(9.0%)**
Marital status	Single	0:11:11	46 (45.1%)	84 (82.5%)	102	**(29.6%)**
	Married	0:11:52	91 (37.4%)	152 (62.6%)	243	**(70.4%)**
Address	Arada	0:11:11	36 (41.9%)	50 (58.1%)	86	**(24.9%)**
	Bole	0:12:39	28 (37.8%)	46 (62.2%)	74	**(21.4%)**
	Qera	0:10:50	28 (35.9%)	50 (64.1%)	78	**(22.6%)**
	Wingate	0:11:27	34 (47.9%)	37 (52.2%)	71	**(20.6%)**
	Red cross	0:13:01	11 (30.6%)	25 (69.4%)	36	**(10.4%)**
Chief Medical Complaint	Medical	0:09:49	24 (42.1%)	33 (57.9%)	57	**(16.5%)**
	Trauma	0:11:02	16 (37.2%)	27 (62.8%)	43	**(12.5%)**
	Labour	0:12:03	80 (38.8%)	126 (61.2%)	206	**(59.7%)**
	Pediatric illness	0:13:32	9 (39.1%)	14 (60.8%)	23	**(6.7%)**
	Other	0:12:15	8 (2.3%)	8 (2.3%)	16	**(4.6%)**
Total		0:11:40	137 (39.7%)	208 (60.3%)	345	**(100%)**

5.3. Distribution of system level factors by ERT

Majority (72.5%) of calls from < 3 km of distance had fast response interval and their mean was also less than standard ERT (8 min) fig 6.

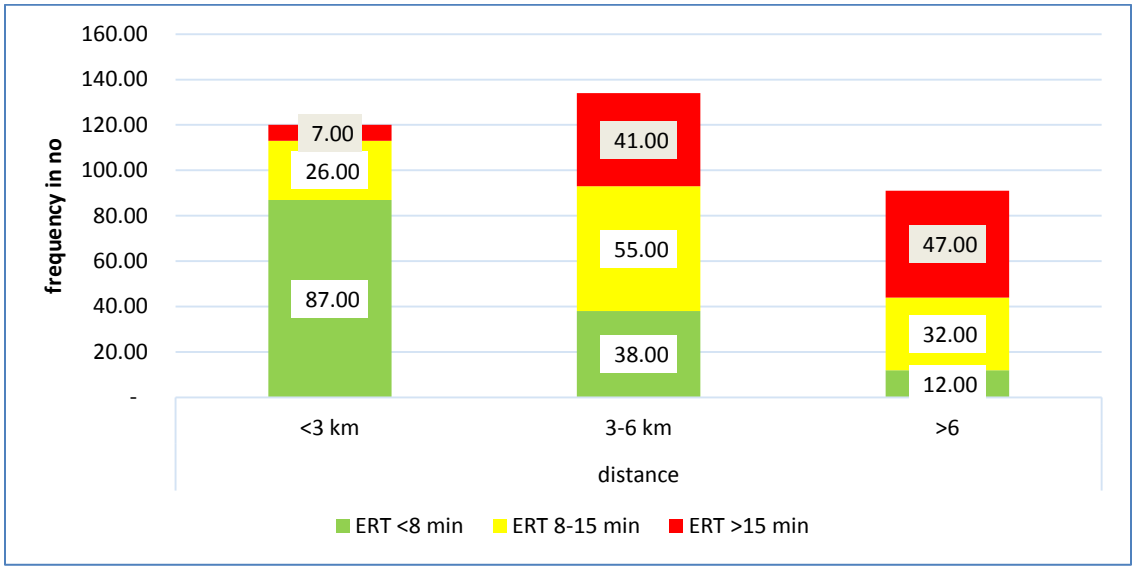

Figure 4: Comparison of distance and response interval among study participants in Addis Ababa, 2019

The mean ERT decrease when the severity of illness increase, for instance, category 1 calls mean were response interval of 9 min and 10 sec while category 4 calls had 13 min 32 sec. More than half of Category 1 calls were fast ERT. Road and commercial calls were better response interval.

