ADDIS ABABA UNIVERSITY

COLLEGE OFHEALTH SCIENCE

DEPARTMENT OF ANESTHESIA

MORTALITY AND ASSOCIATED FACTORS OF GERIATRICS PATIENTS ADMITTED TO INTENSIVE CARE UNIT OF ADDIS ABABA PUBLIC HOSPITALS, ETHIOPIA, RETROSPECTIVE COHORT STUDY.

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The research was submitted to Addis Ababa University School of Medicine Department of Anesthesia for Partial fulfillment of The Master of Science Degree in Anesthesia

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Full title of the research	Mortality and associated factors of geriatrics patients admitted to the intensive care unit of Addis Ababa Public Hospitals, Ethiopia
Duration of the project	Jan 1, 2021, to Dec 31, 2023
Study area	TASH, Y12HMC,SPHMMC
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Abstract

Background: The number of elderly patients referred to the ICU is rising quickly along with the aging population globally. Due to previous medical conditions and age-associated alterations in their bodies, these individuals have a higher chance of mortality. Geriatric mortality was high even in developed countries and sub-Saharan African countries had the highest rates of mortality including our country Ethiopia. Different factors affected these vulnerable populations.

Objective: To assess mortality and associated factors of geriatric patients admitted to the intensive care unit of Addis Ababa Public Hospitals.

Method: A multicenter retrospective cohort study was conducted among geriatric patients in Addis Ababa public hospitals who were admitted to the adult ICU. A total of 302 geriatrics who fulfilled the criteria were included in this study. Data were collected by pretested structured questionnaire from the patient card and ICU log book. After that collected data were entered into the SPSS 26 version for analysis. The association between the risk factors and dependent variable was assessed by using logistic regression. Bivariate and multivariable logistic regressions were employed. A variable with a p-value < 0.05 in multivariable was considered statically significant.

Result: There was a 42.1% incidence of geriatric death in our critical care units. Aging (AOR=9.436, 95%CI, 2.300 – 38.716), MV (AOR=7.281, CI, 2.364 – 22.429), vasopressors (AOR=10.982, CI, 3.658 –32.976), decrease in level of consciousness (AOR=4.766, CI, 1.606 – 14.145), duration of MV (AOR=6.909, CI, 2.138 – 22.322), and length of ICU stay (AOR=15.599,CI, 4.925 –51.970) were the determinants of mortality in this population age.

Conclusion: This study indicated that there was high number of mortality rate and determinant factors that influence mortality were aging, MV, vasopressors, decrease in level of consciousness, duration of MV and length of ICU stay.

Keywords: elderly, Intensive care unit, ICU admission, mortality rate

Declaration

I, the undersigned, declare that this thesis is my original work, has not been presented, in this or

Any other university and all sources of materials used for the thesis have been fully acknowledged.

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APPROVAL BY BOARD OF EXAMINATION

This thesis by Beyene Guta is accepted in its present form by the board of examiners as a requirement for the **Master of Science Degree in Anesthesia**

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Examiner (2)

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List of acronyms/Abbreviations

ARDS	Acute respiratory distress syndrome
CI	Confidence interval
EB	Ethiopian Birr
G.C	Gorgorean calendar
GCS	Glasgow coma scale
ICU	Intensive care unit
IQR	Interquartile range
MV	Mechanical ventilator
SPSS	Software package for social science
WHO	World Health Organization

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CHAPTER ONE: INTRODUCTION

1.1 Background

Global projections indicate that by 2050, there will be 1.6 billion persons 65 years of age or older, a doubling from 761 million in 2021. One in six people globally is predicted to be in this age range by 2050. Over the next thirty years, the old population is expected to expand at the quickest rates in the northern parts of Africa, the western part of Asia, as well as sub-Saharan Africa. Nowadays, Northern America and Europe have the highest percentages of older individuals [1]. For instance, life expectancy in Africa increased to over 65 years in 2015, accounting for 3.5% of the total population (40 million)[2]. On the other hand, 3.2% of the Ethiopian population was over the age of 65[3].

Decline end-organ reserve, diminished performance, and an increasing prevalence of pathological disorders are signs of aging, which is a normal and continuous physiological phenomenon[4]. The WHO categorizes chronological age as: The years 65-75 indicate early old age and the changeover from working lifestyles to retirement; superior age, 75–85 years, which is also the time whilst purposeful losses start to reveal; 85 years of age and above is considered very superior old age and a time that desires more attention and care[5].

An increased risk of multiple medical conditions, the simultaneous development of several chronic diseases, and a rise in comorbidities are linked to aging [6, 7]. As people age, comorbid conditions such as high blood pressure, diabetes, cardiovascular disease, malignancy, and cognitive decline are common[8]. Those ICU patients who have multiple morbidities have higher mortality rates[9]

Intensive care advancements allowed these patients to receive treatment despite their advanced age and related morbidity [10-14]. The amount of elderly patients admitted to intensive care units (ICUs) is rising quickly in several nations due to population aging and rising life expectancy [15-18]. Elderly patients currently make up 42–52% of admissions to intensive care units and nearly 60% of all ICU days, even in highly industrialized nations like the USA[19]. ICU admission rates in sub-Saharan African nations also range from 10.2% - 16.6% [20-22].

The healthcare sector, the economy, and communities around the world are predicted to be significantly impacted by the rapidly increasing aging population. Serious concerns regarding the mortality rate and related variables of elderly patients admitted to intensive care units. Developing successful ways to enhance the health of patients and decrease mortality requires a grasp of these challenges. This research intends to examine the mortality rate and related variables of elderly patients transferred to ICUs, highlighting the challenges and possibilities associated with aging populations.

1.2 Statement of the Problem

Elderly people are one of the world's neglected populations. They have a difficult time getting access to medical services, especially in underdeveloped nations where resources are scarce along with the infrastructure for providing care is frequently poor. When it comes to healthcare establishing priorities, older patients are frequently overlooked in favor of younger patient groups. Elderly people, who have already become vulnerable because of their advanced age, may receive insufficient care and support as a result of this negligence [23, 24].

The number of elderly patients referred to the ICU is rising quickly along with the aging population globally. Due to previous medical conditions and age-associated alterations in their bodies, these individuals have a higher chance of mortality.

In addition to this, these patients were at risk of dying because health professionals were reluctant to provide them with ICU care [25]. According to the study done regarding ICU geriatrics mortality, it was high even in developed countries [26] and those done in African countries indicated the highest rates of mortality [21, 22].

Most of the studies done in Ethiopia on mortality and associated factors identified regarding adult ICU patients' mortality even though the increase in the number of elderly patients in ICU. According to those research, the mortality rate is from 14.9% to 46.8% and cardiovascular cause of disease, patient’s age, disease types, complication, comorbidities, change in mentation, and need for MV and length of ICU stay were predictors of death [27-30].

To improve the mortality rate, it is crucial to determine the mortality and related factors of elderly patients admitted to the intensive care unit. The issue is that attitudes on the effectiveness of interventions for this age group of people are divided, and more study is required to fill in knowledge gaps and propose potential areas for future investigation. There is limited data on the mortality and associated factors of elderly patients in the ICU regarding our setup, despite some research being done on outcomes of adult patients in

the ICU in Ethiopia also makes the gap of knowledge on elderly patients. The goal of this study is to evaluate the mortality and associated factors for elderly patients admitted to the ICU at Addis Ababa public hospitals

1.3 Significance of the Study

The results of this study help; healthcare providers take preventive measures to handle the issue early and ensure that these patients receive the required care and have the best results by determining their risk of death and related factors. Additionally, by identifying the factors that lead to mortality, this knowledge aids in developing ways to minimize healthcare costs and optimize the use of available resources.

