



St. Paul's Hospital Millennium Medical College

Graduate Study Program

**Admission patterns, clinical Outcomes and Associated Factors among Adult Patients
Admitted to Intensive Care Unit of St. Paul's Hospital Millennium Medical College**

Investigator: Meseret Fikre (ECCM Resident)

Addis Ababa, Ethiopia

December 2023



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**A Research Paper Submitted to The Department of Emergency and Critical Care
Medicine, In Partial Fulfilment of Emergency and Critical Care Specialty Training**

Addis Ababa

December 2023

Acknowledgements

I would like to express my gratitude to St. Paul hospital millennium medical college/Addis Ababa burn, emergency, and trauma hospital for providing me with this opportunity and for their administrative support. I would also like to express my heartfelt gratitude to my advisors Dr Dirijit mammo and Dr Etsegenet aklog for their continuous support and guidance throughout the development of this work. Special thanks for Dr Ayalew Zewdie and Dr Haimanot Tessema for their constructive comment and kind correspondence during the development of this work.

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Abstract

Background: Intensive care unit is an area within a medical facility equipped with advanced technologies and personnel trained to provide intensive care. Mortality in ICU is a global burden which results in a huge loss of productivity and financial costs. There is scarcity of information regarding critical ill patients admitted to ICU in developing country like Ethiopia. This research aims to assess the clinical pattern, outcomes and associated factors among patients admitted to SPHMMC ICU.

Objectives: To assess admission pattern, clinical outcomes and associated factors of patients admitted to St Paul ICU.

Methods: Cross-sectional study was conducted at St. Paul's Hospital Millennium Medical College ICU. Systematic random sampling technique was applied to select 240 patients who were admitted from September 2021 to September 2023. Data were entered in to kobo tool box and exported to SPSS version 25 for analysis. Bivariate and multivariate logistic regression were used for association. A P-value of 0.05 at a 95% confidence interval was declared clinically significant.

Result: A total of 240 patients were analyzed, 118 (49.2%) patients were under age category of 20-40yr and 132 (55%) of patients were male. 161 (76.1%) had a pre-existing comorbid medical condition and 221 (92.1%) of patients were medical. Most common source of admission were from adult emergency 161 (67.1%). ICU mortality rate was 42.9%. Multivariate analysis was done and mortality was strongly associated with Unconsciousness at admission AOR : 4.889 (1.419-16.840), Low albumin level AOR 21.862 (1.324-361.06), Infectious disease category AOR: 2.795 (1.124-6.951), Presence of DM Comorbidity AOR : 4.732 (1.602-13.978), treatment with vasopressor AOR: 26.644 (11.043-64.28) and less than 24hr ICU stay with AOR of 4.188 (.975-17.996).

Conclusion: This study showed majority of patients had preexisting comorbidity. Mortality among ICU admitted patients were strongly associated with presence of comorbidity, infectious disease category, low albumin level, short length of ICU Stay, vasopressor use and low baseline GCS at admission.

Keywords: Adult ICU Patients, Mortality, Ethiopia.

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Acronyms

CI- Confidence Interval

SPHMMC - Saint Paul's Hospital Millennium Medical College

EMCCR - Emergency Medicine and Critical Care Resident

ICU -Intensive Care Unit

MV-Mechanical Ventilation

AOD – adjusted Odd Ratio

CD-Communicable Disease

NCD-Non communicable disease

ARDS-acute respiratory distress syndrome

GC-Gregorian Calendar

SPSS- Statistical Package for Social Science

WHO-World Health Organization

DM-diabetic mellites

1.Introduction

1.1 Background

Intensive care unit is an area within a medical facility equipped with advanced technologies such as ventilators, monitoring system, continuous renal replacement therapy and personnel trained to provide intensive, advanced life-support. ICU care is provided by a multidisciplinary team of medical professionals. It can be general or specialized and can be organized by specific systems, pathologies, or problems (e.g., neurological, burn, or trauma ICUs, and medical or surgical ICUs) or by age groups (e.g., adult or PICUs) [1-3].