Only one out of ten heavy traffic condition calls were fast response interval and its mean was 14 min and 17 sec. Majority 267 (77.4%) of the calls were in fine weather condition and 43.8 % of those calls were fast ERT. Only one fifth calls in rainy weather calls were fast ERT.

Around 4/5 were day time calls. The mean response interval of night calls was greater day calls by 5 min and 54 sec. Ambulance rising from dispatch centers were much better proportion of Fast ERT 134 (40.2%) than ambulance found out of dispatch center 3 (25.0%).

EMT told inaccurate location of the scene 37 (10.7%) times. At that time, only 9 (24.3%) had Fast ERT and 15 (40.5%) had Extra Delayed ERT.

Staff work stress (two case per hour) rose up mean ERT in to 14 min and 55 sec. when the staffs, the mean emergency time was, which was greater that staff work load one case per hour 0:09:20 and one case per two hour 0:10:22 had better mean ERT than work load less than one case per two hour 0:11:52.

Table 3: Distribution of factors by ERT interval among study participants in Addis Ababa, 2019 n=340

Variable	Variable category	Mean ERT hh:mm:ss	Emergency Response Time interval		Total No	Variable category %
			< 8 min No (%)	> 8 min No (%)		
Severity of the illness/ injury	Category 1	0:09:10	25 (53.2%)	22 (46.8%)	47	**(13.6%)**
	Category 2	0:10:28	67 (53.2%)	59 (46.8%)	126	**(36.5%)**
	Category 3	0:12:59	26 (27.1%)	70 (72.9%)	96	**(27.8%)**
	Category 4	0:13:32	19 (25.0%)	57 (75.0%)	76	**(22.0%)**
Distance of scene location	< 90 sec	0:09:02	100(64.5%)	55 (35.5%)	155	**(44.9%)**
	90-120 sec	0:09:59	29 (35.8%)	52 (64.2%)	81	**(23.5%)**
	> 120 sec	0:16:40	8 (7.3%)	101 (92.7%)	109	**(31.6%)**
Place of call	Road & commercial	0:09:35	26 (52.0%)	24 (48.0%)	50	**(14.5%)**
	Home	0:13:39	26 (27.1%)	70 (72.9%)	96	**(27.8%)**
	Health facility	0:11:14	85 (42.7%)	114 (57.3%)	199	**(57.7%)**
Road traffic conditions	Light	0:10:33	63 (47.7%)	69 (52.3%)	132	**(38.3%)**
	Moderate	0:11:48	68 (44.2%)	86 (55.9%)	154	**(44.6%)**
	Heavy	0:14:17	6 (10.2%)	53 (89.9%)	59	**(17.1%)**
Weather	Fine	0:11:11	117 (43.8%)	150 (56.2%)	267	**(77.4%)**
	Windy /cloudy	0:12:04	17 (27.0%)	46 (73.0%)	63	**(18.3%)**
	Rainy	0:18:28	3 (20.0%)	12 (80.0%)	15	**(4.3%)**
Shift time day or night	Day 6 AM- 6 PM	0:10:23	130 (47.4%)	144 (52.5%)	274	**(79.4%)**
	Night 6 PM- 6 AM	0:16:17	7 (9.9%)	54 (90.1%)	71	**(20.6%)**
Ambulance location	Dispatch center	0:11:31	134 (40.2%)	199 (59.7%)	333	**(96.5%)**
	Not Dispatch center	0:15:43	3 (25.0%)	9 (75.0%)	12	**(3.5%)**
EMT missed scene location?	Yes	0:15:35	9 (24.3%)	28 (75.6%)	37	**(10.7%)**
	No	0:11:12	128 (41.5%)	180 (58.5%)	308	**(89.3%)**
Measures of staff workload in the previous hour	≥ 2 Case per one hour	0:14:55	13 (23.2%)	43 (76.7%)	56	**(16.2%)**
	one case per hour	0:09:20	25 (64.1%)	14 (35.9%)	39	**(11.3%)**
	one case per 2 hour	0:10:22	44 (46.8%)	50 (53.2%)	94	**(27.2%)**
	<1 case per two hour	0:11:52	55 (35.3%)	101 (64.7%)	156	**(45.2%)**
Total		0:11:40	137 (39.7%)	208 (60.3%)	345	**(100%)**

