

# Original Study Protocol

## Pattern and predictors of emergency department early mortality in St Paul Hospital Millennium Medical college, Addis Ababa, Ethiopia.

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### Abstract

**Background:** To mitigate the consequences of ill-health and preventable mortality, a nation's health system should be adaptable and responsive to morbidity and early mortality trends. To that end, high-quality health-care facility-based studies are required to provide critical information about patterns of deaths occurring in healthcare settings. Literature on mortality statistics in low- and middle-income nations is currently scarce. There is no published literature in the study site, and limited studies exist in Ethiopia, regarding ED mortality. This study aims to characterize all-cause early mortality among patients presenting to emergency departments, understand patterns, and identify predictors of early mortality. That will be scientific evidence for hospital leaders, policy makers and to the larger scientific community in general.

**Methods:** The study design will be a two and half-years, retrospective review of hospital records of patients treated at St. Paul Hospital Millennium Medical College. A chart review of deaths from January. 1, 2020 to June 30 2022, will be conducted. Using SPSS Version 25, descriptive and analytical statistics will be performed. All variables summary statistics will be analyzed. In order to describe the subset of patients who might have benefited from adult ED care, all participants under the age of 12 will be excluded. To assess the association between early death, and demographic and clinical characteristics as well as categorical variables, multivariant method will be used. [*Ethiop. J. Health Dev.* 2024; 38(2): 00-00]

**Key words:** emergency mortality, study protocol, Ethiopia

### Introduction

#### Background;

WHO states that the death rate in developing countries is unacceptably high across much of the developing world, and the persistent disparities in health status affect every country worldwide (1).

Developing nations are experiencing the epidemiologic shift, and they account for a preventable and alarmingly increasing portion of non-communicable disease and injury-related deaths globally. Moreover, acute and critical care services have been remarkably undervalued on top of sub-optimally equipped and insufficient leadership. Hence improving this gap is critical in preventing mortality and disability. It is a known truth that there may be a huge burden of deaths and disabilities if timely, effective, and efficient emergency care is not provided (2-4).

The emergency department of any hospital is where seriously ill patients should check in, the initial management of these patients requires sophisticated medical care, and it is important to standardize the infrastructure and staffing levels in order to mitigate an impact. This is because the morbidity and death rates in any health facility's emergency room are a good indicator of acute care services (2-4).

The prevalence of avoidable deaths in the developing countries are affected by inadequate infrastructure (including equipment) and skilled staff. Patient morbidity and mortality are affected by pre-hospital variables, such as the paramedics' workload, the patient's travel time to the hospital, the distance traveled, the mode of transportation, the time between the onset of the illness and presentation, and the primary illness or injury (2-4).

With an estimated population of more than 120 million, Ethiopia is one of the oldest developing countries. It has less than 100 emergency medicine and critical care physicians as well as less than 250 emergency nurses as of 2012 (5). In addition to having insufficient human resources, the nation lacks an acute care infrastructure (5).

The purpose of this study is to provide scientific evidence for hospital administrators, decision-makers, and scientific community by retrospectively characterizing all-cause mortality among patients presenting to St. Paul Hospital Millennium Medical College -Emergency Department (SPHMMC-ED).

### Methods

#### General objective;

To assess the pattern and predictors of all cause-early mortality in St. Paul Hospital Millennium Medical College (SPHMMC) emergency department (ED), Addis Ababa-Ethiopia.

#### Specific objectives;

- To describe deaths socio-demographic patterns.
- To describe the pattern of all cause-ED mortality.
- To determine predictors of all-cause ED early mortality

#### Study site and design

This is a single center two and half-years retrospective study. The study will be conducted at adult emergency department of SPHMMC. The Hospital is a specialized teaching hospital in Addis Ababa, the capital of the country. Its catchment population is estimated to be over 7 million, making it one of the largest referral centers in the country. SPHMMC receives clients from

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all over the nations. In recent millennium, the hospital was advanced to a medical school, through declaration of the council of the ministries, and with this, it attained its current name. SPHMMC has approximately 22 departments/unites and 300 faculty members, more than 2800 clinical, academic, administrative & supportive staff. With an inpatient capacity is more than 700 beds, the hospital reports an average of 1,500 emergency and outpatient visits daily. The hospital serves as teaching institution for undergraduate and postgraduate medical students, as well as a research center (6).