The findings can also be used to guide the formulation of moral guidelines for intensive care units that honor the wants and desires of geriatric patients and their relatives. The results of this study will be an invaluable tool for scholars and researchers, bridging knowledge gaps for directing further study. In general, the study's insights will directly improve the care and results provided to elderly patients in intensive care units, which is expected to enhance their quality of life span and lower their death rates.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This literature review aims to summarize what has already been the existing knowledge base about geriatric mortality and associated factors, to discuss the impact of the research findings on clinical practice, and to identify gaps in the mortality of geriatric patients in Ethiopia. As a baseline, literature has been reviewed and collected on the incidence of mortality, demographic data, admission source, reason for admission, ICU management, and comorbidities which have an impact on geriatrics ICU mortality and quality of life among geriatrics patients admitted to ICU.

2.2 Mortality of Geriatrics Patients in Intensive Care Unit

A current systemic review of elderly patients admitted to the intensive care unit (ICU) undertaken after the year 2000 revealed that the mortality rates in the ICU varied from 1% to 51%[31]. Geriatric ICU mortality rates vary significantly across different countries and regions. In 2022, a study reported the highest ICU mortality rate in Israel at 40.1%, followed by Australia at 20.6% and the USA at 13.9%[32]. Research in Brazil in 2019 found a geriatric ICU mortality rate of 13-17.3%[33], while a Spanish study in 2016 reported an overall mortality rate of 17%[34].

According to research done in India in 2014, the overall ICU mortality rate in the study population was 19.6%;[35]. A Retrospective study was done in Turkey in 2020; the 28-day mortality rate was, 41.7% [36]. Other research done in China in 2021 indicated that the mortality rates in the ICU significantly increased with age. In the age group of 80 years and older, the mortality rate was 49.5%, whereas the 35.0% rate for the age group of 65–79 years. The mortality rate for men was significantly higher than that for women in the overall study population, and this difference was most pronounced among elderly patients (age≥65 years)[37].

In contrast, studies from Africa have reported much higher geriatric ICU mortality rates. A 2018 study in Burkina Faso found an overall ICU mortality rate of 73%, with 90% of patients dying within 7 days of admission[21], A 2016 Nigerian study reported a geriatric ICU mortality rate of 58.1%[22], a Moroccan study in 2021 found an overall ICU mortality of 44.7%, with 64% of deaths occurring within 5 days of admission and that done in Senegal was 42.8% ICU mortality [20]

Most of the studies done In Ethiopia on mortality and associated factors identified regarding adult ICU patients even though the increase in the number of elderly patients in ICU. According to research done in Jimma University specialized hospital in 2014, there was a 37.7% mortality rate in the ICU during the study period with diseases of cardiovascular origin being the major reasons for ICU admission and death of adult patients [38]. A study conducted in 2023 at Ayder Comprehensive Specialized Hospital found that among adult patients admitted as inpatients, the patient's age, disease type, complication, and comorbidities were independent predictors of death with a mortality rate in hospitals of 14.9%. [39]. In a 2023 study conducted at Tibebe Ghion Specialized Hospital, The patients admitted to the intensive care unit had a total death rate of 29.6% with ICU mortality predicted by years of admission, changed mentation, need for mechanical ventilation, and length of stay in the ICU[27]. Following research conducted in 2021 in southern Ethiopia, the total ICU death rate was 46.8%. The majority of independent predictors included being on a mechanical ventilator, aspiration, cardiac arrest, infection, and unstable vital signs upon admission.[28].

2.3 Factors associated with mortality in the geriatrics intensive care unit

Respiratory, cardiac, and sepsis are the main reasons why older people in the US are sent to the intensive care unit (ICU), with a notable rise in sepsis diagnoses in the last few years [40]. According to research done in 2019 in Brazil Sepsis was the most prevalent diagnosis of ICU admission and surgical emergencies are a separate risk factor for ICU mortality.[33]. According to a Spanish study, patients in the intensive care unit (ICU) who required ventilator support and were 75 years of age or older had an increased risk of passing away; however, patients who had infections or experienced a drop in consciousness during their stay were found to be independent risk factors for death [34].

Patients who were over 80 years old in China were less likely to obtain mechanical ventilation (MV) due to trauma or surgical reasons. In contrast, they were more likely to have MV for medical explanations such as cardiac failure, respiratory infections, and aspiration. It suggests that the percentage from medical wards was greater than that from surgical wards as well as age, the total duration of MV, and ICU Length of stay were independent influence factors for mortality rates.[37] A study done in Turkey in 2020 indicated that the conditions diagnosed in the patients upon admission were neurological disorders (25%), cardiac diseases (55.5%), kidney issues (28.4%), and respiratory illnesses (75.5%). The majority of patients (50.3%) came from the emergency department, with chest disease accounting for the second most common cause (41.5%)[36]. as well as the one done in 2021, (71.1%) of the patients referred from the emergency services to ICU[41]. According to a study done in India Mechanical ventilation and the use of inotropes were found to be predictors of mortality in the elderly population[35].

According to studies conducted in Saudi Arabia, the majority of frequent causes of elderly patients' ICU admissions were cardiac (30.9%) and pulmonary (40.4%) disorders[42].

The study done in Burkina Faso indicated shock, severe brain trauma, coma, surgical condition, complications occurring, and stroke were independent factors for mortality[21]. In 2016, a study conducted in Nigeria revealed that 75% of the patients had multiple co-morbid diseases, with hypertension accounting for 45% of the cases. Of the admissions, 24.2% were due to medical disorders, with cerebrovascular illness making up 60% of the medical category. The remainder, or 75.8%, were for surgical procedures. Of the patients, 58% were admitted after surgery (with general abdominal and neurosurgery procedures accounting for 80% of the surgeries), and 22% had been admitted as a result of trauma. Including all medical and unscheduled surgical admissions, the overall percentage of unplanned admissions was approximately 74.2%. 53.2% of the elderly patients were on mechanical ventilation, and an endotracheal intubation was used in 65% of the cases. Sixty-six percent of patients in the ICU stayed for less than a week, with stays ranging from one to thirty-one days[22], and that done in Morocco identified pneumonia, and shock were the factors predicting mortality[20].

In general, we conclude the review indicates that the most common types of admission are respiratory illness, cardiac disease, and neurological disease by emergency cases while in some African countries, surgical admission is more common than a medical case like Nigeria. ICUs in developed countries admitted large numbers of patients and gave good service. There was a low mortality rate with a higher survival rate when we compared with sub-Saharan African countries.

The incidence of mortality rate in geriatrics in ICU is higher in developing and low-income countries like our country due to limited infrastructures as well as the inability to identify and control predictor factors of mortality.