5.4. Determinants of ERT

In bivariate analysis Patient level factors like, age, Disease/injury type and severity of complaint and level of consciousness had shown association with delayed ERT. System level factors like distance to scene, time of call, activation time, turnout time, dispatch time interval, hour of day, workload in the previous hour, weather, traffic conditions on the roads, wrong location of ambulance and ambulance location were shown significant association with ERT.

Distance from calling place to ambulance location has significant association with response time. The odds of delayed response interval among distance 3-6 km was around 8 times higher than those who have distance less than 3 km. People from longer > 6 km of distance were 17 times more likely to go into delayed ERT than people whore form short distance < 3 km AOR 17.34 95% CI (7.16, 41.98).

Peoples with dispatch interval > 2 minutes were 16 times more likely to have response interval >8 minutes than peoples who had dispatch interval less than one and half minute AOR 15.79 95% CI (5.95, 41.93).

Peoples with severity of illness category 3 had 7 times more likely to have delayed response interval than category 1 patients AOR 6.93, 95% CI (1.74, 27.68). The odds of delayed response interval in peoples who were alert is 3.6 times higher than people who were responsive AOR 3.59, 95% CI (1.08, 11.97).

Heavy traffic and weather condition caused significant amount of delayed ERT. Ambulance response interval in heavy traffic conditions was 16.32 more likely delayed ERT than light traffic condition AOR 16.33, 95% CI (4.49, 59.43). The likelihood of "Long" ERT in bad weather condition was found to be high, at approximately 4 times more than under good weather conditions AOR 3.81, 95% CI (1.42– 10.43).

Heavy staff work load, which is more than two case per two hour, had odd of 4.1 higher than low staff work load which was less or equal to one ambulance call per two hour AOR 4.19, 95% CI (1.31, 13.36) table 4.

Table 4: Table of bivariate and multivariate analysis result of determinants of ERT among study participants at Addis Ababa, 2019.

Variables	Variable categories	COR (95% C.I.)	P-value	AOR (95% C.I.)	P-value
Distance to the scene	< 3 km	1		1	
	3-6 km	6.66 (3.85, 11.54)	<0.001	7.97 (3.34, 19.03)	<0.001
	> 6 km	17.36 (8.39, 35.93)	<0.001	17.34 (7.16, 41.98)	<0.001
Dispatch time interval	<90 sec	1		1	
	90- 120 sec	3.26 (1.86, 5.71)	<0.001	4.62 (1.95, 10.94)	.001
	>120 sec	22.96 (10.40, 50.65)	<0.001	15.79 (5.95, 41.93)	<0.001
Age group	0-15	1		1	
	16-30	1.10 (0.51, 2.38)	0.802	7.20 (1.67, 31.02)	0.008
	31-45	1.92 (1.03, 3.58)	0.040	6.34 (2.25, 17.89)	<0.001
	>45	1.93 (0.82, 4.55)	0.135	11.24 (2.61, 48.45)	0.001
Severity of illness	Category 1	1		1	
	Category 2	1.00 (0.51, 1.96)	0.998	2.68 (0.76, 9.45)	0.126
	Category 3	3.06 (1.48, 6.34)	0.003	6.93 (1.74, 27.68)	0.006
	Category 4	3.41(1.57, 7.39)	0.002	3.72 (0.90, 15.42)	0.070
Level of consciousness	Unresponsive	1		1	
	Pain	1.62 (0.50, 5.21)	0.422	3.22 (0.61, 16.95)	0.168
	Verbal	4.55 (1.46, 14.15)	0.009	0.91 (0.23, 3.64)	0.895
	Alert	2.84 (1.15, 7.00)	0.024	3.59 (1.08, 11.97)	0.037
Traffic Condition	Light	1		1	
	Moderate	1.16 (0.72, 1.84)	0.546	0.62 (0.29, 1.33)	0.218
	Heavy	8.07 (3.24, 20.05)	<0.001	16.33 (4.49, 59.43)	<0.001
Weather condition	Fine	1		1	
	Rainy+ windy + cloudy	2.01 (1.17, 3.45)	0.011	3.82 (1.44, 10.15)	0.007
Staff workload	Low	1		1	
	High	2.49 (1.28, 4.82)	0.007	4.19 (1.31, 13.36)	0.015
Ambulance missed location	No	1		1	
	Yes	2.21 (1.01, 4.85)	0.047	1.49 (0.45, 4.95)	0.511
Ambulance location	Dispatch center	1		1	
	Not	2.02 (0.54, 7.60)	0.208	1.24 (0.19, 8.24)	0.825
Time of call	Day	1		1	
	Night	6.61 (3.17, 13.80)	<0.001	13.23 (4.04, 43.37)	<0.001