Ethiopia had 114 million people and 51 intensive care units with only 324 intensive care unit beds, resulting in a national ICU bed-to-population ratio of 0.3 per 100,000 people. Services were concentrated in the capital Addis Ababa with 25% of bed capacity and 51% of critical care physicians. No ICU had piped oxygen. Only 33% (106) beds had all of the 3 basic recommended noninvasive monitoring devices (sphygmomanometer, pulse oximetry, and electrocardiography). There was limited capacity for ventilation (n = 189; 58%), invasive monitoring (n = 9; 3%), and renal dialysis (n = 4; 8%). Infection prevention and control strategies were lacking.[4, 5].

Mortality in ICU is a global burden which results in a huge loss of productivity and financial cost. It varies across the world range from 9 to 61%. In developed contents like North America, Oceania, Asia and Europe in ICU mortality relatively low with the rate of 9.3%, 10.3, 13.7% and 18.7% respectively, while in the rest of the world such as South America, and the Middle East the mortality found to be 21.7% and 26.2%[3, 5].

Even though critical care services have been undergoing significant progress, critical care service provision in resource-limited settings is lagging far behind and the mortality is still higher. In Africa, the ICU mortality rate is high as it compared to the other developed continents. The mortality rate in Nigeria, Uganda, Tanzania, and Kenya were 32.9%, 40.1%, 41.1%, and 53.6% respectively [3, 6-9].

Different studies showed that the mortality rate of ICU patients in Ethiopia is relatively similar to other Africa countries. Systematic review and meta-analysis was done in Ethiopia ,14 studies were included for the final review and analysis. According to the results of the study, ICU mortality rate in Ethiopia was 39.70%. The SNNP region had the greatest prevalence of mortality in adult ICU (46.67%), whereas Tigray (23.13%) had the lowest. Previous studies done in Jimma, Addis Ababa, Mekelle, Gondor and Ambo showed that the mortality rate was 50.4%, 39%, 27% ,38.7% And 46.9% respectively[10-15]

In conclusion, the burden of mortality in critical care is highest in low- and middle-income countries, including many regions in Africa. In Ethiopia, the mortality rate of ICU patients is significant, and the lack of critical care resources is a major barrier to improving patient outcomes. More research is needed to understand the complex factors that contribute to the burden of critical illness and mortality in Ethiopia and other low- and middle-income countries, and strategies has to be developed to improve critical care outcomes in these regions[2, 14].

1.2 Statement of the problem

Mortality in ICU is a global burden which results in a huge loss of productivity and financial costs. It varies across the world depend on ICU infrastructure, staff availability, and training, pattern, and cause of ICU admission[3, 5, 16].

The burden of life-threatening conditions requiring intensive care unit has grown substantially in the last couple of decades in low- and middle-income countries because of an emerging pandemic, motorization, urbanization, and hospital expansion. However, the advancement of ICU care is very limited due to the high cost of infrastructure, training, medical staff, failure to incorporate international guidelines for evidence-based care, and inadequate medical supplies[6, 13].

Studies on ICU patients in Sub-Saharan Africa, including Ethiopia, have primarily focused on admission patterns, mortality rates, and their determinants. However, there is still uncertainty in the body of evidence regarding the pattern of disease, outcomes and the factors influencing clinical outcomes among patients admitted to ICU[2, 13, 14, 17].

There is scarcity of information regarding outcome and associated factors of critical ill patients admitted to ICU in the study area. Therefore, the aim of the current study is to describe clinical outcomes and associated factors among patients admitted to intensive care unit of St Paul hospital.

1.3 Rationale of the study

Intensive Care Unit is a specialized area in the hospital where critically ill patients are admitted for specialized care. The patients admitted to the ICU are usually suffering from acute or chronic medical conditions that require immediate and intensive medical attention. These patients are usually at high risk of morbidity and mortality, and it is essential to monitor their progress closely. Despite the availability of advanced medical technologies and treatments, the outcomes of patients admitted to the ICU can still be variable. Hence, understanding the factors that influence the outcomes of patients admitted to the ICU is of utmost importance[3, 16].

