ADDIS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCES

SCHOOL OF MEDICINE

DEPARTMENT OF EMERGENCY MEDICINE

PREDICTORS OF 24 HOUR ADULT EMERGENCY DEPARTMENT MORTALITY AND ITS MAGNITUDE AT A TERTIARY HOSPITAL, ADDIS ABABA, ETHIOPIA: MIXED METHOD STUDY

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A research thesis submitted to the Department of Emergency and Critical Care Medicine, College of Health Sciences presented in partial fulfillment of the requirements for a specialty certificate in emergency and critical care

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This is to certify the thesis prepared by Endalamaw Wondimagegn entitled predictors of 24hr adult emergency departement mortality and its magnitude at tertiary hospital Addis Ababa and submitted in partial fulfillment of requirements for a specialty certificate in emergency and critical care medicine complies with the regulations of the university and meets the accepted standards with respect to originality and quality.

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Acronyms

AAU- Addis Ababa University

ACS-Acute coronary syndrome

CHS-college of health science

CI-confidence interval

ED- emergency department

EMS-emergency medical service

ETB-Ethiopian birr

IRB-institution review board

LMIC-low- and middle-income country

OR-odd ratio

RTA-road traffic accident

TASH- Tikur Anbesa Specialized Hospital

SPHMMC-Saint Paul Hospital Millennium Medical College

SPSS- Statistical Package for the Social Sciences

WHO-world health organization

Abstract

Background: The definition of early emergency department mortality differs for different countries. In Ethiopia, the ministry of health define as death within 24 hours of emergency admission, excluding a dead body on arrival. The 2016 transformation guideline targets to decrease the emergency department mortality < 0.6%(1).

Objective: The study aims to assess the magnitude of emergency department mortality and its predictors within 24 hour of admission at the adult Tikur Anbessa Specialised Hospital emergency department.

Methodology: the study was mixed method study. Initially cross- sectional study, conducted within the study period of October 1, 2024, to September 30, 2025, at the Tikur Anbessa Specialised Hospital adult Emergency department. After the initial quantitative analysis was conducted, and showed that sepsis (54.1%) was the major contributor to deaths, a focused group discussion was conducted with the emergency and critical care postgraduate students on four open ended questions, and the results triangulated with the initial quantitative analysis to elaborate the main findings and suggest solutions. For the quantitative analysis, mean, median, and frequency were used for descriptive analysis. Multivariable logistic regression was conducted to assess the significance of the association.

Results: The magnitudes of adult emergency department mortality at Tikur Anbessa Specialised Hospital within 24 hours of admission were 161 out of the 14,276 emergency admissions making the mortality rate 1.128%. Medical causes were the major contributors of the emergency department mortality, and sepsis covers 54.1% of the deaths within 24 hours of admission. Different factors contributed for the increase in mortality of patients with sepsis. Duration of symptoms before ED arrival, <12 hours, and >24hr- 1 week; main diagnosis at admission with cardiovascular and renal were significantly associated for very early mortality. The protective variables in this study were oxygen saturation >90% and being placed in the red or orange.

Conclusion and Recommendation: The magnitude of Tikur Anbessa Specialised Hospital was still high, and medical causes, mainly sepsis is the most common cause of death due to different factors. In conclusion TASH should give training on sepsis management and recognition, involve the infectious disease physicians in the daily round and equip the emergency department with material and human resource.

Key Word: ED mortality, early mortality, Addiss Abeba

1: INTRODUCTION

1.1: Background

The emergency department is the backbone of the hospital, providing service for the most urgent and critical patients, and it is open 24 hours a day. For many individuals, the ED is the first point of contact with the healthcare system, making it a crucial gateway for timely diagnosis and treatment. Due to the nature of the patient who comes to the emergency department, the department needs a lot of resources in terms of both material and human resource.

In Ethiopia, the ministry of health 2016 transformation guideline, ED mortality is defined as death within 24 hours of admission, excluding the dead body on arrival. The transformation guideline targets an emergency department mortality rate of less than 0.6 %. Based on this definition and the countries transformation guideline emergency departments in Ethiopia gives service for the first 24 hours of admission(1).

Emergency department mortality remains a major concern in many parts of the world, especially in low and middle income countries. While globally accounts 15-16% of all hospital deaths, the proportion is significantly higher in regions such as sub-Saharan Africa. In these regions, it is found that ED Mortality can be up to 5% higher compared to more developed settings(2) .

Due to the high burden of cases and mortality at emergency care system WHO recommends initiation of emergency care system and regular monitoring of the progress in all countries regardless of their economic level (3). Management of emergency cases timely and effectively improves the adverse outcomes of the cases both at the emergency department and inpatient department(4).

In countries like Ethiopia, where ICU beds and advanced care units are often limited emergency departments also serve as improvised critical care areas . Even if there is different factors that affect the prognosis of the patients at the emergency department lack of the ICU beds and advance care units also contribute for the worse prognosis of emergency department patients mostly in the developing countries. So , the limited capacity of EDs and hospitals to provide quality care for patients can act as an intermediate factor in potentiating the detrimental effect of poor prognostic indicators (5,6).

1.2: Statement of the problem

Emergency department mortality is still high and covers around 5-15% of in-hospital mortality, but in some hospitals it reaches even >50% of total deaths in the hospital. Despite the burden of ED mortality, there is no adequate studies that identified the contributing factors, and still the burden of ED mortality is high globally, and it is higher in sub Saharan Africa (2).

In Ethiopia, the adult emergency department mortality was 7.71% in a systematic review done on, 2023 and the most common contributing factors are: rural residence, unconsciousness, long time for arrival, and having comorbidity. The study also showed that the emergency department mortality were high in Addis Abeba (5).

So as a country in Ethiopia, the ED mortality is still too high. The studies done on ED mortality and its contributing factors are still few. So, this study will assess the magnitude and its predictors for ED mortality and suggest solutions for the institution and stakeholders.

The ED mortality at TASH was also high. In a retrospective study done at TASH ED, the mortality rate within 72 hours of admission were around 1.68% and 54% of deaths are within 24 hours of admission(6).

1.3: Significance of the Study

The emergency department serves as a crucial entry point for patients with life-threating conditions. In many low-income settings like Ethiopia, these departments often under significant resource constraints yet they remain central to saving lives. Despite their importance there is limited local evidence on the predictors to early mortality among patients admitted to the ED, and died within 24 hours of admission. This study also aims to fill that gap by exploring the extent and causes of 24 hours mortality at the adult emergency of TASH, one of the country's referring centres.

Since TASH is the pioneer institution to start training on emergency and critical care as a postgraduate level the findings of the study will be disseminated and used to even guide the police makers and stake holders in the emergency and critical services.

2: LITRATURER REVIW

2.1: Magnitude of emergency mortality

The overall emergency department mortality in a study done at Pleven, excluding the traumatic deaths was 2.4 per 100,000, the same as the previous study for them. Most of the deaths (70.9%) in this study were even within 2.3 hours of admission to the emergency department (7). In another, five year retrospective study done in Pakistan from 2004-2018 , with an objective of reviewing all emergency department deaths during the study period , there were 322 deaths out of 507,759 emergency department visits ,making the magnitude of overall emergency mortality 0.076 (8).

In a 2 year study done at Rome, Italy, excluding the trauma and paediatric patients, aiming to identify the cause of early deaths (within 6 hours of ED admission), 52% of the deaths were within 6 hours from a total of 175 deaths(9).