CHAPTER SIX

6. Discussion

This study determined ERT and associated factors which potentially determine in various level. Eight minute used as cut of value to classify ERT as short, in which 39.7 % of study participants achieved it. This finding is in agreement with prospective national census of ambulance response times to emergency calls in Ireland (23). Although, it is by lower the than the previous study done on epidemiology of ambulance utilized in Ethiopia (59.8%) (15). This is because the previous study was took 9 min as cut of value to determine ERT and it was retrospective survey. Our finding is also much lower than the study done on factors affecting the ambulance response time in Singapore (89.9 %) and Australia (90%) (7,15). This is due to variation in study set up, infrastructure, EMS system and equipment.

It is found that the mean ERT is 11.40 (SD $\pm$ 6.5), it was higher than the previous study done in Ethiopia (10.1) as well as in the New York: 8.46 ($\pm$ 6.4), in USA : 9 (IQR, 7-11) and in Australia:10.6 (8.1–14.0) (15,31,36). This difference is due to the fact that high income countries like USA and Australia have deferent technologies like GPS, which shortens ERT. In addition, distance to the scene and dispatch time interval is short in the above countries (37). But our result is much better than the study done on ERT and Pre-hospital trauma survival of national ambulance service, in Greater Accra, Ghana (16.9 ± 0.7) (24). Since Ethiopia has started pre-hospital care before Ghana, it had better system and facility, and this may be considered as reason for the stated gap (38).

Majority of calls were for labor and inter-facility transfer, this result is in line with previous study done in Ethiopia (15), and the study done on the state of emergency medical service (EMS) in Africa (38). High proportion of labor call is due to the attention given to laboring mothers by FMOH of Ethiopia with motto 'No mother could die while given birth' and most of the laboring mothers referral were from Health Centers. Yet, only half of the EMT calls are emergent and life threatening. This is very small compared to other studies done in Singapore and Australia (7,31). This is might be due to people's lack of awareness about ambulance utilization, absence of uniform central ambulance call number and abuse of the existing number with false/fake calls.

Dispatch time interval is found to be significant determinant of ERT. Even though, this finding is complemented by study done in Australia, the mean dispatch time interval of 2.55 in our study is

significantly higher (31). This may be is due to the fact that they have better communication device.

In this study, we have shown that distance to the scene is significantly associates with emergency response time. The study done in Australia also confirmed that distance extends response time (31). In our study the mean distance of the scene is 4.9 and IQR (3-7) km, which is higher compared to the above study mean 3.3, IQR (1.9–5.6) km (31). This is may be due to they have multiple dispatch centers serving with narrow radios.