Assessment of the characteristics and outcomes of critically ill patients admitted to ICUs in low-income countries may help with the identification of priorities and resources required to improve care for patients who are likely become critically ill in any hospital.

For this reason, there has been ample interest in measuring ICU outcomes and patterns of admission both in terms of mortality and resource utilization. But there is little information about ICU patient disease pattern and outcome in the study setting. This study aims to examine outcome and associated factors among patients admitted to the medical intensive care unit of St. Paul's Hospital Millennium Medical College.

Therefore, the information obtained from this study can be used to develop evidence-based interventions aimed at improving patient outcomes, reducing the risk of complications, and improving the quality of care provided to patients in ICU.

2. Literature review

Even though medical care has significantly improved over the last century, mortality in ICU remains a global public health issue, in addition to death in ICU other metrics of intensive care outcome include morbidity and functional disability. The mortality rate in critical care units across the world range from 9 to 61% [18].

Population-based study was conducted in 2010 at the Universities of Toronto and Washington according to this study burden of critical illness in developed nations is higher than commonly thought and is predicted to increase as the population ages. ICU mortality for unselected patients in North America, Europe, Australia, and New Zealand ranges from 8–18%; mortality varies based on underlying disease, patients with acute lung injury mortality was found to be 35–45% and patients with septic shock had mortality of 50-60%. On the other hand, the death rate in developed-world hospitals following an ST-elevation myocardial infarction is as low as 7%[19].

The Intensive Care Over Nations (ICON) audit was done in 2012 involving 84 countries to Assess worldwide burden of critical illness and the result of this study showed ICU mortality rate in North America, Oceania, and Europe is comparatively low at 9.3%, 10.3%, and 18.7%, respectively; however, in South America and the Middle East, it is 21.7% and 26.2% respectively, This large database also highlights that sepsis remains a major health problem worldwide and it is associated with high mortality [20].

In 2006 Study was done based on the national intensive care registries in Finland, Sweden, and Norway and ICU mortality was 9.1%, which is considered low compared with reports from other countries. Length of stay of nonsurvivors is short in Scandinavia (1.5 days), but is longer in Norway than in Finland and Sweden. Shortest LOS was found in patients aged older than 80 years and in emergency medical admissions [21].

Retrospective Cohort Study was done at Australian and New Zealand ICUs from prospectively collected data on index patient admitted from 1993–2003. The data set comprised 223,129 patients, the mortality rate was 16.1% and factor associated with mortality were Age, need for mechanical ventilation, male gender and emergency surgery over elective surgery. Overall hospital mortality rate in patients admitted to Australian and New Zealand ICUs decreased by 4% over 11 yrs.[22].

In Africa, the ICU mortality rate is high, ranging from 32.9 to 54%, compared to the other developed continents

5-year retrospective review carried out in the University of Nigeria hospital Enugu between the year 2008 -2012 to assess admission pattern and outcome of patients admitted to ICU. The result of the study showed neurosurgical cases was the most common reason for admissions while the lowest was due to critical incidents arising from anesthesia. Out of the neurosurgical admissions majority was due to severe traumatic brain injury (TBI) followed by neurosurgical cases (intracranial tumors, spinal cord injury, and moderate brain injury) The overall ICU mortality rate was 34.6% and Severe TBI accounted for the highest number of mortalities in this study [23].

Another retrospective study was conducted among patients admitted to the ICUs of the four public tertiary referral hospitals of Tanzania for the three-year period from 1 January 2009 to 31 December 2011. result of the study was majority of patients were male with male to female ratio of 1.4:1. The median age was 34 years. Intracranial injury was the most frequent admission diagnosis for all age groups. The overall in-ICU mortality was 41.4%. Among patients of all age groups, renal failure (acute and chronic), shock, burns and septicemia were conditions with the highest in-ICU mortality rate of over 80% each. Tetanus had the longest median of ICU stay, and an in-ICU mortality of 71.1%[8].