Studies conducted in tertiary hospitals in Nigeria, found that the overall mortality rate in emergency departments was around 6% and 7.61%. They also discovered that in the second study, 43.6% of deaths happened within just 24 hours of admission, which brings the 24-hours mortality rate to about 3.32%(10,11). In another study from a tertiary teaching hospital in Rwanda, the overall mortality rate in the emergency department was even higher, clocking in at 12.2%. And if you look specifically at medical patients, that number jumps to around 16.5%.

In a systematic review done in Ethiopia that includes 18 studies, the overall mortality rate of emergency department were 7.71, the mortality were in Dire Dawa (16.7%), Amhara (12.89%), Oromia (10.28%), and Addis Ababa(4.35%)(5).

In a study at SPHMMC, over a 2 and half year period the magnitude of overall mortality for emergency department were 3.02% and 50% of the deaths were within 24 hours of admission(12).

In a retrospective institutional based study the mortality rate of emergency department at TASH were 1.9% and 1.68%. the studies used 72 hours as a cut-off point and from the total deaths in the second study they found that 54% deaths were within 24 hours (6,13).

2.2: Associated factors of early mortality

There are different factors associated with emergency department mortality. From these factors acute myocardial infarction was one of the most common associated factors identified. In a study done 9 years back at Pleven, 58.4% (222 deaths out of 380) were due to acute myocardial infarction followed by other factors; age above 69.9 years, late presentation, and absence of advanced care for chronic cases(7). In 5 year retrospective review done in a busy emergency department in Pakistan, the most common contributing factor for ED mortality were acute coronary syndrome(33.8%). In this study delayed arrival to the emergency department were also identified as poor prognostic factor(8). In 1 year retrospective study done in Italy Rome with the aim of identifying the clinical and etiological difference in early (within 6 hours of admission) and late deaths in the emergency department, acute coronary syndrome was the most common (30%) cause of the early deaths. This study also showed that from all the deaths due to acute coronary syndrome 79% of them died within 6 hours and from all haemorrhagic shock deaths 82% of them died within 6 hours. In the late group (after 6 hours) sepsis and respiratory failure contributed 27% of the deaths each, and overcrowding increases the mortality of these cases(9).

In a retrospective study done at Nigerian tertiary hospital, altered level of consciousness was the most common (45.6%) presenting symptom in the deaths. In this study the highest numbers of deaths were recorded in the age group of 30-39 but proportionally the mortality were higher for those in the age of 60-69 years with a mortality rate of (11.5%) (11). In another 5 year study done in Nigeria the most common cause of death identified from the medical illness were stroke(25%), HIV related illness (10%), and heart failure(9.7%)(10).

In a systematic review comprising 18 studies to identify the prevalence and determinants of mortality in Ethiopian hospitals; overall emergency department mortality was high and rural residence, unconsciousness, having comorbidity and time to reach hospital >1hour had significant association with odds ratio of 2.3, 3.86, 2.82, and 4.73 respectively(5).

In a case control study done at Jimma University Medical Centre , with the aim of isolating the risk of mortality at emergency department and its associated factors , in both the case and control groups patients with comorbidity and malignancy were at risk for emergency department death 70.8%, and 78.2% respectively. Concerning the immediate cause of early deaths respiratory failure was the commonest in cases and controls, 89.6% and 44.3%

respectively. In this study respiratory failure, cardiovascular disease, age>65, rural residence, and being triaged to red were significantly associated with early mortality(14).

In a study done at SPHMMC, from the medical causes of emergency mortality; sepsis, respiratory disease, liver disorders. Gastrointestinal bleeding and diabetic complications were strongly linked with early deaths (12).

In a prospective cross sectional study done at TASH; the most common cause of death were head injury(21.5%) and sepsis (18.8%), and the only significantly associated factor with very early mortality(within 6 hours) was symptom duration <4hours(13). In another retrospective study done at TASH, the most common cause of the deaths were medical emergencies; shock (36.7%), respiratory disease (30%), and sepsis (16.8%). In this study residence being in Addis Ababa and comorbidity with HIV AIDS had significant association with very early (within 24 hour) mortality (6).

2.3: Conceptual Framework

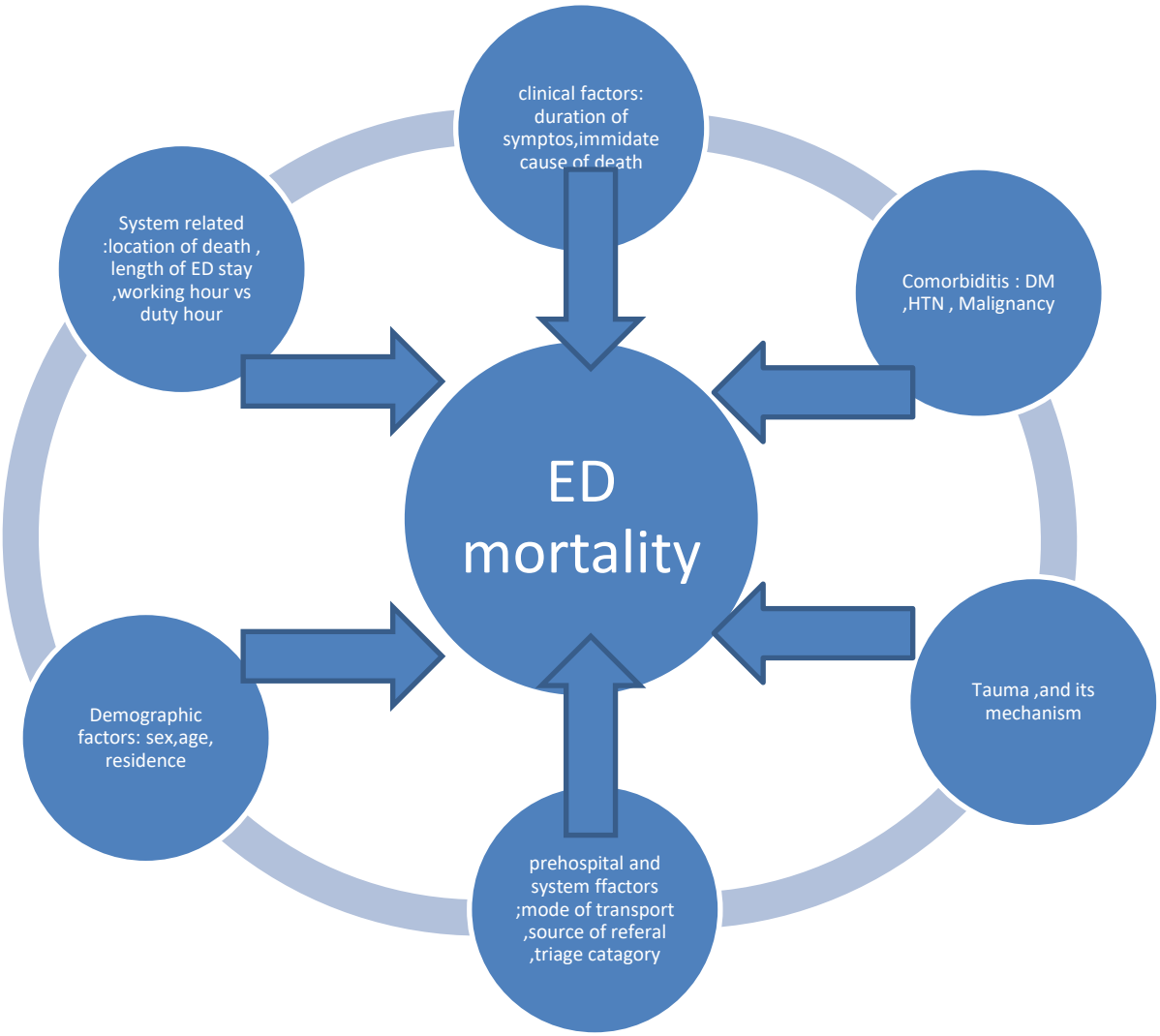

Figure 1: Conceptual Framework of ED mortality within 24hrs of admission to adult TASH ED

CHAPTER 3: OBJECTIVES

3.1: General Objective

- To assess the magnitude and predictors of 24 hour adult emergency department mortality at TASH emergency department.