To mitigate distance problems, pre-allocation of ambulance away from dispatch center and near to the community has shown significant impact in reducing the distance as well as ERT in other studies (34). But in our study the mean ERT of ambulances start from dispatch center is by 4 min and 12 sec less than from those who start driving from other palace. This was happened mainly as a result of prolonged dispatch interval (mean= 4:50) in away calls. Which potentially resulted from absence recommended emergency communication devices like radio in our setup (39).

The same km increase in distance did not have similar odd with other studies. For instance, the odd of prolonged ERT around six km distance is 4.3 in Australia but in our study 7.9 (31). This is may be because of poor knowledge or attitude of other drivers to give a way for ambulance, road condition and ambulance drivers skill.

This could also be explained by higher OR in heavy traffic condition. Our study show that the odd of prolonged response interval in heavy traffic condition is 16 times higher than light traffic condition. In most developed countries drivers have good awareness and attitude of ambulance traffic rules, when they heard the siren they give the middle space of the road for ambulance. So that, the odd of prolonged ERT, even in crowded traffic condition, is less in those countries.

Our findings shows that bad weather condition significantly affects ERT AOR 3.81, 95% CI (1.42–10.43). This finding is in agreement with study done in Singapore (7). It is apparent that bad weather decrease visualization, as a result car speed decreases and heavy traffic condition resulted.

The mean response time becomes lesser when the severity illness increases and the patients level consciousness deteriorates. This means, EMT gave fastest response for category 1 calls like respiratory failure, facial, neck, chest injuries, severe hemorrhage, and neck injuries, than category 4 calls, which are problems that are less urgent and possibly transport within a clinically appropriate time frame. This finding was similar with the study done in Australia (31). This displays EMT prioritize and give quake response for severe cases.

The mean ERT of night calls is greater than day time calls. This result supported by the national census of ambulance response times to emergency calls in Ireland (23). This could be due to night time they have been sleeping and it takes long time to get up and turn out from dispatch center. In addition, in our setup, there is no EMT communication device except personal cell phone and ambulance nurses sleep away dispatch centers. This would cumulatively rise the problem.

Variables like Sex, chief medical complaint and address, which are shown association in other studies, did not show significant association in our study (7,31). This could be due to the difference in study setup and study design. Those studies used retrospective analysis of one year data so that they had very large sample size.

CHAPTER SEVEN

7. Strength and limitation

7.1.Strength

The study is new in its kind that no other published similar study, which identified determinants of ERT, has been done in the Country yet.

Data collection method was observational and interview and primary data was collected by trained and experienced EMT workers.

Unlike other pre-hospital related research conducted in Ethiopia, this study included Red Cross Ambulance Service.

7.2.Limitation

Our study was conducted only on the capital city of Ethiopia that makes hard to generalize the results to other areas of Ethiopia.

ERT influenced by multiple factors which were not measured in our analysis. Which includes EMT year of experience, knowledge and attitude about ERT, ambulance driver's knowledge and skill about defensive driving, road condition (presence of isolated road for ambulance), dispatching system, ambulance availability, public awareness, GPS and presence communication device etc.

Lack of similar study in the Country even in Africa to compare results.

Possibility of observation bias can be there during observation.

This study included calls from health facility in which ambulance nurses may give fast response that could affect the whole time intervals

CHAPTER EIGHT

8. Conclusion and Recommendation

8.1. Conclusion

This study has determined ERT and the risk factors that affect emergency response interval by classifying ERT in to “Long” (>8 min) compared to “Short” (< 8 min).

The mean ERT is large and majority of the study participants has transported in long emergency response time. Noncritical conditions and interfaculty transfer are the main Ambulance users.

In this study, we provide evidence that distance to the scene, dispatch time interval, and heavy traffic condition are the largest effect, amongst other significant factors such as weather, age category of illness, level of consciousness, time of call and staff work load.

Factors like ambulance misallocation and ambulance location had shown significant association only in bivariate logistic regression.