Conceptual Framework

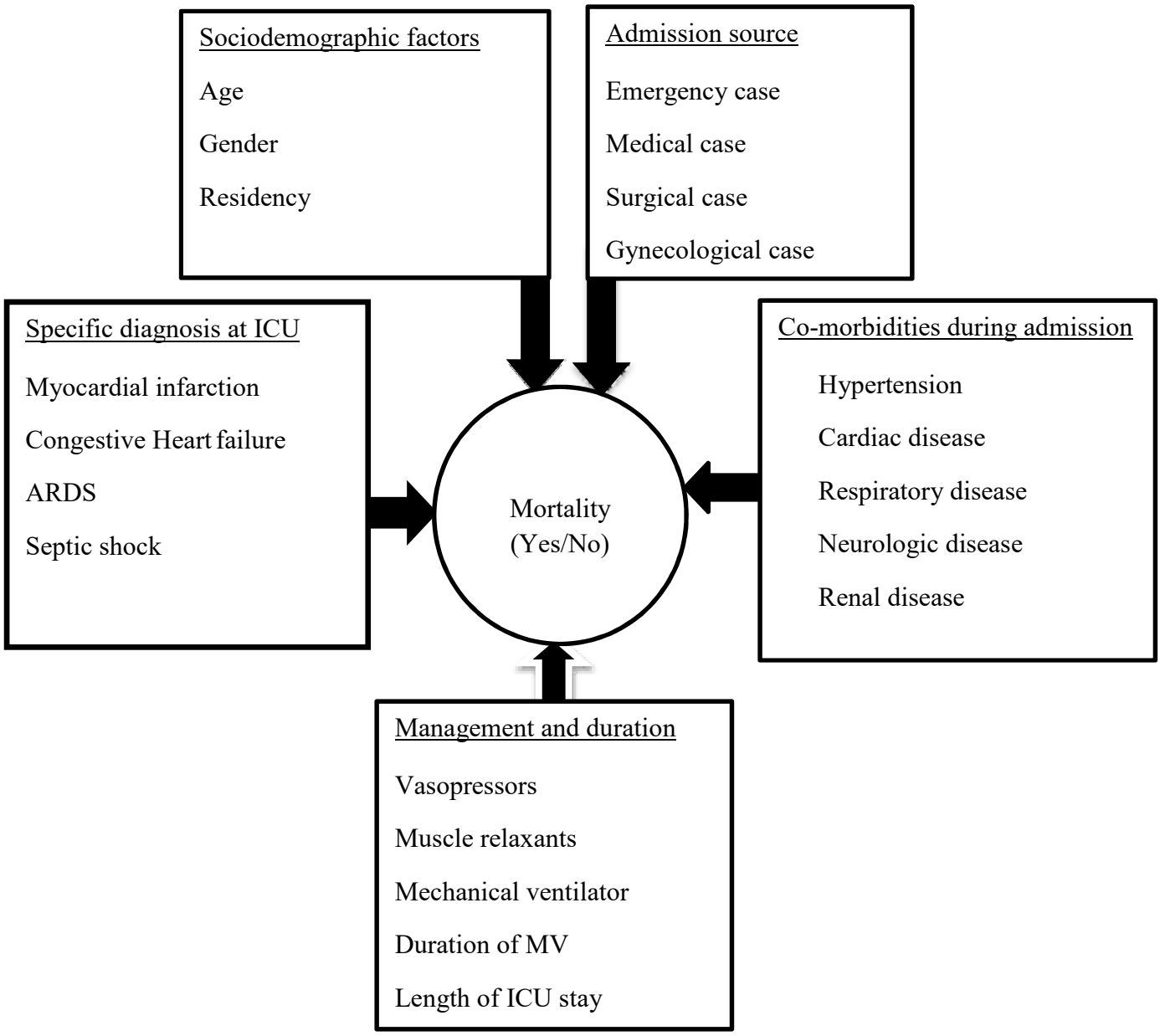

Figure 1: Conceptual framework of factors associated with geriatrics mortality in the intensive-care unit at addis ababa selected public hospital 2021-2023, [43-45].

CHAPTER THREE: OBJECTIVES

3.1 General objective

To assess mortality and associated factors of geriatric patients admitted to the intensive care unit of Addis Ababa Public Hospitals, Ethiopia.

3.2 Specific objectives

To determine the incidence of geriatric mortality in the intensive care unit of Addis Ababa Public Hospitals, Ethiopia

To identify factors associated with geriatric mortality in the intensive care unit of Addis Ababa Public Hospitals, Ethiopia.

CHAPTER FOUR: METHOD AND MATERIAL

4.1 Study design

A multi-center retrospective cohort study was used.

4.2 Study area, and period

The research was carried out in Addis Ababa, the capital city of Ethiopia which has a population size of 4.8 million[46].

There are 14 public hospitals, over 40 private hospitals, 86 health centers, and numerous Non-Governmental Organizations and health institutions. Out of 14 public hospitals, 11 public hospitals of Addis Ababa give the ICU service; from them, Tikur Anbesa Specialized Hospital (TASH) has 12 ICU beds, St. Paul's Hospital Millennium Medical College (SPHMMC) has 13 ICU beds and Yekatit 12 medical college (Y12HMC) has 10 ICU beds which give ICU service with the center of specialty. These hospitals are relatively equipped and serve almost the whole population of the city as well as receive patients from other all regions of the country for different subspecialty areas. The study was conducted in these three hospitals from April 1 to May 31, 2024, G.C.

4.2.1 Population

4.2.2 Source Population

- The source of the populations were all patients admitted to the ICU at Addis Ababa public hospitals

4.2.3 Study Population

- The study populations were all geriatric patients admitted to the ICU at Addis Ababa selected hospitals who fulfilled inclusion criteria during the study period.

4.3. Eligibility Criteria

4.3.1 Inclusion Criteria

- All patients aged ≥ 65 years
- ICU admission more than 24hrs and

4.3.2. Exclusion Criteria

- Missed key variable
- The patient transferred to another hospital
- Patient admitted more than one times
- Patients with muscular disease who need chronic MV
- Covid-19 patients who were diagnosed and transferred to the Covid center

4.4. Variables

4.4.1 Dependent variable

Mortality (yes or no)

4.4.2 Independent variable

Socio-demographic variables; age, gender, residency

Source of admission; medical case, emergency case, surgical case, gynecological case, postoperative case

Presence of comorbidities illness; hypertension, diabetes mellitus, neurologic disease, cardiac disease, malignancy, renal disease, respiratory disease, ARDS and others

Reason for admission; cardiovascular disease, respiratory disease, infectious disease, neurologic disease, endocrine disease, renal disease, hematologic disease, poisoning, trauma

Vital signs at admission; PR, RR, T^0, SPO2, SBP and GCS

Specific diagnosis at ICU;myocardial infarction(MI),congestive heart failure (CHF), acute respiratory disease syndrome, septic shock, diabetic ketoacidosis(DKA),stroke,

Human immunodeficiency virus (HIV),infection pneumonia, cardiogenic shock, pulmonary thromboembolism

Management of patients during ICU stay; mechanical ventilator, blood transfusion ,use of muscle relaxants, use of analgesia, use of sedative drugs, use of vasopressor, length of ICU stay

4.5 Sample Size Determination and Sampling Techniques

4.5.1 Sample Size Determination

The sample size was calculated manually based on a single population proportion by assuming 50% of the geriatrics patients admitted to ICU as no similar study was found in the study area (to obtain the maximum representative sample size) with 95% confidence level and α=5%. Therefore, the total sample size was,

$n= (Z \alpha /2)2\times p\times q / d2$

$= (1.96)^2\times 0.5 \times 0.5/ (0.05)^2$

$= 384$

Where:

n = sample size.

Z= desired 95% confidence, Z=1.96

p = prevalence (50% is preferred to obtain the largest possible sample size)

q =1-*p = 1-0.5= 0.5*

d = is the margin of sampling error tolerated

4.6 Sampling Technique

All patients who were admitted to the critical care unit from January 1, 2021, to December 31, 2023GC who fulfilled the study's inclusion criteria were included until the required sample size was completed. Study participants were selected by systematic random sampling technique. First, the sample was determined depending on the number of geriatric ICU patients in each purposely selected public hospital, and then the total sample size was proportionally allocated to each public hospital, depending on the number of geriatric ICU patients. The geriatrics ICU patient lists were obtained from the ICU log book of each unit at three selected public hospitals.

After three months situational analysis was done the total ICU admissions in three centers were (N = 2160) patients. The total number of geriatrics ICU patients of two years of admission were TASH (960), SPMMC (720), and Y12HMC (480) giving a total =2160. The study populations were taken from each ICU with a proportion allocation formula by dividing the admission in each ICU by the total admission of the three ICUs multiplied by the sample size (n = 352). Then, the required number of participants was selected with systematic random sampling with a skip interval of (k = 6).