In 2015 cross sectional study was done at Moi Teaching and Referral Hospital (MTRH) in Eldoret, Kenya to identify factors associated with mortality of patients admitted between January 1, 2013, and April 5, 2015. ICU mortality was 53.6%, and 30-day mortality was 57.3%, Factor associated with mortality were age younger than 10 years and age above 50 years, sepsis, acute stroke, acute respiratory failure. The need for mechanical ventilation and vasopressor support. However, Drug/alcohol poisoning was associated with lower adjusted odds of mortality[9]

According to various studies conducted in Ethiopia, the mortality rate following ICU admission was high, ranging between 18.3 and 67.4%. According to various study predictors of mortality were training and skills of medical staff, nurse-to-patient ratio, infrastructure, and shortage of essential drugs and equipment among hospital resource factors. patient related factors were Age, Duration of ICU stay, presence of comorbidities, complications at ICU, traumatic injury,

sepsis, need for mechanical ventilation, need for vasopressors/inotrope, and low GCS score were potential factors affecting the survival of patients in ICU [17, 24].

A retrospective cross-sectional study was conducted at University of Gondar among patients admitted to MICU from September, 2015 to April, 2019. The most common categorical diagnosis at admission was all type cardiovascular, respiratory and infectious diseases. Overall mortality rate of the MICU was 38.87%. The need for mechanical ventilation, abnormal mental status on admission and short ICU stay were significantly associated with the clinical outcome of MICU patients[25].

A retrospective observational study conducted in JUSH ICU for the 12-month period from 23 August 2011 to 22 August 2012. The leading causes of medical admission were cardiac disease, septic shock, non-tuberculous respiratory disease and tetanus. The overall ICU mortality rate was 50.4% and major causes included trauma, cardiac disease, acute abdominal presentations, septic shock, tetanus and hysterectomy secondary to uterine rupture. Medical diagnoses accounted for 50.1% of admissions followed by surgery (43.2%) and obstetrics (5.8%). Corresponding mortality rates were 53.6, 48.0 and 42.9%, respectively [15].

A retrospective institution-based cohort study was done at adult intensive care unit of Ambo University Referral Hospital who were admitted from September 2019 to December 2021. The overall mortality rate was 46.9%. Factors associated with mortality were Glasgow coma scale < 9, patient with coexisting disease, mechanical ventilation requirements and patients who stayed less than four days in intensive care unit[26].

Retrospective study was conducted on all patients admitted to internal medicine wards and the ICU at Ayder Comprehensive Specialized Hospital in Tigray from November 1, 2017 till October 31, 2018. The most common Admission categories were diseases of the circulatory system, infectious/parasitic diseases and diseases of the respiratory system followed by cancers. The overall mortality rate was 14.9%. On multivariate analysis, the independent predictors of mortality were presence of complications and disease category (CDs vs NCDs). Patients with CDs had a higher mortality rate than those with NCDs but the proportionate mortality rate was higher for NCDs than CDs[27].

A multi-center retrospective Cohort study conducted in three teaching and referral hospitals in Southern Ethiopia referral hospital from June 20, 2018, to May 20, 2020. The majority causes of ICU admission were Trauma followed by ARDS and Congestive heart failure. The incidence rate of mortality among ICU patients was 46.8%. The major causes of mortality were trauma, Congestive heart failure, ARDS and stroke. Cardiac arrest, aspiration, being on a mechanical ventilator, hypoxemia at admission, and low GCS, and the use of antibiotics and length of stay were independent predictors of mortality. [28].

Case-series study of all patients admitted to the MICU Of Addis Ababa between 1985-2000 using patient registers was carried out to analyze patterns of medical admissions into MICU of the Addis Ababa University Teaching Hospital. According to the study Acute infectious and cardiovascular diseases accounted for half of the entire critical care admissions. Among specific diagnoses, diabetic ketoacidosis was the leading cause of admission followed by acute myocardial infarction and severe complicated malaria. The overall mortality of the MICU was 32%. Severe and complicated malaria was the leading cause of death followed by tetanus and acute myocardial infarction [29].