### Data collection

A standardized data collection checklist (7) will be developed and utilized to review death information from patient medical records, including the ED triage record, clinical care notes, and hospital death certificates. A retrospective analysis will be conducted for all patients who passed away in the emergency room from January, 1, 2020 to June, 30, 2022, will be done. Early ED mortality is defined as death occurring within 24 hours of ED presentations, according to definitions of available literatures and clinical relevance. ED early and late deaths are dependent on independent variables (age, sex, duration of c/c, triage category, mode of arrival, referring region, prior ED visit, length of stay in ED, cause of death, specific diagnosis). Demographic information, pre-hospital data, triage data, method of payment, chief complaint, triage level, time of ED presentation, time from ED presentation to death, primary reasons of death, and comorbidities will all be gathered.

Six data collectors, alongside the authors who are expertise in emergency nursing, public health and emergency medicine, will be trained by primary investigator to gather data using a standardized data collection tool. All data collectors will receive training before beginning data collecting in order to ensure the quality of the data. It will be cross-checked that the collected data is complete and quality. On spot corrections will be done immediately. Throughout the data collection period, authors will supervise and monitor, and support will be provided to the data collectors as per needed.

### Study variables.

The dependent variable is ED death. The independent variables consist of age, sex, duration of chief complaint, triage category, mode of arrival, referring region, prior ED visits, length of stay (LOS), cause of death, and primary working diagnosis.

### Statistical Analysis

Using SPSS Version 25, descriptive and analytical statistics will be made. All variables' summary statistics will be performed. In order to describe the subset of patients who might have benefited from adult ED care, all participants under the age of 12 will be excluded.

The causes of mortality will be categorized into clinically relevant groups to facilitate analysis. The time to death, cause of death, and relationships between demographic and clinical factors will be

examined using Pearson's Chi square test. The length of stay in ED will subsequently be dichotomized into  $\leq 24$  hours and  $>24$  hours. The purpose of dichotomization is to better understand the most severely ill and injured patient population that would likely benefit from successful early ED interventions. This 24 hours' time frame, which is designated as "early" ED mortality will be used for analysis. Age, gender, cause of death, time of presentation to the ED, method of transportation to the ED, day of presentation to the ED, and symptom duration will all be evaluated using logistic regression analysis to determine the adjusted impact on the likelihood of dying within 24 hours of ED presentation. The St. Paul Hospital Millennium Medical College IRB has given its approval for the ethical use of the data. This is not experimental study, and conducting experiments on humans or using human tissue samples is not applicable to this research. Since we will use secondary data having consent of participant was not applicable to our study.

### Ethical considerations:

The St. Paul Hospital Millennium Medical College-institutional review board has given its approval for the ethical use of the data. Data will not be collected directly from patients. No vulnerable populations will directly be participated in the study. Paper forms used to collect study data will be stored in secure locked cabinets. Data from questionnaires and study materials will be entered into electronic databases, both paper study forms and electronic database data will not have identified information. Electronic databases will be stored on encrypted and password protected endpoint devices in accordance with guidelines.

### Summary of literature review:

This section will summarize the available national and international protocols, guidelines, standards as well as journal articles in the context of ED mortality.

Literature on all-cause ED mortality specially in LMIC are limited, but the available data shows that mortality rate are significantly high. The causes are believed to be multifactorial and includes, a burden of disease, challenges related with universal access to quality health services, medical equipment and medications, trained health care providers and consequences of poor health awareness. Provision of universally accessible affordable and quality emergency care has been shown to have an impact on reduction of ED mortality. Understanding the gap in acute care areas, international institutions are working on capacity improvement of the LMIC health system (1-4).

A prospective 8 months study done in Ethiopia in 2012/2013 and published in 2015, Addis Ababa University, Black lion Hospital is one of available literature. Which shown that within study period about 9,954 patients visited ED of which 220 cases were registered as death occurred within 72 hours of ED stay, resulting this makes deaths within 72 hours 1.9%. There was male predominance within death groups making the ratio of male to female 1:1.4. Highest deaths occurred within 6-24 hours (37%) and followed by deaths within 1-6 hours (21%), 24-72 hours (20%), and

death on arrival (DOA) 15%, while 6 % were within less than one hour of ED presentation. The mean age of death was 43.1 years. The most common causes of deaths were traumatic head injury accounting about 21.5 %, sepsis accounting about 18.8 % and followed by respiratory failure causing 15.1 % of deaths. The triage category for the majority of deaths was orange (48.6 %) while minorities 12 % were triaged as yellow or green. Patients transported by ambulance were only 21.5 %, and in most cases (82.5 %) were visiting an ED for the first time in 30 days and paid out of pocket for their care (82.7 %). The majority of patients presented to the ED on weekdays (67.9 %) whereas the time of death was evenly distributed between daytime, evening and overnight throughout the week. Relative to medical patients, trauma patients were more likely to be male, less likely to have had prior recent ED visits and were triaged as higher acuity. In this study the predictors of death within 6 hours of ED arrival were patient symptom duration less than 4 hours (7).