N= the total number of ICU admissions in three centers

Since the study population was < 10,000 a correction formula $nf = \frac{n}{1+\frac{n}{N}} = \frac{384}{1+\frac{384}{2160}} = 320$

10% missed /incomplete data and the final sample size was approximately = 352.

The calculated sample size was proportionally allocated for each hospital as the following figure.

By using the proportional allocation formula

TASH, $n_i = \left(\frac{n}{N}\right) Ni = \left(\frac{960}{2160}\right) 352 = 157$ SPMMC, $ni = \left(\frac{n}{N}\right) Ni = \left(\frac{720}{2160}\right) 352 = 117$

Y12HMC, $ni = \left(\frac{n}{N}\right) Ni = \left(\frac{480}{2160}\right) 352 = 78$

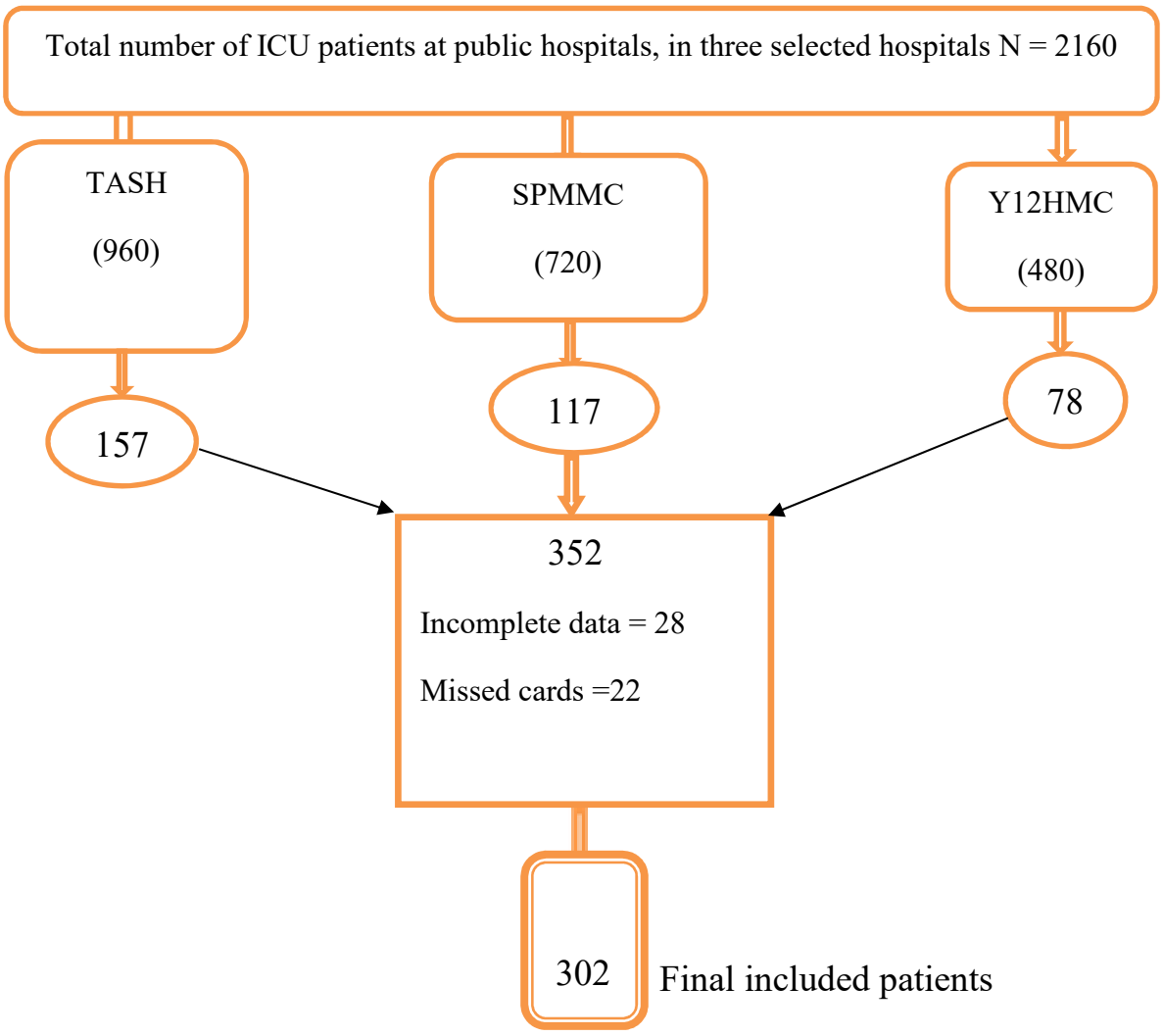

Figure 2: Strobe flow chart shows patients' allocation at three selected hospitals.

4.7 Data Collection

The questionnaire was adapted by reviewing different literature and ten days before the data collection a pre-test was conducted in Addis Ababa, Zewuditu Memorial Hospital in 5% of the sample size for completeness and validity of the data collection format. Based on the findings of the pre-test, questions were modified. The principal investigator was continuously supervising the data collectors for completeness and consistency and the records were cross-checked.

The following data were collected retrospectively: age, gender, residence, source of admission, the reason for ICU admission, specific diagnosis at ICU, presence of comorbidities and vital signs during admission, were obtained from patient chart and treatment characteristics; the need for mechanical ventilation and days on MV, the need for vasopressors, length of stay, death, and cause of death were recorded from intensive care unit registration. Three ICU nurses were employed in the data collection process and one anesthetist was a supervisor. A 1-day training was given for them on the objectives of the study, the contents of the questionnaire, and issues related to confidentiality. Duration of data collection from April 1 - 30, 2024

4.8 Data Quality Assurance

Data collectors received training to guarantee the quality of the data, and the investigator was given continuous monitoring and follow-up. Additionally, a daily check was conducted to ensure that the data was consistent and complete. The data was sorted, categorized, and summarized once it was gathered and verified for reliability, accuracy, and completion.

4.9 Operational Definition

Geriatrics: patients who are 65 years and above

Death: patients who died in the intensive care unit.

Survive: patients who improved and were discharged from ICU

Intensive care unit: is a separate area to care for patients with critical illness

Source of admission: types of cases (like emergency, medical, surgical…)

4.10 Data Processing and Analysis

After the processing of the data was completed it was entered to the SPSS 26 generation for analysis. The characteristics of the participants were analyzed using descriptive statistics like frequency, percentage, median, and interquartile range, and cross-tabulation. By checking multicollinearity using variance inflation factor < 10 and tolerance test > 0.1, variables having $p < 0.25$ at bivariate logistic regression analysis were fit into multivariable logistic regression. Statistically significant associations in multivariable analysis were defined as having a p-value of less than 0.05.

4.11 Ethical Considerations

We obtained Ethical clearance from Addis Ababa University College of health science. The department of anesthesia was provided approval and a letter of collaboration for the Tikur Anbesa Specialized Hospital, Yekatit 12 hospital medical college and St.paulos

millennium medical college. We submitted legal letter to all three hospitals. After complete explanations of the study's goals and methods, all selected hospitals were allowed to perform the study. The data collector collected the data after permission from the hospital and study participant information was obtained from the record. The privacy of the health facility was kept.

4.12 Dissemination Plan

The result of the study will be presented to the department of anesthesia staff. It will be submitted to journals for publication. The research will recommend to the concerned body to allocate resource utilization for ICU to integrated care for older people. Finally, it will be published in journals, and on the AAU College of Health Science repository.