3.2: Specific Objective

1. To determine the magnitude of the adult emergency 24 hour mortality at TASH emergency department.
2. To identify the common predictors of very early mortality at TASH adult emergency department.

4: METHODOLOGY

4.1: Study Area

Tikur Anbessa Specialized Hospital was established in 1972. Currently it is the largest academic hospital in the country, and also the largest referral centre in Ethiopia. TASH is currently functioning under Addis Ababa University, college of medicine and health science. Even though other specialized hospitals have emerged over the years and eased some of the load, people from all regions of Ethiopia still come to TASH for care often because it is their best or only hope.

The Emergency Department (ED) of TASH operates currently as a centre, with its own building, with a total of 7 floors, and only the ground and the first floor functional at this time with greater than 40 beds at the first floor and same bed numbers at the 1st floor as short stay ward for adult emergency and has also paediatric emergency as component of emergency centre in the same building.

The adult emergency department of TASH serves around 18000 patients per year. The adult emergency centre of TASH has its own staff. There are 10 emergency and critical care medicine consultants, 48 postgraduate students of emergency and critical care medicine and nurse.

4.2: Study Period

The study was conducted over a 3 month period from September1, 2024 to November 30, 2025.

4.3: Study Design

The study design were mixed type –Explanatory sequential design

4.4: Population

4.4.1: Target population

For the quantitative study: All patients who visited Tikur Anbessa specialized hospital in the study period of 1 year

For the qualitative study: All health professionals of TASH

4.4.2: Source Population

For the quantitative study: All patients admitted to the adult emergency unit of TASH in the study period.

For the qualitative study: All health professionals of TASH working at emergency department

4.4.3: Study Population

For quantitative study: All adult patients who died within 24 hours of admission to adult emergency department at TASH excluding those dead on arrival or with incomplete records between October 2024 and September 2025.

For the qualitative study: All emergency and critical care medicine physicians

4.4.4: Sample population

For quantitative study: From a total of deaths registered as deaths with in 24hr of admission a sample population of 154 was taken excluding those dead on arrival and with incomplete records from October1, 2024 to September 30, 2025.

For qualitative study: The 9 emergency and critical care medicine postgraduate students who were selected purposely by the principal investigators based on their representativeness of each group and active participation in the management of emergency patients.

4.5: Eligibility Criteria

4.5.1: Inclusion Criteria

All patient who was recorded as death within 24 hours of admission at adult emergency department of TASH was included in the study.

4.5.2: Exclusion Criteria

From the deaths who was registered within 24 hours of admission

1. Medical records with incomplete data
2. Medical records that are recorded as dead body on arrival

4.6: Sample Size Determination and Sampling Technique

All the deaths in the study period of October 1, 2024- September 30, 2025 within 24 hour of admission to the adult emergency department of TASH were included.

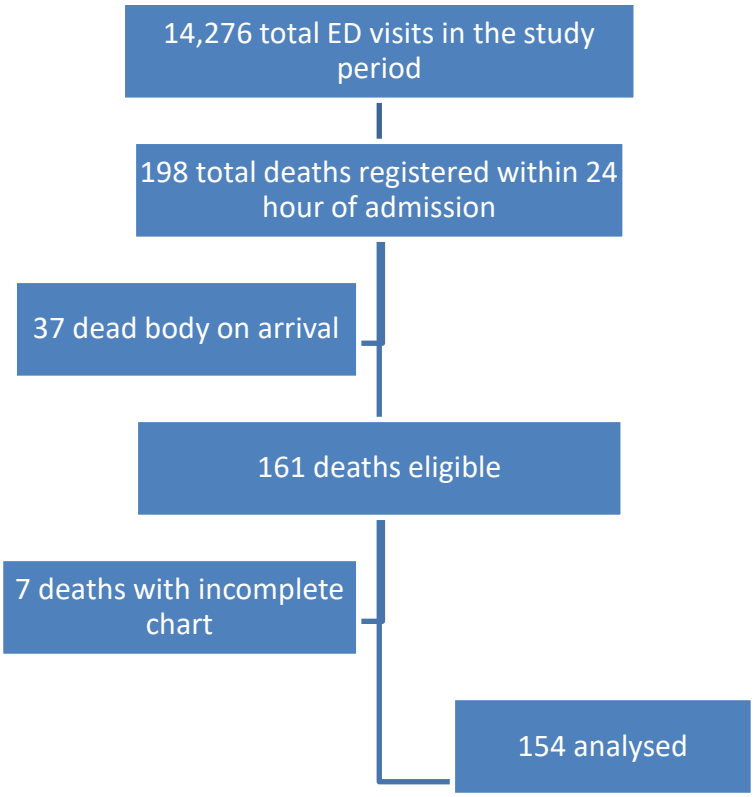

Figure 2: Sampling method for the deaths within 24 hour of admission to adult TASH ED

For the qualitative study: The principal investigator selected 9 emergency and critical care postgraduate students, purposely selected by the principal investigator based on their willingness to participate in the focus group discussion and the representativeness of the group.

4.7: Study Variable

4.7.1: Dependant Variables

Mortality within 24 hours of admission at adult TASH ED

4.7.2: Independent Variables

Age, Sex , Triage score, Mode of transport, Source of referral, Time of death, Duration of illness, Presence of chronic illness, Primary diagnosis, Length of stay in the ED, and Mechanism of trauma for trauma cases

4.8: Operational Definition

ED mortality: Death in the emergency department within 24 hours of admission.

Very early mortality: Death within 6 hours of admission to emergency department

Adult: Those patients who are admitted to the adult emergency department of TASH and age above 14.

Presence of chronic illness: Diseases which persist more than 1 month and have Confirmation from known health department by health professional with support of evidence.

Triage category: The classification of patients based on the level of urgency and injury. Triage early warning score (TEWS), was used for this study.

Duration of chief complaint: Is a reported length of time of the illness by the patients after he/she noticed of their sign and symptoms.

Dead body on arrival: Patients who are already died or no sign of life before they arrive to the emergency department.

4.9: Data Collection Procedures

For quantitative study: The data collection was started after questionnaire prepared by adopting from previous studies , and modified (5,6,12,15). The questioner was prepared in English language, and pre-test was done on 5% of the population at TASH emergency department by taking the charts of deaths before the study period. After the pre-test the deaths within 24 hours of admission were isolated from the log book and data collected by the principal investigator.

For the qualitative data: A four open-ended questions were prepared with the aim of explaining the gaps and challenges of sepsis management at the emergency department and revised by the primary advisor. After that 9 emergency and critical care postgraduate students were selected from year one to year 3, based on their active engagement of emergency activities, communication skill, and willingness to participate in the focused group discussion. The discussion was conducted at one of the cafeterias of TASH with both Amharic and English language and audio record was taken for analysis.