A limitation of this study was that a minimum sample size was not calculated, making it difficult to draw conclusions based on data with insufficient sample size. additionally, patients who died after 72 hours were excluded, which complicates generalization of findings to overall ED mortality, as death after prolonged lengths of stay could be significant in LMICs.

As this study was prospective and excluded deaths after 72 hours of ED stay, ward deaths that occurred within 72 hours of presentation, has been included, cannot be good enough for our study finding.

In a separate three years retrospective study conducted at Black lion Hospital, in 2018 to 2020, total mortality rate of 2.8%, of which 7.6% were deaths on arrival, and 71.4% were deaths occurred within 72h. Majority of the patients were from Addis Ababa (41%) and self-referred (51%). The average age of death was  $43.5 \pm 17.33$  years, with male to female ratio of 1.2:1. Majority of cause of death were medical diseases causing about 92.7% of deaths. This study indicated that 44.5% of participants fell under the red triage category, and more than half 54% arrive at the hospital by taxi. The top three causes were, shock 186 (36.7%), respiratory disease 152 (30%), and sepsis 85 (16.8%). Red triage category and duration of symptoms 4–24h were negatively associated with very early ED mortality (8).

In comparison to previous study, there were slight increment in overall mortality and a significant reduction in death on arrival. Changes in predictors of early mortality, and top cause of death pattern change were noted, but gender proportion remained nearly the same.

This study design as well, as other features are almost similar with our study and could have great potential for comparison.

In another multicenter national eight years retrospective study which included 43 public and private hospitals in Addis Ababa city, there were

47,153 deaths registered, with male to female ratio of 1.3:1. The most common causes of deaths being a grouped diseases as one entity (HIV/AIDS, Tuberculosis, respiratory infection, DM, Meningitis, Maternal Conditions, and Conditions arising during perinatal period) (9).

Despite the strength of being multicenter, large retrospective cohort made it stronger, lack of specification for each hospital's deaths, and summing up diseases in a group as single entity makes it difficult for comparison.

In a three-year (2000–2003) retrospective study conducted in the emergency department of an urban Nigerian hospital, 446 patients died out of 22,791 seen during the study period, for a crude mortality rate of 2%. The male to female death ratio was 1.5:2, with the trauma and non-trauma subsets being 4.6:1 and 1.2:1 respectively. across all age categories, were considered, the 20–49 age group was the most affected, accounting for 79.8 percent of all deaths. The overall mean age at death, however, was  $33 \pm 9.4$  years. Trauma fatalities had an average peak age of 20–29 years, while non-traumatic deaths had an average peak age of 40–49 years. Road traffic accidents and assault were the leading causes of traumatic death, accounting for 57.8 % and 11.1 % of all traumatic deaths, respectively. Cardiovascular diseases accounted for the majority of non-traumatic deaths (25.2%). Most patients (70.95) died within six hours after arriving at the emergency department, while 3.6 percent (16) died on arrival. The average length of stay in the emergency department was around 22 hours (10).

In a separate 3-year retrospective study conducted in one sub-urban Nigerian hospital, the total number of patient visits to the emergency department from 2005 to 2007 was 5754, with a male to female ratio of 1.4:1. There were 281 deaths registered, throughout the period, making a crude mortality rate of 4.88 % with male to female ratio of 2.3:1. The patients that died ranged in age from 19 to 100 years, with a mean of 47.324.5 years. The age groups 41–50 had the largest number of deaths. The majority of deaths occurred in people under the age of 50 (11).

The limitations of the two Nigerian studies mentioned above include their purely descriptive study with limited variables and the study setup being both medical and trauma has been included.

Being on the same continent, with potential similarities in socio-demography and healthcare infrastructure, makes it relevant to our study but relatively being done before 19 and 15 years respectively makes it relatively older for comparison.

In summary, literature from LMIC shows a significant burden of mortality, primarily from preventable diseases, with the leading causes of death related to infectious diseases and trauma. The mean age of death ranges between 33 to 50 years. The male to female ratio of death showed relatively high mortality in male groups (12–16).