These results can be a foundation for other developing countries and lead to further interventions and suggestions to improve the EMT quality in Ethiopia.

8.2. Recommendation

Based on the findings we forward the following recommendations:

Minimizing distance to the scene: the mean distance to the scene was larger and just above 7 km of distance there was no response time below 8 min. To mitigate this, it is better if other dispatch centers should be established and/or pre-allocation of ambulances near to potential call area is implemented.

Awareness creation for drivers. Road traffic condition is significant determinant of ERT. During our data collection time we identified that most drivers did not give the road for ambulance, especially in crowded situation. It is better if MoH and other concerned bodies give training about the issue. Moreover, it is better if strong traffic rule should be set and implemented.

Public awareness creation: majority of our study units are non-critical emergency and interfaculty transfers, but pre-hospital care is primarily for critical emergencies before they arrive to health facility. It is better if public awareness creation should be made by concerned body to increase emergency ambulance utilization.

Staffing of EMTs and Training: Now a days, EMT trained paramedics are available in Ethiopia. It is better if they employed and have mechanisms to improve the qualities of staffing regarding on job and refreshments trainings. In addition, Capacity building training should also be given for existing ambulance nurses and dispatch center workers on relevance of ERT.

Communication Device: dispatch time interval found to be significantly determinant of ERT. Radio communication devices are recommended standard and it also shortens dispatch time interval.

GPS: Computerized GPS car tracking system has been recommended technology for ambulance dispatching and tracking. In order to decrease ambulance missing scene location it is better if it is system installed

Central call number and dispatch center: it is better all dispatch center use the same 3 digit phone number.

Further research: This study has done with limited resource it is better if other study will be done with large resource and include other variables which were not studied in our survey.

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2. Annexes

Annex -1: Assurance of Principal Investigator

ASSURANCE OF PRINCIPAL INVESTIGATOR

The undersigned agrees to accept responsibility for the scientific ethical and technical Conduct of the research project and for provision of required progress reports as Per terms and conditions of the Research Publications Office in effect at the time of Grant is forwarded as the result of this application.

Name of the student: Muluken Bafa

Date._____ Signature _____

Approval of the Advisors

Name of the primary advisor: Dr Assefu Woldersadik.

Date._____ Signature _____

Name of the secondary advisor: Mr Asmamaw Abebe.

Date._____ Signature _____

Annex – 2: Information Sheet and Consent Form

Participant information sheet and informed consent form for study units

My name is Muluken Bafa and I am MSc in Emergency Medicine and Critical Care Nursing (EMCCN) student in Addis Ababa University. Now I am working as data collector for the research being conducted to assess Emergency Medical Services Response Time and Associated Factors for Emergency Patient Transportation at Addis Ababa Town/ Ethiopia. I kindly request you to express your understanding freely.

The Study Title: Emergency Medical Services Response Time and Associated Factors in Emergency Patient Transportation at Addis Ababa Ethiopia 2018-19 G.C

Purpose of The Study: The main aim of this study is to write a thesis as a partial requirement for the fulfillment of a Master's Degree in EMCCN for the principal investigator. Moreover, the result of the study will be used as evidence and input for high decision makers at country level FMoH.

Procedure and Duration: The data collectors collected the necessary information from participants using structured data collection tools to have pertinent data that is helpful for the study. The duration of data collection had been for 60 days.

Risk and Discomfort: By participating in this research project, there is no risk that comes to the participants. Whereas expressing full concern and understanding is of great important to the research project which is in turn important for overall implementation of program.

Benefit: The research have no direct benefit to those who have participated in this project. But the indirect benefit of the research for the participant and overall as a country is very great, as identifying area of improvement and taking appropriate decision helps to improve the quality of EMS Service.

Confidentiality: The information acquired from the participant is confidential. There was no information that could identify in particular. The findings of the study is general for the study community and will not reflect anything particularly of individual persons.

The data collection tools were coded to exclude showing names and other personal information's. No reference will be made in oral or written reports that could link participants to the study.