4.10: Quality Assurance

The questions were developed by revising the previous literatures and the advisors also communicated and approved the appropriateness of the questions. The data collection started after pre-test conducted on 5% of the sample population and questioners revised. The data collection was done by the principal investigator and data cleaning and completeness was done before entering to SPSS version 25 and in each step of the research the primary advisor was informed.

The qualitative part of the study was conducted by the principal investigator after the questioners developed and commented by the primary advisor for appropriateness.

4.11: Data Analysis and Management

For quantitative analysis: The data were cleaned and checked for completeness before entering to SPSS version 25 for analysis. For continuous variables, mean, median, and standard deviation were used; for categorical variables, frequency and percentage were used. Multivariable logistic regression was done to check for the presence of association between the independent and dependant variables, after the length of stay before death was classified into very early (within 6 hours) and early (> 6hours). Model fitness test was done by using person chi square test, and it was p-value =000, which shows it is significant. The findings of the quantitative analysis were presented with text, tables and graphs.

For qualitative analysis: A focused group discussion was conducted with 9 postgraduate students of emergency and critical care medicine, and an audio recording was taken. The audio recording was transcribed, translated and a thematic analysis was done, and findings were presented with text.

4.12: Ethical Consideration

The data collection started after ethical clearance was given by the department of emergency and critical care medicine, and submitted to the chief clinical service director of the emergency. The data were organised mainly by the principal investigator, and the identity of participants, both in the qualitative and quantitative studies were not disclosed to anyone..

5: Result

5.1: Results of the quantitative analysis

5.1.1: Socio-demographic profile of the patients

Based on the 154 deaths included in the secondary analysis male gender covers 51.3 %(79) with a male: female ratio of 1.1:1. The age of the deaths ranges from 14- 90 with mean age of 49.94 +- 17.834. Most of the patients came to adult emergency department of TASH were from Addis Ababa 64.9% (100) followed by Oromia 13.3 %(21), and almost greater than half (50.6%) of the patient's came to the emergency department via the taxi, and only 52(33.8%) of patient's came with ambulance to adult emergency department of TASH. The source of referral for the deaths within 24 hours of admission in the study period was mainly self-referral 82 (53.2%) followed by referral from the health centre 33(21.4%)

5.1.2: Magnitude of mortality

In the study period of 1 year, (from October 1, 2024-september 30, 2025) there wear a total of 14, 267 patients visited the adult emergency department of TASH and from this 198 wear registered as death within 24 hours of emergency visit. Out of the 198 deaths, 37 were recorded as dead body on arrival, that makes the magnitude of emergency department mortality within 24 hours of admission 161(1.128%) excluding the dead body on arrival. From the 161 deaths who are alive upon arrival, 61(37.89%) deaths were within 6 hours of admission to the adult emergency department. The secondary analyses were done on 154 of the deaths after excluding the dead bodies on arrival (37 deaths), and incomplete records of deaths (7 deaths).

Table 1: Socio demographic profile of the deaths within 24 hours of TASH adult ED

Socio demographic profile		Frequency	Percent
Sex	Male	79	51.3
	Female	75	48.7
Age	14-24	11	7.1
	25-34	20	13
	35-44	34	22.1
	45-54	25	16.2
	55-64	28	18.2
	>64	36	23.4
Address	Addis Ababa	100	64.9
	Oromia	21	13.6
	Amhara	10	6.5
	SNNPR	7	4.5
	Other	16	10.4
Mode of transportation	Ambulance	52	33.8
	Taxi	78	50.6
	Public transport	1	0.6
	Other	23	14.9
Source of referral	Public hospital	23	14.9
	Private centre	3	1.9
	Health centre	33	21.4
	Self	82	53.2
	OPD	12	7.8
	Other	1	0.6

NB; other for adress includes Afar, Benishangul , Somalia , and Tigray

Other for mode of transportation includes patients carried by attendants

Other for source of referal was for patients came from police stations

5.1.3; Clinical profile of the deaths

5.1.3.1: Presentation at triage

On the analysis of 154 patients who died in the study period the clinical data points that most of the patients (77.3%) had no visit to the emergency department before the visit leading to death and only 1(0.6%) patient had visit greater than 1 before the vist that leads to death . The majority (64.3%) were triaged as red, indicating immediate life threatening conditions needing urgent intervention or care, followed by the orange category (22.7%).

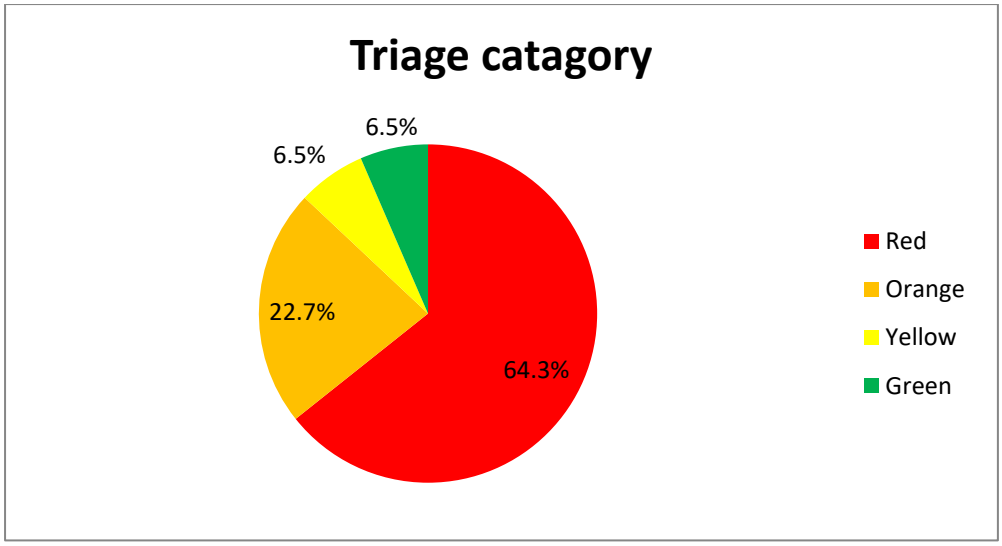

Figure 3; Triage category of the deaths within 24 hours of admission at TASH adult ED

In this study the vital signs of the deaths within 24 hours of admission were analysed by taking the first vital sign recorded on the chart. For the blood pressure measurement almost half of the patients have blood pressure in the normal range, but 33.1% were hypotensive, and 20.1 were hypertensive. In the other hand the pulse rate measurements showed that 51.9% of the deaths presented with tachycardia, and 9.1% presented with un-recordable pulse. Respiratory rates were mostly within normal limits, but 36.3% had rates above 25 breaths per minute indicating respiratory distress. And oxygen saturation levels below 90% were recorded in 47.4% of patients in this study. For the consciousness level of the patients based on the AVPU almost half (48.9) patients presented with affected consciousness, and 40(26%) were unresponsive at the time of presentation to the triage.

For the presenting compliant the common presenting symptom was respiratory (35%) followed by neurologic symptoms (27.9%). In this study trauma related complaints were covering only 6.5% of the presenting complaints. And for the duration of symptoms from start to emergency arrival significant proportion of the patients (49.4%) had symptoms >24 hours to 1 week, and only (17.5%) patients presented within 4 hours of symptom onset.