CHAPTER FIVE: RESULT

5.1. Socio-demographic characteristics of the geriatric patients at ICU in Addis Ababa selected hospitals.

There were a total of 302 patients were included in this study for the final analysis and described by descriptive statistics like frequency and percentage, determined by the table, pie chart, and bar graph. Among these 132(43.7%) were female and 170(56.3%) were male whereas 200(66.2%) were between 65 – 75 years of age, 72(23.8%) were 75 – 85 years and 30(9.9%) were > 85 years. More than half of the patients 163(54%) came from rural areas and 139(46%) were from urban areas.

Table 1: socio-demographic characteristics of the geriatrics patients at ICU in Addis Ababa public hospitals.

Variables		**Frequency**	**Percent**
Age	65-75	200	66.2
	75-85	72	23.8
	>85	30	9.9
Gender	Female	132	43.7
	Male	170	56.3
Residency	Rural	163	54.0
	Urban	139	46.0

5.2 Clinical characteristics of the geriatric patients at ICU in Addis Ababa selected hospitals.

5.2.1 Source of admission and reason for admission of the geriatric patients at ICU in Addis Ababa public hospitals.

From the total patients 99(32.8%) were admitted from medical case, followed by emergency case 84(27.8%), postoperative case 61(20.2%), and surgical case 40(13.2%), and fewer of the patients were admitted from gynecology case 18(6%).

From the total patients 22.8%, were admitted due to cardiovascular disease, 18.2% neurological disease, 16.2% respiratory disease, 4% due to poisoning and 3.6%hematologic disease.

Table 2: source of admission and reason for admission of the geriatric patients at ICU in Addis Ababa public hospitals.

Variables		Frequency	Percent
Source of admission	Emergency case	84	27.8
	Medical case	99	32.8
	Surgical case	40	13.2
	Gynecological case	18	6.0
	Post operation case	61	20.2
Reason for ICU admission	Cardiovascular disease	69	22.8
	Respiratory disease	49	16.2
	Infectious disease	21	7.0
	Neurologic disease	55	18.2

	Endocrine disease	22	7.3
	Renal disease	18	6.0
	Hematologic disease	11	3.6
	Poisoning	12	4.0
	Trauma	17	5.6
	Others	28	9.3

5.2.1 Specific diagnosis of geriatrics patients at ICU in Addis Ababa selected hospitals.

From the diagnosed at ICU; septic shock 25.5%, myocardial infarction 10.93%, ARDS 10.6%, and stroke 10.6% whereas cardiogenic shock 3.64% was less diagnosed.

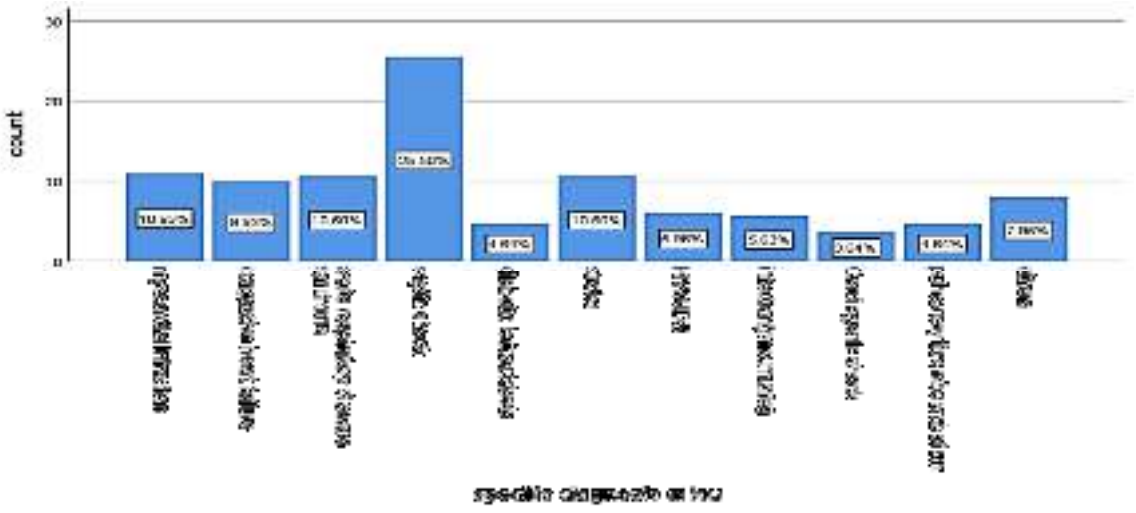

Figure 3: Specific diagnosis of geriatrics patients at ICU in Addis Ababa public hospitals.

5.2.2 Comorbidities distribution among the geriatrics patients at ICU in Addis Ababa selected hospitals.

Comorbidities distribution among the participants were dominated by hypertension 171(56.6%) and followed by cardiac143 (47.4%), respiratory129 (42.7%), renal 127(42.1%) and neurologic diseases107 (35.4%). 83.1% of the patients were presented with more than two multiple comorbidities.

Table 3: Comorbidities distribution among the geriatrics patients at ICU in Addis Ababa public hospitals.

Variables		Frequency	Percent
Hypertension	No	131	43.4
	Yes	171	56.6
Diabetes Mellitus	No	225	74.5
	Yes	77	25.5
Neurologic Disease	No	195	64.6
	Yes	107	35.4
Cardiac Disease	No	159	52.6
	Yes	143	47.4
Malignancy	No	233	77.2
	Yes	69	22.8
Renal Disease	No	175	57.9
	Yes	127	42.1
Respiratory Disease	No	173	57.3
	Yes	129	42.7
Others	No	234	77.5
	Yes	68	22.5
Number Of Comorbidities	No	14	4.6
	One	37	12.3
	≥ 2	251	83.1

5.3 Clinical Management of the geriatrics patients at ICU in Addis Ababa selected hospitals.

5.3.1 Patients' vital signs during ICU admission of geriatrics patients at Addis Ababa selected hospitals.

Clinically the participants had a decrease in heart rate 128(42.4%), an increase in respiratory rate 193 (63.9%), a decrease in blood pressure 115(38.1%), a decrease in body temperature 144(47.7%) and a decreased mental status165 (54.6%).

Table 4: patients' vital signs during ICU admission of geriatrics patients at Addis Ababa public hospitals.

Variables		Frequency	Percent
Pulse rate	60 -100	47	15.6
	<60	128	42.4
	>100	127	42.1
Respiratory rate	12-18	72	23.8
	<12	37	12.3
	>20	193	63.9
Systolic blood pressure	90-140	75	24.8
	<90	115	38.1
	>140	112	37.1
Oxygen saturation	>90	214	70.9
	<90	88	29.1
Temperature	36.5-37.5	127	42.1
	<36.5	144	47.7
	>37.5	31	10.3
Mental status	GCS=13-15	37	12.3
	GCS = 9-12	100	33.1
	<9	165	54.6

5.3.2 Management given for geriatric patients at ICU in Addis Ababa selected hospitals.

During ICU management most of the patients were took vasopressor 222(73.5), MV 176(58.3%), analgesia 289(93.5%), muscle relaxant 144(47.7%), sedatives drugs 216(69.9%) and blood transfusion152 (49.2%).

Table 5: Management given for geriatric patients at ICU in Addis Ababa selected hospitals.

Variables		Frequency	Percent
Use of vasopressor	No	80	26.5
	Yes	222	73.5
Use of analgesia	No	13	4.2
	Yes	289	93.5
Use of muscle relaxant	No	158	52.3
	Yes	144	47.7
Use of sedative drugs	No	86	27.8
	Yes	216	69.9
Blood transfusion	No	150	48.5
	Yes	152	49.2
MV	No	126	41.7
	Yes	176	58.3

5.3.3 Duration of mechanical ventilation and length of ICU stay of geriatrics patients at Addis Ababa selected hospitals.