A Hospital based retrospective study was conducted on patients who were admitted to MICU of SPHMMC from 2007 to 2012. Diseases of the cardiovascular system were the most common reason for MICU admission and associated with the highest mortality rates. Diabetic Ketoacidosis was the leading cause of admission followed by all strokes and Unspecified Diseases of Circulatory System. The overall mortality of the MICU was 39 %. Among the top fifteen causes of admission, all strokes had the highest case fatality proportion followed by Intestinal Obstruction ,Severe Pneumonia ,whereas DKA had the lowest case fatality ratio [11].

A prospective observational study was conducted from March 2017 to February 2018 in four selected ICUs in Addis Ababa (St. Paul's, AaBET, and Zewditu Memorial Hospital and landmark). The ICU and 28-day mortality rate were 41.8% and 50.9% respectively. Male sex, modified Sequential Organ Failure Assessment score ≥ 10 on day 1 of ICU admission, and comorbidity of HIV or malignancy were the independent predictors of 28-day mortality[24].

2.1 Conceptual framework

This is the conceptual framework developed specifically for this study by the principal investigator after reviewing related studies in which this study is intended to revolve. The framework tries to depict factors that can potentially contribute to mortality among patients admitted to the intensive care unit, and it is believed to support the present study entitled ‘Clinical Pattern, Management Outcome and Associated factors of patients admitted to ICU Center of St. Paul's Hospital Millennium Medical College’.