Table 2: Baseline characteristics of the deaths within 24 hours of admission at adult ED, TASH

Variables		Frequency	Percent
Prior ED visit	No visit	119	77.3
	1 visit	34	22.1
	>1 visit	1	0.6
Presenting symptoms at ED	Respiratory	39	25.3
	Cardiac	9	5.8
	Neurologic	43	27.9
	GI symptoms	27	17.5
	Trauma	10	6.5
	Respiratory with others systems	15	9.7
	Others	11	7.1
Duration of symptom	<4hr	27	17.5
	4-12hr	16	10.4
	13-24hr	8	5.2
	25hr-1 week	76	49.4
	>1 week	27	17.5
BP	Hypertensive	31	20.1
	Normal	55	35.7
	Hypotensive	51	33.1
	Un recordable	17	11
PR	<60	20	13
	60-100	40	26
	>100	80	51.9
	Un recordable	14	9.1
RR	<12	4	2.6
	13-24	93	60.4
	>24	56	36.3
	No breathing	1	0.6
SO2	>90%	66	42.9
	<90%	73	47.4
	Un recordable	15	9.7
GCS	Alert	79	51.3
	Verbal	24	15.6
	To pain	11	7.1
	Unresponsive	40	26

NB: other for presenting symptoms include non-specific symptoms like fatigability, light headedness, decreased appetite

5.1.3.2: Main diagnosis of the deaths within 24 hours of admission at adult TASH ED

In this study medical causes overwhelmingly dominated deaths (84.4%) within 24 hours of admissions, with only 15.6 % attributed to surgical causes. Within the medical causes, infection/sepsis were the leading diagnosis, responsible for 54.1% of cases (45.8% alone and 8.3% infection/sepsis with other causes), demonstrating sepsis as the primary driver of early mortality in the emergency department. Neurologic causes (16%) like stroke, and oncologic causes (9.1%) and its complication followed. Cardiovascular causes also contributed to 9% of the deaths but renal, liver, and DM and its complications were less common.

The most common focus of infection/sepsis were chest 69.2% (53.8% alone and 15.4% in combination with others) followed by gastrointestinal system 19.2%.

In another category most deaths were from non-traumatic causes (94.8%), emphasizing the high burden of medical emergencies compered to trauma in this setting.

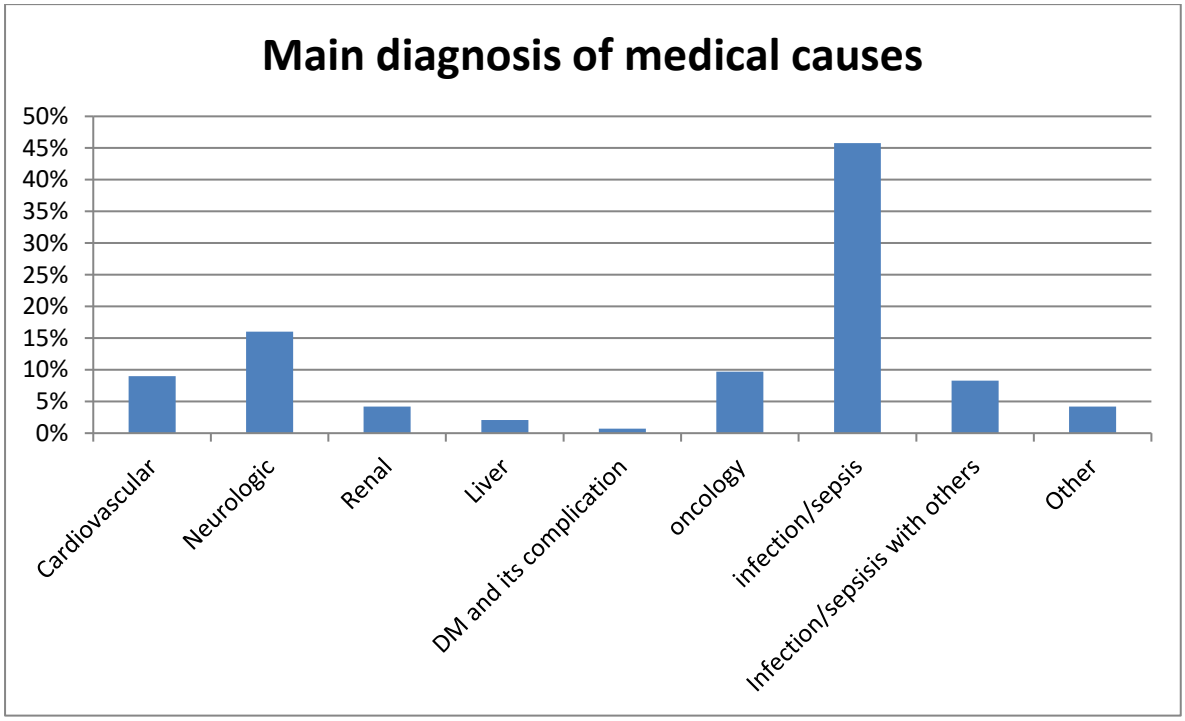

Figure 4: Main diagnosis of medical causes of deaths within 24 hours of admission at TASH adult ED

Table 3; Major diagnosis, main diagnosis, chronic disease, and focus of infection and vasopressor initiation of the deaths within 24 hours of adult ED, TASH

Variables		Frequency	Percent
Main diagnosis	Medical	130	84.4
	Surgical	24	15.6
Major diagnosis	Traumatic	10	5.2
	Non traumatic	144	94.8
Chronic disease	HTN and DM	21	17.2
	Cardiac	17	13.9
	Liver	4	3.3
	Renal	2	1.6
	Malignancy	61	50
	Malignancy with chronic disease	10	8.2
	Other	7	5.7
	Total	122	100
Focus of infection for infection/sepsis	Chest	42	53.8
	Gastrointestinal	15	19.2
	Genitourinary	2	2.6
	CNS	2	2.6
	Musculoskeletal/ wound	2	2.6
	Other	3	3.8
	Chest and others systems	12	15.4
	Total	78	100
Vasopressor	Yes	51	65.4
	No	27	34.6

NB: Others for the main diagnosis of medical causes contain toxicological cases, and unknown diagnosis

Other for chronic disease includes HIV AIDS

Other for focus of infection includes focus of unknown origin

5.1.3.3: Investigations of the deaths within 24hour of admission at TASH ED

From the 154 deaths included in this study 74.4% (110) having undergone investigations, while 28.6 %(44) had none performed. Among the deaths with available haematological data (105 of deaths), anaemia had a prevalence of 62.9 %(66), thrombocytopenia was present in 56.2 %(59), and white blood cell (WBC) abnormalities were observed, with leukocytosis seen in 62.9 (66 of deaths) and leukopenia 20% (21 of deaths). Renal function abnormalities were documented in 35.7% (55 out of 103 cases), reviling a significant burden of renal impairment in this population.

Electrolyte disturbances were also fairly frequent: sodium abnormalities were recorded in 59% of cases, predominantly hyponatremia (54%) with hypernatremia being rare (4.6%). These electrolyte abnormalities were indicative of metabolic disturbances that could contribute to or result from the pathophysiological state leading to mortality.