Of the total 302 patients, 58.3% of the patients received mechanical ventilation, the median duration of mechanical ventilation was 7 days, with an IQR of 9 whereas the median length of ICU stay was 7.5 days with an IQR of 9 days. The minimum and maximum duration of MV was 1 day and 26 days respectively and the length of ICU stay was 1 day and 28 days.

5.3.4 Complications and mortality happened at the ICU in Addis Ababa public hospitals.

Of the geriatric patients who faced complications at the ICU 127 (42.05%) died during ICU management care and only 38 (12.58%) of the patients were discharged after recovering from complications and 137(45.36%) of the patients were not complicated.

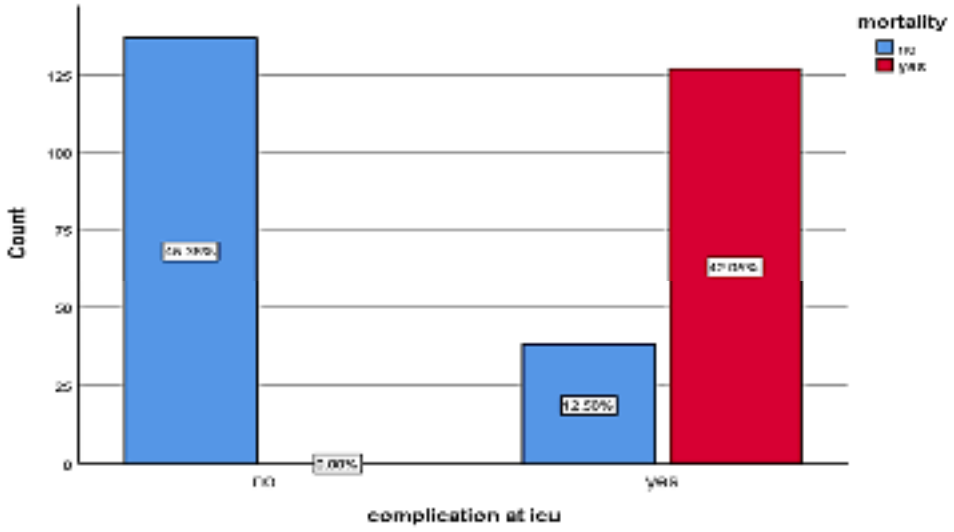

Figure 4: Complications and mortality happened at the ICU in Addis Ababa public hospital.

5.3.5 The overall incidence of mortality at ICU in selected Addis Ababa public hospitals.

Of the total 302 geriatrics patients admitted to ICU, the incidence of mortality at ICU was 42.1% with CI at 95% (36.4% - 47.8%), and 57.95% of the patients were improved and discharged from the ICU.

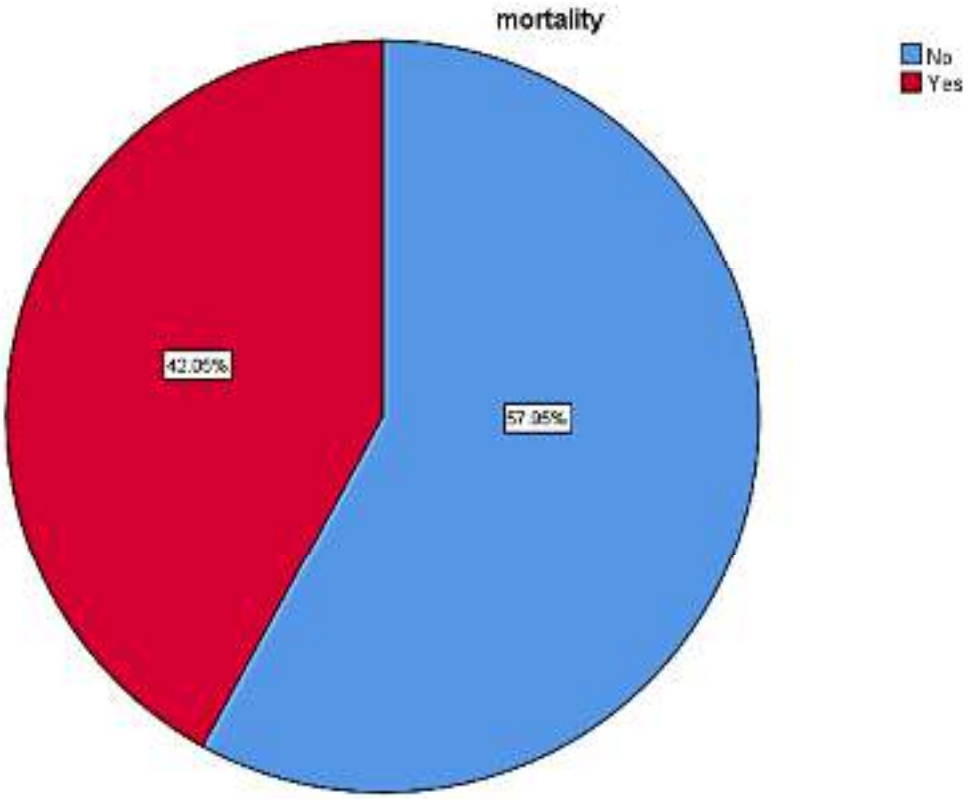

Figure 5: pie chart of the overall geriatric patients' ICU mortality at Addis Ababa public hospitals.

5.4 Factors associated with geriatrics mortality at ICU at Addis Ababa selected hospitals.

After checking the assumption of binary logistic regression in the binary logistic model, each variable was tested and those fulfilling the criteria with p value less than 0.25 were entered into the multivariable logistic regression model. Then it was conducted after checking the model fitness test (Osmer and Lemeshow). The p-value of the Osmer and Lemeshow test of model goodness of fit was 0.282 thus the assumption was fulfilled since the $p > 0.05$.

In multivariable logistic regression analysis, the age of the patients, use of mechanical ventilation, use of vasopressors, mental status, duration of MV, and length of ICU stay were significantly associated with geriatric patient death at ICU after controlling other variables constant at $p < 0.05$.

However, malignancy, other diseases, vital signs, use of muscle relaxants, and use of sedative drugs were not significantly associated with geriatric death at the ICU.

According to this study, individuals between the ages of 75 and 85 had 3.413 times greater death probabilities than patients between the ages of 65 and 75. The probabilities of death were 9.436 times higher in patients over 85. Relative to patients on MV, those who were not on MV had a considerably decreased death rate (AOR = 7.281, 95% CI: 2.364 – 22.429, p-value = 0.001). This shows that in elderly ICU patients, the usage of MV is a reliable indicator of death.

The mortality rate was considerably higher in patients who used vasopressors than in patients who were not given them (AOR = 10.982, 95% CI: 3.658 – 32.976, p-value = 0.001). This suggests that among elderly critically ill patients, the usage of vasopressors is linked to a higher risk of death. Lower score on the Glasgow Coma Scale: Compared to those with GCS 13–15, those having GCS less than 9 showed higher risks of dying(AOR = 4.766, 95% CI: 1.606 – 14.145, p-value = 0.001).

Mortality was highly associated with the length of ICU stay. In comparison to patients stayed for fewer than seven days, patients stayed for 14–20 days experienced a greater

death rate (AOR = 5.526, 95% CI: 1.768 – 17.270, p-value = 0.003). Similar to this, patients who stayed for 21–27 days died at a higher rate compared with those who were stayed for fewer than 7 days (AOR = 4.005, 95% CI: 1.279 – 12.536, p-value = 0.017). The greatest death rate (AOR = 15.599, 95% CI: 4.925 – 51.970, p-value = 0.001) was observed in patients who stayed for longer than 28 days.