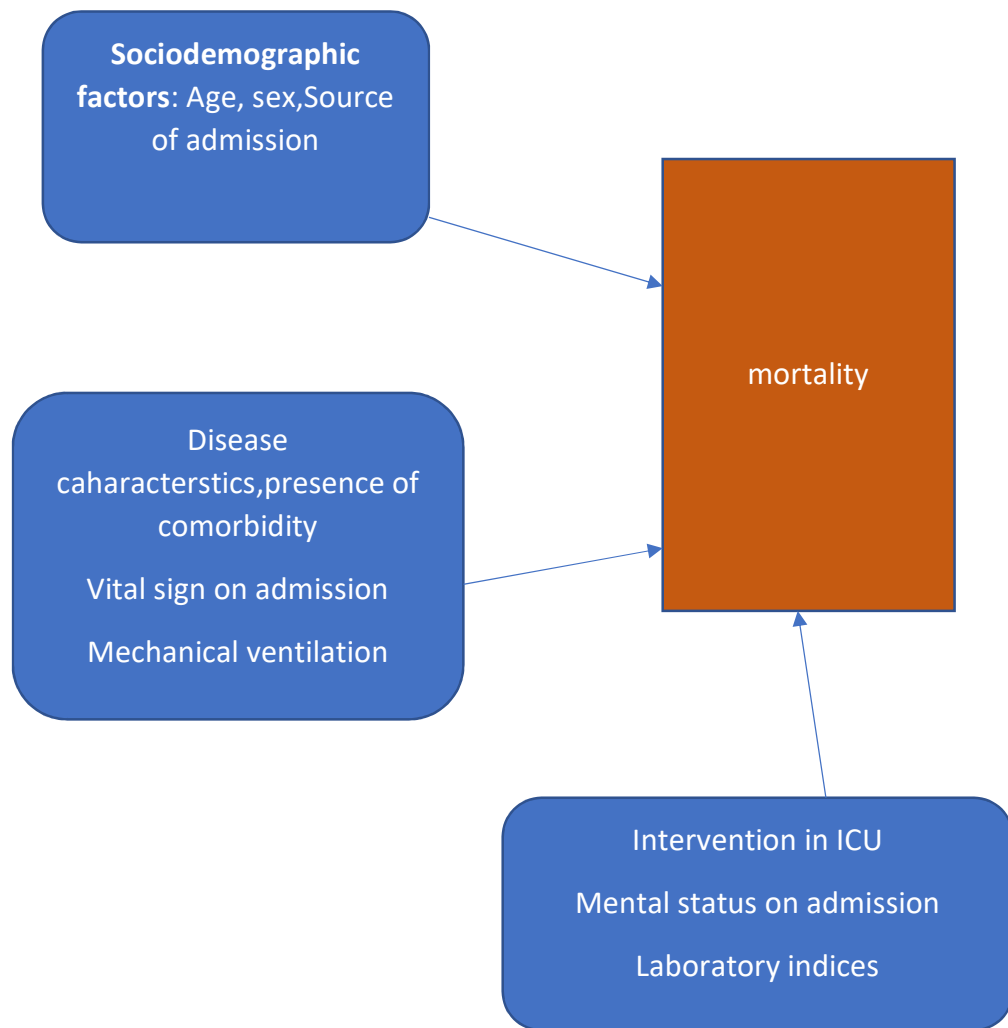


Figure 1 Conceptual framework for factors that could affect mortality among ICU admitted patients developed based on literatures[11, 14, 25].

international audit

3.Objectives of the study

3.1 General Objectives

- To assess admission pattern, clinical outcome and associated factors of patients who were admitted from September 2021 to September 2023, to St. Paul Hospital Millennium Medical College ICU.

3.2 Specific objectives

- To determine admission pattern of patients admitted to SPHMMC ICU from September 2021 to September 2023
- To identify outcome of patients admitted to SPHMMC ICU from September 2021 to September 2023
- To identify factors that affects outcome of patient admitted to SPHMMC ICU from September 2021 to September 2023

4.Methodology

4.1. Study Setting

This study was conducted at SPHMMC ICU, which is located at the capital city of Ethiopia was established through a decree of the council of Ministers in 2010

The college has more than 2800 clinical, academic and administrative and supporting staffs that provide medical specialty service to patients who are referred from all over the country. The inpatient capacity is more than 700 beds and an average of 1200 emergency and outpatient clients are seen daily in the hospital.

The hospital ICU was opened in late 2006 with the help of foreign donations (German donors). Currently, The ICU is a fourteen-bed general intensive care unit with MV and monitors on each bed and have one dialysis machine. Staffed with one full time intensivist and one to one ratio of nurses per bed. currently started intensivist fellowship with one intensivist and four intensive fellows.

4.2. Study design and Study Period

- An institutional based cross-sectional study was conducted at St Paul ICU from November 1 to 30,2023.

4.3 Source Population

- All adult patients admitted to ICU from September 2021 to September 2023

4.4 Study Population

- All sampled adult patients who were admitted to St Paul ICU from September 2021 to September 2023 that fulfills eligibility criteria.

4.5 Sample Size determination and sampling technique

4.5.1. Sampling size determination

Taking the population proportion of patients who were admitted to ICU, reported to have an overall mortality rate to be 39% taken from the previous study done at St Paul ICU

$$n = \frac{z^2 p(1-p)}{e^2}$$

n = the required sample size

p = proportion of patients admitted to ICU reported to have mortality of 39%

$Z_{\alpha/2}$ = the critical value at 95% confidence level = 1.96

e = precision (margin of error) = 5%

Accordingly,

$$n = \frac{(1.96)^2 * 0.39(1 - 0.39)}{0.05^2}$$

$$n = \frac{(1.96)^2 * 0.39(0.61)}{0.05^2}$$

$$n = 365$$

Therefore, the minimum calculated sample size, by adding 10% of the calculated sample size for contingency that might happen due lost charts or incomplete reports, the final sample size became 400.

Correction formula for finite population was used and sample size reduced to 240.

4.5.2 Sampling Technique

Systematic Random Sampling technique was used

4.6 Eligibility Criteria

4.6.1 Inclusion Criteria

Patients aged ≥ 14 years old admitted to ICU during the study period.

4.6.2 Exclusion Criteria

- Incomplete Patient chart
- Transferred cases to other facilities

4.7 Variables

4.7.1 Dependent Variables

Clinical outcomes (alive or died)

4.7.2 Independent Variables

- Age, Sex
- Presence of comorbid illness
 - ✓ DM, CKD, HTN, RVI, TB
- Specific Diagnosis at admission
- Disease category at admission
- Source of admission
- Disease characteristics
- Vital signs during admission
- Mental status at admission
- length of stay
- Need of MV
- Albumin level
- Intervention during ICU stay
- Procedure done during ICU stay