Table 4: Investigations of the deaths within 24hr of admission at TASH adult ED

Variables			Frequency	Percent
Investigations		Yes	110	74.4
		No	44	28.6
		Total	154	100
Anaemia		Yes	66	62.9
		No	39	37.1
		Total	105	100
Thrombocytopenia		Yes	59	56.2
		No	46	43.8
		Total	105	100
WBC abnormality		Leucocytosis	66	62.9
		Leukopenia	21	20.0
		Normal	18	17.1
		Total	105	100
Renal function abnormality		Yes	55	53.4
		No	48	46.6
		Total	103	100
Electrolyte abnormality	Sodium abnormality	Hypernatremia	4	4.6
		Hyponatremia	47	54
		Normal	36	41.4
		Total	87	100
	Potassium abnormality	Hypokalmia	22	25.9
		Hyperkalaemia	22	25.9
		Normal	41	48.2
		Total	85	100
	Chloride abnormality	Hyperchloremia	7	8.05
		Hypochloremia	37	42.53
		Normal	43	49.43
		Total	87	100

5.1.4: Location, Timing and Immediate cause of death

For the location of deaths most of the deaths occurred at red zone (66.9%) followed by orange zone(20.1%) while yellow, green , and resuscitation areas cover 2.6%, 5.8%, and 4.5% respectively. Regarding for the timing of death 64.9% occurred during the duty hours, and only 35.1% happened during working hours.

The immediate causes of death were diverse in this study, with multi-organ failure covering the largest proportion 39 %(60 deaths). Herniation accounted for 22.1%, respiratory arrest for 18.2%, and sudden cardiac arrest for 14.3%. These finding underscore MOF as the predominant immediate cause, indicative of sever systemic compromise in fatal cases.

Table 5: location of death, timing of death, and immediate cause of death within 24hr of admission at TASH adult ED

Variables		Frequency	Percent
Location of deaths	Red	103	66.9
	Orange	31	20.1
	Yellow	4	2.6
	Green	9	5.8
	Resuscitation	7	4.5
Timing of the deaths	Working hour	54	35.1
	Duty hour	100	64.9
Immediate cause of deaths	Respiratory arrest	28	18.2
	Sudden cardiac arrest	22	14.3
	MOF	60	39
	Herniation	34	22.1
	Embolism	6	3.9
	Other	4	2.6

NB: other in immediate cause of death contains the unknowns

5.1.5: Associated factors of very early mortality

A binary and multi-variable logistic regression was conducted to differentiate the clinical, and demographic predictor's influencing very early deaths (0-6 hours) in the adult emergency department of TASH. In the binary regression vital signs at triage like oxygen saturation and blood pressure being hypotensive; duration of symptom before ED arrival, <12 hours, and >24 hours to 1 week; triage category being red and orange; medical diagnosis; presence of chronic disease with malignancy, main diagnosis at the time of admission being cardiovascular, renal and oncology and location of the being orange are significantly associated with p-value <0. 05 with 95% CI.

But in the multi variable regression done, duration of symptom before ED arrival <12 hours (AOR 55.437; 95% CI: 3.531-870.440; p=0.004), and >24 hours-1 week (AOR 13.518; 95% CI: 1.262-144.866; p=0.031) were significantly associated. From the main diagnosis at admission with cardiovascular (AOR 29.563; 95%CI: 1.330-657.087; p=0.032), and renal (AOR 240.741; 95% CI: 3.083-18795.997; p=0.014), were significantly associated for very early death (within 6 hours). In the contrary oxygen saturation >90% ((AOR 0.029; 95% CI: 0.002-0.469; p=0.013), were negatively associated or protective of death within 6 hours of admission.

Table 6: Multi variable logistic regression of associated factors of very early deaths

Variables		Duration of stay ED		COR(95%CI)	P-value	AOR(95% CI)
		0-6hr	>6hr			
Duration of symptoms	<12hr	26	17	**0.082(0.021-0.314)**	**0.004**	**55.437(3.531-870.440)**
	12-24hr	3	5	0.208(0.032-1.349)	0.120	12.170(0.523-283.333)
	>24hr-1 week	29	47	**0.203(0.056-0.733)**	**0.031**	**13.518(1.262-144.866)**
	>1 week	3	24			
Blood pressure at triage	Hypotensive	21	30	2.041(0.669-6.225)	0.895	0.872(0.114-6.657)
	Normal	16	39	3.482(1.128-10.754)	0.648	0.616(0.077-4.931)
	Hypertensive	14	17	1.735(0.524-5.743)	0.817	0.713(0.041-12.463)
	Un recordable	10	7			
Oxygen saturation	>90%	15	51	**9.350(2.597-33.663)**	**0.013**	**0.029(0.002-0.469)**
	<90%	35	38	2.986(0.870-10.246)	0.161	0.154(0.011-2.104)
	Un recordable	11	4			
Major diagnosis	Medical	46	84	3.043(1.236-7.495)	0.081	0.102(0.008-1.330)
	Surgical	15	9			
Type of chronic disease	HTN	3	7	0.259(0.022-3.063)	0.977	0.949(0.028-32.010)
	DM	1	3	0.333(0.016-7.140)	0.717	0.297(0.000-213.618)
	Cardiac	8	9	0.125(0.013-1.216)	0.451	3.630(0.127-104.002)
	Liver	3	1	0.037(0.002-0.793)	0.919	1.581 (0.000-10741.902)
	Renal	0	2		0.998	-
	Malignancy	27	34	0.140(0.017-1.174)	0.533	2.436(0.148-40.020)
	Other	2	5	0.278(0.020-3.884)	0.444	4.369(0.101-189.883)
	HTN+ DM	1	6	0.667(0.035-12.840)	0.605	0.354(0.007-18.081)
	Malignancy with others	1	9			
Main diagnosis at time of admission	Cardiovascular	8	5	**0.125(0.019-0.823)**	**0.032**	**29.563(1.330-657.087)**
	Neurologic	8	15	0.375(0.066-2.145)	0.305	5.139(0.226-116.915)
	Renal	2	4	**0.400(0.041-3.900)**	**0.014**	**240.741(3.083-18795.997)**
	Liver	2	1	0.100(0.006-1.712)	-	-
	Oncology	10	4	0.080(0.012-0.540)	0.156	11.458(0.395-332.511)
	Infection/sepsis	17	49	0.576(0.115-2.899)	0.178	5.444(0.463-64.070)
	Other	5	1	0.040(0.003-0.555)	0.106	19.747(0.533-732.197)
	Infection /sepsis with others	2	10			
Location of death	Red	45	58	3.222(0.597-17.383)	0.098	0.087(0.005-1.572)
	Orange	6	25	10.417(1.611-67.334)	0.051	0.061(0.004-1.015)
	Yellow	2	2	2.500(0.194-32.194)	0.809	1.606(0.035-74.524)
	Green	3	6	5.000(0.584-42.797)	0.128	0.052(0.001-2.343)
	Recess	5	2			

5.2: Results of the qualitative analysis

A focused group discussion was conducted with a total of 9 postgraduate students of emergency and critical care medicine (2 year 1, 3 year 2, and 4 year 3), of whom 6 were male, and 3 were female. The discussion focused on four major questions that were developed by the investigator to know more on sepsis recognition, management pathway, strengths, and pitfalls of TASH ED management on sepsis, and suggestions for improvement of sepsis related mortality. The participant's insights are summarized as follows.

5.2.1: Identification and screening of sepsis

Almost all of the participants said that for recognition of sepsis they use primarily on vital signs (hypotension, fever, RR changes), and from the scorings qSOFA. Other scores like SIRS, MEWS, NEWS, and SOFA are not practically used in the emergency department because of the lack of investigations. ‘’We recognize and identify patients based on their vital signs at triage, like hypotension, fever and underlying condition we will suspect sepsis. We identify by using qSOFA, and start management" (P1, P2).