A substantial relation was found between the duration of MV and death. (AOR = 6.909, 95% CI: 2.138 – 22.322, p-value = 0.001) showed that patients who were on MV for 7–13 days showed a greater mortality risk than individuals who received for less than a week. (AOR = 3.619, 95% CI: 1.163 – 11.263, p-value = 0.026) showed that patients who remained on MV for 14–20 days also had a greater mortality rate than the ones who received for fewer than 7 days. (AOR = 5.718, 95% CI: 2.000 – 16.349, p-value = 0.001) showed that the highest rate of mortality was observed in patients who were on MV for longer than 21 days.

Table 6: factors associated with geriatrics mortality at ICU in Addis Ababa selected hospitals.

Variable	Mortality				
	No n (%)	yes n (%)	COR(95% CI)	AOR(95% CI)	p-value
Age 65-75	142(71%)	58(29%)	1	1	
75-85	27(38%)	45(62%)	3.990 (2.260 - 7.042)	3.413 (1.298 – 8.978)	0.013*
>85	6(19.4%)	24(80.6%)	10.201 (3.977 - 26.165)	9.436 (2.300–38.716)	0.002*
Malignancy					
No	127(54.5%)	106(45.5%)	1	1	
Yes	48(69.6%)	21(30.4%)	0.524 (0.295 - 0.931)	0.453 (0.190 – 1.080)	0.074
Others#					
No	127(54.3%)	107(45.7%)	1	1	
Yes	48(70.6%)	20(29.4%)	0.495(0.276 - 0.885)	0.763 (0.311 – 1.869)	0.554
RR 12-18	52(72.2%)	20(27.8%)	1	1	
<12	17(45.9%)	20(54.1%)	3.059 (1.338 - 6.994)	2.247(0.617 – 8.184)	0.220
>20	106(54.9%)	87(45.1%)	2.134 (1.185 - 3.844)	1.154 (0.446 – 2.986)	0.768
SpO_2 >90	105(49.1%)	109(50.9%)	1	1	
<90	70(79.5%)	18(20.5%)	0.248 (0.138 - 0.444)	1.170 (0.250 – 5.475)	0.842
T^O 36.5-37.3	59(47.6%)	65(52.4%)	1	1	
<36.5	97(66%)	50(34%)	0.420 (0.257 - 0.688)	1.323 (0.590 – 2.968)	0.497
>37.3	19(61.3%)	12(38.7%)	0.548 (0.246 - 1.223)	0.530 (0.161 – 1.749)	0.298
SBP 90 – 140	30(40%)	45(60%)	1	1	
<90	72(62.6%)	43(37.4%)	0.398 (0.219 - 0.723)	0.718 (0.257 – 2.002)	0.526
>140	73(65.2%)	39(34.8%)	0.356 (0.195 - 0.651)	0.745 (0.287 – 1.932)	0.545
GCS 13-15	13(35.1%)	24(64.9%)	1	1	
9-12	52(52%)	48(48%)	2.811 (1.679 – 4.706)	1.576 (0.683 – 3.637)	0.286
< 9	110(66.7%)	55(33.3%)	3.373 (1.617 – 7.038)	4.766 (1.606 – 14.145)	0.001*

= others (comorbidity diseases like epilepsy, rheumatoid arthritis, hepatitis disease and gastrointestinal diseases...)

	No n (%)	yes n (%)	COR(95% CI)	AOR(95% CI)	p-value
MV					
No	105(83.3%)	21(16.7%)	1	1	
Yes	70(39.8%)	106(60.2%)	7.571 (4.336 - 13.220)	7.281 (2.364 – 22.429)	0.001*
Vasopressor					
No	74(92.5%)	6(7.5%)	1	1	
Yes	101(45.5%)	121(54.5%)	14.776 (6.172 - 35.370)	10.982 (3.658 –32.976)	0.001*
muscle relaxant					
No	102(66.5%)	50(33.5%)	1	1	
Yes	73(48.6%)	77(51.4%)	2.094 (1.316 - 3.333)	1.299 (0.542 – 3.112)	0.588
sedative drugs					
No	70(81.4%)	16(18.6%)	1	1	
Yes	175(57.9%)	127(42.1%)	4.625 (2.525 - 8.471)	0.693 (0.144 – 3.326)	0.647
Length of stay					
<7	33(45.8%)	39(54.2%)	1	1	
7 – 13	18(52.9%)	16(47.1%)	1.428 (0.633 - 3.224)	2.870 (0.869 – 9.476)	0.084
14 – 20	62(77.5%)	18(22.5%)	1.482 (0.703 - 3.126)	5.526 (1.768 – 17.270)	0.003*
21 – 27	52(55.9%)	41(44.1%)	1.740 (0.843 – 3.593)	4.005 (1.279 – 12.536)	0.017*
≥28	10(43.5%)	13(56.5%)	1.992(0.992 – 4.000)	15.599 (4.925 –51.970)	0.001*
MV duration					
1-6	80(81.6%)	18(18.4%)	1	1	
7-13	25(54.3%)	21(45.7%)	3.733 (1.723 - 8.090)	6.909 (2.138 – 22.322)	0.001*
14-20	30(50.8%)	29(49.2%)	4.296 (2.086 – 8.848)	3.619 (1.163 – 11.263)	0.026*
>21	40(40.4%)	59(59.6%)	6.556 (3.422 – 12.558)	5.718 (2.000 – 16.349)	0.001*

Note; 1 = reference group, COR= crude odd ratio, AOR= adjusted odd ratio, CI=confidence interval, n= number, RR = respiratory rate, SBP = systolic blood pressure,T^0 = temperature, GCS = Glasgow coma scale, SpO2 = peripheral oxygen saturation, * = p value < 0.05

CHAPTER SIX: DISCUSSION

In this study the incidence of geriatric patient mortality at ICU is 42.1% with CI at 95% (36.4% - 47.8%) which is more than half higher than the research done in the USA (13.9%)[32], Brazil(13-17.3%)[33], Spain(17%)[34], India(19.6%);[35] and Australia(20.6%)[32]

This might be due to infrastructure, well-organized ICU care, and technological support with separated ICUs based on specialty relative to our country.

The research done in Morocco and Senegal were comparable with our study results relatively which were 44.7% and 42.8% of mortality rates respectively[20, 22]. This may be due to the ICU setup and mechanical ventilator used across African countries being relatively similar.

On the other hand, the research done in Nigeria (58.1%)[22], And Burkina Faso (73%) indicated higher mortality rates than our result which implies the lack of geriatric expertise in their setup the restriction of bed space, the resistance to admitting elderly patients, and the lack of insurance payment for this patient's ICU treatment[47].

In this research, the risks of death were shown to be 3.413 times higher in patients aged 75-85 years than in individuals aged 65-75 whereas the risk of death was 9.436 times higher for those above 85 years of age.

Similarly, the research done in Brazil in 2019 identified age as a significant predictor of geriatric ICU mortality. According to a recent study done in Australia, the aging group over 90 years old had the greatest case fatality rate (29.6%), increasing a tendency to rise with age[47]. In addition to this, the research done in China in 2022 also verified that age was a significant predictor of geriatric mortality[48]. This might be due to the

physiologic changes as an advance in age, there is a decrease in immunity defense to the disease, different pharmacological treatments, and the inability to protect regular body autoregulation makes the population vulnerable to death in the ICU.

Research done in Argentina and China in 2018 and 2022 respectively contrary to our result, male gender was a predictor for geriatric mortality[48, 49]. In addition to this in Argentina, Aging-related processes, not age itself, are the better indicators of death[49]. One year later in 2019 systematic review in Argentina found that the mortality rates among elderly patients on mechanical ventilation, were greater in those over 65 years of age (OR 1.80, 95% CI 1.56 –2.08)[50].