**List of abbreviations**

C/C Chief complaint  
 DOA Death on arrival  
 DM Diabetes mellitus  
 ED Emergency department  
 HIV/AIDS Human immuno-deficiency virus  
 LMIC Low-and middle-income country  
 LOS-Length of stay  
 PI-Primary investigator  
 SPHMMC-St. Paul hospital millennium medical collage  
 UGIB-Upper gastrointestinal bleeding

**Declarations****Ethics approval and consent to participate**

Ethical approval was obtained from St Paul Hospital Millenium Medical collage IRB, Consent to participant is not applicable since this study is secondary chart review

**Consent for publication**

We authors agreed on publication of this study protocol as per EJHD publication guideline.

**Availability of data and material**

As datasets are being on collection phase it is not applicable.

**Competing interests**

We have no conflict of interest.

**Funding**

We have no external funding grant provided for this study and the needed budget will be contributed by authors.

**Authors' contributions**

The principal investigator initiated the concept of conducting this study as well as reviewing literatures, study design selection and final manuscript preparation. The co-author involved in literature review, study design selection, manuscript write up and editorial work.

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**References**

1. Everybody's business: strengthening health systems to improve health outcomes: WHO's framework for action. World Health Organization; 2007. p. 1–56. ([http://www.who.int/healthsystems/strategy/everybodys\\_business.pdf?ua=1](http://www.who.int/healthsystems/strategy/everybodys_business.pdf?ua=1))
2. Hirshon JM, Risko N, et al. Health Systems and services: the role of acute care. Bull World Health Organ. 2013; 91:386–8. doi:10.2471/BLT.12.112664.
3. Hsia R, Razzak J, Tsai AC, Hirshon JM. Placing emergency care on the global agenda. Ann Emerg Med. 2010; 56:142–9.
4. Razzak JA, Kellermann AL. Emergency medical care in developing countries: is it worthwhile? Bull World Health Organ. 2002;80(11):900–5. Epub 2002 Dec 3. PMID: 12481213; PMCID: PMC2567674.
5. Germa, F., Bayleyegn, T., Kebede, T., Ducharme, J., & Bartolomeos, K. (2013). Emergency medicine development in Ethiopia: Challenges, progress and possibilities. African Journal of Emergency Medicine, 3(1), 3–9. <https://doi.org/10.1016/j.afjem.2012.08.005>
6. SPMMC. (2022). St. Paul's Hospital millennium medical college strategic plan 2018/19-2022/23 ( 1<sup>st</sup> ed.,Vol1) (E-book).St. Paul Hospital millennium medical college.
7. Hunchak, C., Teklu, S., Meshkat, N. et al. Patterns and predictors of early mortality among emergency department patients in Addis Ababa, Ethiopia. BMC Res Notes 8, 605 (2015). <https://doi.org/10.1186/s13104-015-1592-z>
8. Yosha HD, Tadele A, Teklu S, Melese KG. A two-year review of adult emergency department mortality at Tikur Anbesa specialized tertiary hospital, Addis Ababa, Ethiopia. BMC Emerg Med. 2021 Mar 19;21(1):33. doi: 10.1186/s12873-021-00429-z. PMID: 33740901; PMCID: PMC7980661
9. Misganaw A, Mariam DH, Araya T, Ayele K. Patterns of mortality in public and private hospitals of Addis Ababa, Ethiopia. BMC Public Health. 1007;2012:12.)
10. Ekere AU, Yellowe BE, Umune S. Mortality patterns in the accident and emergency department of an urban hospital in Nigeria. Niger J Clin Pract. 2005 Jun;8(1):14–8. PMID: 16392450.
11. A.B. Chukuezi and J.N. Nwosu, Pattern of Deaths in the Adult Accident and Emergency Department of a Sub-Urban Teaching Hospital in Nigeria, Asian Journal of Medical Sciences 2010,2(2): 66–69
12. Onwuchekwa AC, et al. Medical Mortality in the accident and emergency unit of the University of Port Harcourt Teaching Hospital. Niger J Med. 2008;17:182–5.
13. Osime OC, et al. Patterns of trauma deaths in an accident and emergency unit. Prehosp Disaster Med. 2007;22:75–8.
14. Afuwape OO, Ogunlade SO, et al. An audit of deaths in the emergency room in the university college hospital Ibadan. Niger J Clin Pract. 2009;12:138–40.
15. Ugara GU, Ndifon W, Bassey IA, Oyo-Ita AE, Egba N, Asuquo M, Udosen AM. Epidemiology of death in the emergency department of a tertiary health centre south-south of Nigeria. Afr Health Sci. 2012;12:530–7.