Most of the participants explained that they think sepsis is being over diagnosed because of: the lack of investigations like culture to conform; clinical overlap to other diagnosis like malaria, and malignancy; or because of the fear of missing it. As participant 4 specifically noted it absence of physician at triage complicates the identification and management of sepsis. "When no physician at triage patients in shock may wait a long time; even after orders are written medications were delayed" (P4). "Clinical signs overlap with malaria; malignancies and we often over diagnose to avoid missing sepsis" (P5). "It is better to over diagnose than miss sepsis, especially in immune suppressed patients" (P6).

5.2.2: Treatment and disposition pathway

Almost all participants mentioned that there is a delay in antibiotic initiation by greater than 1 hour due to different reasons like, drug shortages or lack of availability in the hospital pharmacy, financial and payment issues, human resource shortages, and overcrowding. They described also there is no monitoring checklist for sepsis patients and monitoring is poor due to lack of equipment and shortage of staff. "Antibiotics typically start after 1.5 hours; pharmacy stock outs and payment delays cause problems" (P3, P5). "We have shortages of nurses, and only two monitors at red zone; respiratory rates recorded inaccurately, no monitoring checklists" (P1, P5). "High patient load delays evaluation and treatment initiation by hours" (P2, P6).

5.2.3: Strength and pitfalls of current management

All participants of the focused group discussion mentioned early sepsis recognition with high index of suspicion as a strength, and participant 7 also added specifically the use of ultrasound for fluid resuscitation as strength of the current management of sepsis patients at adult emergency of TASH. "Our key strength is early identification with high clinical suspicion; ultrasound assists with fluid resuscitation" (P1, P7).

As of the weakness all of the participants mentioned that delayed antibiotics and vasopressor initiation , poor culture use and antibiotic stewardship , lack of continuous monitoring and patient follow-up are the major problems of emergency department sepsis management. "We know the protocols but fail to implement due to lack of resources, monitoring, and proper follow-up; overcrowding worsens delays and contributes to mortality" (P4, P9).

5.2.4: Suggestions and solutions to improve sepsis mortality at ED

The participants of the focused group discussion suggested different solutions and they almost have similar ideas.

The first suggested solution by most of the participants was, improving the availability of resources like antibiotics, vasopressors, infusion pumps, and monitoring equipment. "If all necessary equipment and drugs are reliably available, we'd reduce mortality significantly" (P1)

Most of the participants agreed on frequent on-going training for the nurses and physicians on sepsis recognition and management and development of institutional based specific sepsis guidelines with the local context and patient population. "Regular training and locally adapted guidelines rather than generic international protocols will improve practice" (P2, P3).

Multidisciplinary collaboration mainly infectious disease specialist's daily round at least in the morning to guide rational use of antibiotics, culture interpretation and escalation /de-escalation of treatment were mentiond spesficaly by 2 participants as a solution. "Daily infectious disease rounds could improve antibiotic stewardship and clinical outcomes" (P5, P8).

Finally, reducing overcrowding was also mentioned as a solution to decrease the mortality of patients at ED by increasing timely evaluation and frequent monitoring. "Overcrowding is a major barrier to timely antibiotics and good monitoring; reducing patient load needed" (P7, P9).

6: Discussion

The magnitudes of adult emergency department mortality at Tikur Anbessa Specialised Hospital within 24 hours of admission were 1.128%. In this study the gender distribution is almost equal and most of the patients came from Addis Ababa. When we see the mode of transportation only 33.8% patients came with ambulance despite they are critical. Medical causes were the major contributors of the emergency department mortality, and sepsis covers 54.1% of the deaths within 24 hours of admission. Different factors contributed for the increase in mortality of patients with sepsis. Duration of symptoms before ED arrival, <4 hours, 4- 12 hours, and >24hr- 1 week; main diagnosis at admission with cardiovascular and renal were significantly associated for very early mortality. The protective variables in this study were oxygen saturation >90% and being placed in the red or orange.

The 24 mortality rate of 1.128% is two times higher than the national target of 0.6%. Even if there is no study done specifically on 24 hours ED mortality there was a sub-group analysis done from the overall mortality at SPHMMC, and from the 72 hours mortality at TASH. The mortality rate in this study is higher than SPHMMC (0.75%), and TASH in 2018-2020 (0.9%) (12,13). The increment in the magnitude of mortality may be because TASH is one of the largest referral hospitals, receiving the most critical and difficult cases all over the country that need multidisciplinary involvement and most of the patients came from referring hospitals are with terminal illness like malignancy, CKD and CLD. The very early deaths (within 6hrs) constituted 37.89% of the deaths that is significant and it may indicate the need for urgent resuscitations, and accuracy of identifying and treating those who need acute care.

The mean age of the deaths was 49.94 years with a near equal gender distribution (51.3% male). These findings are in line with the previous study done at SPHMMC (49.8 year) but higher when compared to the studies done on TASH(43.5 years and 43.1 years)(6,12,13).

In this study most of the patient's (64.9%) were from Addis Ababa that is also true in previous studies done at SPHMMC and TASH. The transportation to ED at the time of admission was predominantly by taxi (64.9%), only 33.8% used ambulance for arrival despite they are critically ill, indicating the possibility of pre-hospital care gap. Even if the study shows a significantly low utilisation of an ambulance , it is not a new finding in researches done previously(6,12,13).

The other major finding was from the comorbidity, malignancy was the most common, that shows the burden of non-communicable diseases in the adult emergency department of TASH, and this may be due to the difference in the patient population at TASH, because it is the biggest referral hospital and most of the cases come with referral from all over the country for speciality care. And it is also the only tertiary hospital that is actively doing radiotherapy, and patients are being referred from all over the country for radiation therapy to TASH, that may contribute to the high burden of malignancy in this study.

The medical causes (84.4) are very high in this study, with infection /sepsis (54.1%) as leading cause of death and chest was the primary focus of infection (69.2%). These findings are in line with a previous study done on TASH and SPHMMC (6, 21). The focused group discussion shows that there is different reasons for the increase in mortality from sepsis , the initial problem is reliance of the physicians on vital signs and qSOFA scoring that is insufficient for early identification, and screening and sometimes lead to over diagnosis due to overlap of the clinical parameters. Most of the participants agreed on the over diagnosis of sepsis because of different reasons like lack of investigations, patients clinical profile, and fear of missing it. As most of the participants of the focused group discussion mentioned; delays in initiating antibiotics and resuscitation due to shortage of medications, poor monitoring due to lack of monitoring equipment, patient overload, and limitation in human resource also complicates the outcome of patients with sepsis, and contribute for the increment of the mortality. At triage most of the patients present with hemodynamic instability 51.9% tachycardia , 33.1% hypotension and almost half (48.9%) with altered consciousness. This vital signs show that there is a significant hemodynamic instability and organ dysfunction upon arrival contributing to the early mortality of those patients, and support the higher incidence of sepsis .

Symptom duration before arrive: less<4 hours (AOR 171.0), 4-12 hours (AOR 29.16), and 25 hours to 1 week (AOR 82.34) significantly associated with very early mortality. This finding is similar to the previous study done at TASH from 2018-2020, that the only significantly associated finding was symptom duration within 4 hours (2). In other studies done both at TASH and SPHMMC, symptom duration was not associated with very early death(6,12,13).