Rights to Refusal or Withdrawal: Giving permission for this study is fully voluntary. You have the right to permit or not for this study. If you decide to permit the study, you have the right to terminate the study at any time if you consider something related to the study is wrong.

Contact Address: This research project will be reviewed and approved by the institutional review board of College of Health Science, School of Medicine, Addis Ababa University. If at any case you want to know more information about the research and its undertakings, you can contact the committee through the address of advisor and /or principal investigator.

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Annex-3: Declaration of informed voluntary consent:

I have read the participant information sheet. I have clearly understood the purpose of the research, the procedures, the risks and benefits, issues of confidentiality, the right of participation and the contact address for any queries. I have been given the opportunity to ask any questions for things that may have been unclear. I was informed that I can terminate the study at any time. Therefore, I declare my voluntary consent to permit this study to be conducted in this institution with my signature as indicated below.

Signature of the participant_____

Name: _____ Date_____

Signature of Principal Investigator_____

Name: _____ Date_____

Thank you for your cooperation!!

Annex -4: Data Collection Tool

Part –I: Assessing Patient level factors

No	Variables	Category	Code
1.	Sex	Male ……1 Female ……..2	
2.	Age	…… years	
3.	Religion	Orthodox ……1 Protestant ……2 Muslim ……3 Catholic ……..…..4 Others ……...5	
4.	What his/ her Marital Status	Single……... 1 Married …… 2 Divorce …… 3 Widowed ……...4 Others ……...5	
5.	What is the highest level of education did the patient have attained	Certificate and below ….. 1 Diploma …….. 2 BSc /BA …….. 3 Masters and above …….. 4	
6.	Time of call	…….(HH:MM)	
7.	Place of call	……..kifleketema	
8.	Chief Medical Complaint	Chest pain……1 Breathing problems……2 Unconscious/fainting…… 3	

		Labor ……..……4 Falls……...……5 Overdose/poisoning……6 Traffic accident…….. 7 Convulsions/seizures…….. 8 Haemorrhage/lacerations…….9 Heart problems……10 other(specify)……..…… 11	
9.	Severity of the illness/ injury	Category1…….. 1 Category2…….. 2 Category3…….. 3 Category4……4	
10.	Level of consciousness	Alert……1 Verbal …….2 Pain ……..3 Unresponsive ……4	
11.	How long had patient been waited to call for ambulance after c/c or symptom begun (time of sx begun)	…….(HH:MM)	

Part II System level and process related factors

S.NO	Variables	Category	Code
1.	Distance to scene(km)	……..km	
2.	Hour Of Day or Time of Call	…….(HH:MM:SS)	
3.	Activation Time	…….(HH:MM:SS)	
4.	Turnout Time	…….(HH:MM:SS)	
5.	Hour of arrival at the scene	…….(HH:MM:SS)	
6.	Time of Depart from the scene	…….(HH:MM:SS)	
7.	Time Arrival to Hospital	…….(HH:MM:SS)	
8.	Time of Departure from Hospital	…….(HH:MM:SS)	
9.	Month		
10.	Day of Week		
11.	Weather	Fine……1 Windy ……..2 Cloudy …….3 Light rain…….……4 Heavy rain……..5	
12.	The traffic conditions on the roads	Light ……1 Moderate……. 2 Heavy…….. 3	

13.	Place of incident	Road……1 Home……2 Commercial……...3 Health facility……4 Others……5	
14.	Measures of staff workload in the previous hour (No of Emergency cases per total hour)	…….(case/hour)	
15.	Does the Emergency Vehicle located at dispatch center?	Yes ……...…1 No ……2	
16.	Misallocation (incorrect telling) of the incident place	Yes ……...…1 No ……2	
17.	Previously functioning but currently closed road because of various reasons like Construction	Yes ……...…1 No ……2	
	Summary of time intervals		
	Unit activation interval	…….(HH:MM:SS)	
	Turnout interval	…….(HH:MM:SS)	
	Response interval	…….(HH:MM:SS)	
	Time at scene	…….(HH:MM:SS)	
	Transport interval∗	…….(HH:MM:SS)	
	Hospital interval∗	…….(HH:MM:SS)	