According to our findings, patients who were administered vasopressors had a death rate that was 11 times risk than that of patients who didn't get them (adjusted odds ratio = 10.982, 95% CI: 3.658 – 32.976, p-value =0.001). This suggests that among elderly ICU patients, using vasopressors is linked to a higher risk of death. Support to our result, research done in the USA shows that a higher need for vasopressors is linked to a higher death rate, especially in cardiac disease patients 0.22(0.06 – 0.79), p=0.02, [51]. This may be due to physiological changes related to receptors, so reducing the requirement for vasopressors could improve mortality. A recent study conducted in China runs counter to our findings, which suggest that dopamine is a separate risk factor that lowers ICU duration of stay (P=0.001) but increases the development of arrhythmia[52].

In contrast for clients on MV, those who weren't on MV had a considerably decreased death rate (AOR = 7.281, 95% CI: 2.364 – 22.429, p-value = 0.001). This shows that in elderly ICU patients, the usage of MV is a reliable indicator of death. In line with our results study done in India, the use of mechanical ventilation was found to be a predictor of mortality in the elderly population[35]. Research done in Brazil opposes our results as while being required before being admitted to the ICU or throughout the ICU stay, the effect of MV did not predict death, rather longer ICU stay was associated with MV requirements[53]. This might be due to the patient's condition and the experience of the physician who manipulates the mechanical ventilator.

From our result, the duration of MV and the length of ICU stay were significantly associated with mortality in geriatric patients. The research done in China suggested a similar concept that, the total duration of MV and ICU Length of stay were independent influence factors for mortality rates[37]. This may be due to ventilator-associated pneumonia or other infections acquired in hospitals and the similarity of MV available in our setup from Chinese medical products.

Contrary to our results research done in Spain in 2013, reported a significant rise in ICU mortality for elderly patients relative to younger age patients, even when there were not any variations in the length of mechanical ventilation rather than the existence of pneumonia, sepsis, and trauma were associated with differences in death[54]. This may be due to the patient's clinical conditions.

The death risks were 4.766 times greater for patients with a GCS of less than 9 compared to those with a GCS of 13–15. the study done in Turkey also states a low consciousness during their stay in the ICU was found to be an independent risk factor for death[55]. This might be due to hypoxia from airway obstruction, so an early secure airway is needed.

These interventions were given for common medical case patients; cardiac, respiratory, and neurological disease for cardiac and respiratory function support. This needs their availability, and well-trained health professional for better ICU management care for this population, otherwise, their effects highly contribute to geriatric mortality rather than a better outcome. So it is better to give attention to this population during ICU management care.

CHAPTER SEVEN: STRENGTH AND LIMITATIONS

Strength

Multicenter study

Primary study in our setup

Limitation

There was no full data to evaluate the acute physiology, age, and chronic health evaluation and sequential organ failure assessment. Missed long-term patient follow-up after discharge.

CHAPTER EIGHT: CONCLUSION

This study indicated that there was high number of mortality rate and determinant factors that influence mortality were aging, MV, vasopressors, decrease in level of consciousness, duration of MV and length of ICU stay.

CHAPTER NINE: RECOMMENDATION

For our health institution

1. Separate ICU care center to minimize the admission problem for geriatrics
2. Having training specialty departments in geriatrics as in other populations like pediatrics and obstetrics may minimize these contributory factors' risk for death in the ICU.

For Health Professionals

1. Address the value of thorough geriatric assessments
2. Give priority to the early identification and treatment of important mortality predictors
3. Continue your professional growth and education to stay current on the best methods for caring for elderly patients in intensive care units.

For Researchers

1. Carry out additional research to investigate how particular interventions affect the death rates and results of elderly intensive care unit patients.
2. Work together with interdisciplinary teams to plan and carry out clinical trials aimed at enhancing the outcomes of older people in the intensive care unit.

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Annex I: English Version Oral Consent

Title: Mortality and associated factors of geriatrics patients admitted to intensive care unit of Addis Ababa Public Hospitals, Ethiopia, retrospective cohort study. From 2021-2023

Hello, my name is Beyene Guta MSc in advanced clinical anesthesia at Addis Ababa University. I am researching the Mortality and associated factors of geriatric patients admitted to the intensive care unit of Addis Ababa Public Hospitals.

Your involvement in this study is only based on your full willingness and the right to choose not to take part; in addition to that you have the right to stop at any time if you are willing to participate. There is no personal benefit for the participant by participating in the study but the result will aid researchers and other health professionals in developing their way of managing geriatrics patients admitted to the intensive care unit.

The information you provide will be kept confidential by using a code number and only the researcher asses the coded data. The data collected will only be used for this study. Your willingness to participate plays a vital role in the success of this study.

Based on the above information, are you willing to participate?

A. Yes B. No

Date of data collection _____

If you have any questions, you can contact me at beyeneguta2020@gmail.com or 0919574263

Annex II

Questionaries' checklist

Socio-demographic characteristics card no……. Date……		
100	Age	Age (years) 65–74 years 75–85 years Over 85 years
101	Gender	0 = Female 1 = Male
102	Residency	0 = Rural 1= Urban
200	source of admission	0 = Emergency ward 1= Medical ward 2= Surgical ward 3= Gynecology ward 4= Operation Room

201	Reason for ICU admission	1= Cardiovascular disease 2= Respiratory disease 3= Infectious disease 4= Neurologic disease 5= Endocrine disease 6= Renal disease 7= Hematologic disease 8=Poisoning 9= Trauma 10= others(specify)----------
202	Specific diagnosis at ICU	0= Myocardial infarction(MI) 1= Congestive Heart failure (CHF)

		2= Acute respiratory disease syndrome 3=Septic shock 4= Diabetic ketoacidosis(DKA) 5= Stroke 6= Human immunodeficiency virus (HIV) 7= infection pneumonia 8= Cardiogenic shock 9= Pulmonary thromboembolism 10 = Others, specify ----------
203	Comorbidities	
	Hypertension Diabetes mellitus Neurologic disease Cardiac disease Malignancy Renal disease Respiratory disease ARDS Others	1= Yes 0= No 1= Yes 0= No 1= Yes 0= No 1= Yes 0= No 1= Yes 0= No 1= Yes 0= No 1= Yes 0= No 1 = yes 0=No 1= yes 0= No
204	Number of comorbidities	a, None, b, 1 c ≥ 2
205	Need for IMV	1= Yes 0= No

Vital signs during admission		
300	Pulse rate	A, < 60 b, 60 - 100 c, >100
301	Respiratory rate	A, normal 12-18 b, bradypnea < 12 c, tachypnea > 20
302	Systolic Blood pressure (mmHg)	A, <90 b, 90-140 c, >140
303	Oxygen saturation	A, < 90 b, > 90
304	Temperature (0^c)	A,< 36.5 b, 36.5-37.3 c,>37.3
305	Mental status	1= Conscious 0= Unconscious GCS = <9 9-12 13-15
306	Laboratories finding	Wbc = …… Hgb = ….. Plt =…..
		Cr = ….. Urea =……
		Alb =…. ALP = ….. AST=….. ALT=…. RBS= …..
		Na^+ =……K^+ =…….. Cl^- =……..
Management of patients during intensive care unit stay		
401	Mechanical ventilation	1= Yes 0 = No
402	If yes, on 401 for how long?	----------

403	Use of vasopressor	1= Yes 0 = No
404	Blood transfusion	1= yes 0= No
405	Use of analgesia	1= yes 0 =No
406	Use of muscle relaxants	1= Yes 0 = No
407	Use of Sedative drugs	1= Yes 0 = No
500	Complications at ICU	1= yes 0 = No ----------
501	Length of intensive care unit stay	----------days
502	Mortality	0= No 1= Yes