From the main diagnosis at admission that leads to death cardiovascular and renal diseases were strongly associated with very early mortality. But in a study done at SPHMMC, cardiovascular and renal disease are not significantly associated rather sepsis, respiratory

disease, liver disorders, gastrointestinal bleeding and diabetic complications are significantly associated with early mortality(12). In the previous studies done at TASH this disease conditions are not associated with early deaths rather it is comorbidity with HIV AIDS were significantly associated with the very early mortality(6,13).

Despite these important findings in this research there are a number of limitations. The first limitation was the initial quantitative data were retrospective with incomplete records. The other limitation of this study was difference in the time cut-off from the previous studies that makes comparison of the findings difficult.

Chapter 7: Conclusion

The mortality rate of adult emergency department of TASH within 24 hours of admission was high, so the current functioning emergency infrastructure should be assessed, and improve the management of acute, and critical patients.

Mainly, the deaths were due to medical emergencies, sepsis being as the leading cause and there were different gaps identified that need immediate attention, and improvement to decrease mortality. Despite, cardiovascular and renal disease has significant association with very early mortality the actual number of deaths been small when we compare with other disease conditions.

Ambulance utilization for critical ill patients was still low showing that there is a big gap in the pre-hospital care. So creating awareness on pre-hospital care and ambulance utilisation is mandatory. Despite, they are critically ill and need urgent intervention patients were triaged and disposed to the low acuity areas of yellow, and green.

8: Recommendation

The emergency and critical care department should give a continuous regular training to the physicians, and nurses on sepsis recognition, treatment, and monitoring. Developing institution specific protocols and daily round with the infectious disease specialists might also decrease sepsis related mortality.

TASH should strengthen the triage of the emergency department so that critical patient should be identified, and disposed to the red and orange areas, and strengthen these areas with resource, and manpower to improve the quality of monitoring and follow-up.

For ministry of health: To create awareness to the community regarding ambulance utilisation, and strengthen pre-hospital care.

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Annex 1; Data collection tool

Questioners for quantitative part of the study (since the study was retrospective and on charts of deaths consent not prepared and for the qualitative part oral consent was taken)

1. MRN_____

I. Socio demographic characteristics

1. Age in year's _____

2. Sex_____

3. Address:

a) Addis Ababa
b) Oromia
c) SNNPR
d) Amhara
e) Other (specify)_____

II. Baseline Information

1. Date of Admission to ED ------/------/-----

2. Source of referral

a) Private sector
b) Public hospital
c) Health centre
d) Self-referral
e) OPD
f) Other

3. Mode of transportation

a) Ambulance
b) Taxi
c) Public transport
d) Others (specify) ----------

4. Prior ED visits in past 30 days

a) No ED visits
b) 1
c) ≥2

5. Presenting symptoms to the ED

a) Respiratory
b) Cardiac
c) Neurologic
d) Gi symptoms
e) Trauma
f) Other

6. Duration of symptoms

a) <4 hours
b) 4-24 hours
c) 24-48 hours
d) > 48 hours to 1 week
e) > 1 week

7. BP at triage

a) Hypotensive
b) Normal
c) Hypertensive
d) Unrecordeble

8. Pulse rate

a) <60
b) 60-100
c) >100
d) Unrecordeble

9. Respiratory rate

a) <12
b) 12-24
c) 25-35
d) >35
e) No breathing

9. Oxygen saturation

a) >90%
b) <90%
c) Unrecordeble

10. GCS at triage

a) Alert
b) To Verbal
c) To Pain
d) Unresponsive

11. Triage category

a) Red
b) Orange
c) Yellow
d) Green

12. Time of death

a) Working hour
b) Duty hour

13. Length of stay in ED before death----------

14. Major diagnosis category

a) Traumatic -----if yes go to question number 17
b) non-traumatic

15. Major diagnosis category

a) medical
b) surgical

16. Presence of any chronic disease

a) Hypertension
b) Diabetic mellitus
c) Known cardiac patient
d) Known cancer patient
e) Others (specify)_____
f) No chronic disease

17. Mechanism of injury (for trauma)

a) RTA
b) Assault
c) Gunshot
d) Stab
e) Falls
f) Suicide
g) Others specify_____

18. Sites of injury

a) Head injury
b) Chest injury
c) Neck injury
d) Spinal cord injury
e) Upper extremities injury
f) Lower extremities injury
g) Others (specify) _____

19. Main Diagnosis of medical causes

a) Cardiovascular
b) Renal disease
c) Liver disease
d) Infection/sepsis

e) DM and complication
f) Oncologic
g) Other (specify) ___ _____

20. If infection /sepsis what was the focus of infection

a) Chest
b) GI
c) GU
d) CNS
e) Musculoskeletal/wound
f) Other

21. Any investigation? If performed

a) Yes
b) No

22. Anaemia present or not

a) Yes
b) No
c) Not done

23. WBC abnormality

a) Leucocytosis
b) Leukopenia
c) Normal
d) Not done

24. Thrombocytopenia

a) Yes
b) No
c) Not done

25. Renal function test abnormality

a) Yes

b) No
c) Not done

26. Sodium abnormality

a) Hypernatremia
b) Hyponatremia
c) Normal
d) Not done

27. Potassium level

a) Hypokalaemia
b) Hyperkalaemia
c) Normal
d) Not done

28. Chloride level

a) Hyperchloromia
b) Hypochloremia
c) Normal
d) Not done

29. Immediate causes of death

a) Respiratory arrest/failure
b) Cardiac arrest
c) MOF
d) Herniation
e) Massive emboli
f) Others (specify) _____

30. Location of death

a) Red zone
b) Orange zone
c) Yellow and green zone
d) Recess

Questioners for the qualitative study

1, How are you recognizing sepsis at the emergency department?

2, How you describe management and disposition pathway of sepsis at TASH ED?

3, what are the pitfalls and strength of sepsis management at TASH ED?

4, Any suggestions to decreases the mortality of patients with sepsis at TASH ED?

Annex 2: Assurance of the principal investigator

I the undersigned declare that this thesis proposal "predictors of 24hr ED mortality and its magnitude at adult TASH emergency department", agree to accept all responsibilities for the scientific and ethical conduct of the research project. I will provide a timely progress report to my advisor and seek the necessary advice and approval from my primary advisors during the research. I will communicate timely to my advisors and the Department.

Name of the student: Endalamaw Wondimagegn_Belie_____

Signature: _____

Date: _____

Approval of the primary Advisor: _____

Name of the primary advisor: _____

Signature: _____

Date: _____

Ethical clearance

To: To Whom It May Concern

FROM: Dr Birhanu Tesfaye

Head Department of Emergency and Critical Care

Email…berhanu.tesfaye@aau.edu.et

Phone, 0911333266

Subject: About Ethical clearance

I am writing to confirm that the Department of Emergency Medicine has granted ethical clearance for the research study entitled “predictor’s of 24 hour emergency department mortality and its magnitude at TASH adult emergency department ； A 1 year institutional based retrospective cross sectional study . This study is conducted by Dr. Endalamaw Wondimagegn, a third -year post graduate student in Emergency and Critical Care Medicine at Addis Ababa University. The thesis proposal has received approval from the Committee of the Emergency Medicine program.

Your assistance with Dr. Endalamaw’s research project would be greatly appreciated. We thank you in advance for your cooperation and support.

Should you have any further queries, please do not hesitate to contact me at the address provided above.

With regards.