Annex -5: Emergent Severity Index (ESI)

Triage scale (TS) or Emergent Severity Index (ESI)

ESI Category 1- (RED) Immediately life threatening ----→Resuscitation

EG. Respiratory failure, facial, neck, chest injuries, severe hemorrhage, neck injuries, unstable vital signs (shock), coma with airway obstruction, severe respiratory distress, convulsions, chest pain with unstable VS, Severe GI bleeding

ESI Category 2 – (orange) Emergent imminently/potentially life threatening if care is

Not given within 1hr (pending respiratory failure, altered Consciousness without airway obstruction, moderate trauma with Stable vital signs, such patients require frequent re-triage until them Are seen by the physician and they are the second priority following

ESI Category 3 (Yellow)- less urgent potentially serious, could be delayed

Eg. Injuries to the Lower genitourinary tract, peripheral nerves and vessels, splinted fractures, soft tissue lesions, they also require re- triaging and if any deterioration appears they might be re-categorized accordingly

ESI Category 4 (Green) non urgent, can be send to nearby health institution, regular OPDs, after counseling or 1st aid

ESI Category 5 (BLACK/Blue) Dead

Organization and Sequence of patient evaluation (triage)

1. Initially evaluate the patient according to organizational protocol
2. After the evaluation score the patient's condition using the **Triage Early warning Score (TEWS), Table 1**
3. Then add your findings and categorize the patient according to the **Emergent Severity Index (ESI Table 2**
4. Any patient who was categorized as green, yellow or orange may be re-categorized accordingly if deterioration appears.

Table 1 TEWS: Triage Early Warning Score.

ADULT TRIAGE SCORE								
	3	2	1	0	1	2	3	
Mobility				Walking	With Help	Stretcher/ Immobile		Mobility
RR		less than 9		9-14	15-20	21-29	more than 29	RR
HR		less than 41	41-50	51-100	101-110	111-129	more than 129	HR
SBP	less than 71	71–80	81-100	101-199		more than 199		SBP
Temp		less than 35		35-38.4		38.5 or more		Temp
AVPU				Alert	Reacts to Voice	Reacts to Pain	Unresponsive	AVPU
Trauma				No	Yes			Trauma
over 12 years / taller than 150cm								

Table 2 Emergent Severity Index (ESI)

Colour	RED	ORANGE	YELLOW	GREEN	BLUE
TEWS	7 or more	5-6	3-4	0-2	DEAD
Target time to treat	Immediate	less than 10 mins	less than 60 mins	less than 240 mins	
Mechanism of injury		High energy transfer			
Presentation		Shortness of breath - acute		ALL OTHER PATIENTS	DEAD
		Coughing blood			
		Chest pain			
		Haemorrhage - uncontrolled	Haemorrhage - controlled		
	Seizure - current	Seizure - post ictal			
		Focal neurology - acute			
		Level of consciousness reduced			
		Psychosis / Aggression			
		Threatened limb			
		Dislocation - other joint	Dislocation - finger or toe		
		Fracture - compound	Fracture - closed		
	Burn – face / inhalation	Burn over 20%	Burns - other		
		Burn - electrical			
		Burn - circumferential			
		Burn - chemical			
		Poisoning / Overdose	Abdominal pain		
	Hypoglycaemia – glucose less than 3	Diabetic - glucose over 11 & ketonuria	Diabetic - glucose over 17 (no ketonuria)		
		Vomiting - fresh blood	Vomiting - persistent		
		Pregnancy & abdominal trauma or pain	Pregnancy & trauma		
			Pregnancy & PV bleed		
Pain		Severe	Moderate	Mild	
	Senior Healthcare Professional's Discretion				