4.8 Operational Definition

- Adult
 - Age ≥ 14 years
- Disease characteristics
 - Trauma-for traumatic injury
 - Surgical-for those being managed with operative or non-operative surgical conditions
 - Medical-for all cases other than above mentioned
- ICU Outcome
 - represents the end clinical status of patients who were admitted to ICU as documented in patients' card (alive or death).
- Disease category
 - All respiratory failure were under respiratory disease.
 - Infective heart disease and rheumatic heart disease were under cardiovascular disease
 - Guillen Barrie Syndrome was under the category of neurologic disease.
 - Sepsis and septic shock, tetanus, malaria, meningitis-under infectious disease category
- Length of ICU stay
 - Short defined as less than 24hour

4.9 Data Collection Tools and Procedures

The questionnaire was prepared After reviewing different literatures and undertaking modifications for the population studied. It was modified further after a pre-test and before the data collection, then followed and reviewed during data collection. It was collected by trained nurses working at ICU treatment center and completeness was checked by principal Investigator. Data was collected through reviewing charts and ICU registry by using pretested structured data retrieval form(checklist) which included Sociodemographic profile of patient, source of admission, admission diagnosis, admission category, vital sign during admission, presence of comorbidity, length of stay, intervention in ICU, and treatment outcome.

4.10 Data Quality Control

An English version, pretested checklist was used to collect data. Brief training for the data collectors about the process of data collection was given before the process of data collection.

Close supervision was maintained during data collection and filled checklists will be double-checked daily for consistency and completeness by data collectors and principal investigator before analysis.

4.11 Data Processing and Analysis

Data entering, coding and clearing was performed using Kobo tool box. The entered Data was exported to SPSS version 25 for analysis. Descriptive statistics was carried out and the results were presented using text, tables and graph. Both bivariable and multivariable logistic regression analyses were performed to identify the association between independent variable and outcome variable. Model fitness was checked using a Hosmer-Lemeshow goodness-of-fitness test. The variables in bivariate analysis with $p < 0.2$ were entered into multivariable logistic regression. The strength of the association of factors associated with outcome was demonstrated by computing an adjusted odds ratio (AOR) with a 95% confidence interval (CI). Finally, the analyzed data were organized and presented in tabular, graphical, and descriptive forms accordingly. After adjusting their effect on the outcome variable, those variables with a P-value < 0.05 with a 95% confidence interval were considered as factors significantly associated with mortality.

4.12 Ethical Consideration

This study required secondary data from patient charts. The data from the case records was handled with strong confidentiality. The research proposal was approved by the ethical board of St. Paul's hospital millennium medical college and department of emergency medicine and critical care. The study was started after ethical clearance obtained from St. Paul's hospital millennium medical college institutional review board (IRB) with Ref. No. of pm 23/131 and after permission from the hospital management to review records. Owing to the retrospective design, the requirement for informed consent was waived.

4.13 Dissemination of Results

The results of the study will be reported to SPHMMC, Emergency medicine, and the critical care department and will also be presented to the medical and/or scientific community at different national and international meetings. Other ways of disseminating the finding may be through morning sessions to physicians and nurses involved in managing these patients as well as publishing to a journal.

5.Results

5.1 Sociodemographic profile of study participants

A total of two hundred forty patients' medical records were reviewed in this study. From a total of 240 studied patient charts 132 (55%) were male and 108(45%) were females, the male/female ratio was 1.2:1. One hundred eighteen (49.2%) belong to the age group 20–40 years. 103(42.9%) were from the Addis Ababa region followed by Oromia region 97(40.4%) (Table 1)

Table 1Socio Demographic Characteristics of Patients Admitted to ICU Center of St. Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia from september 2021 to september 2023.

	Frequency (N)	Percent (%)
Age (years)		
<20	8	3.3%
20-40	118	49.2%
41-60	79	32.9%
>60	35	14.6%
Gender		
male	132	55.0%
female	108	45.0%
Address		
Addis Ababa	103	42.9%
Oromia	97	40.4%
Amhara	28	11.7%
SNNP	11	4.6%
other	1	0.4%
Category of admission		
medical	221	92.1%
surgical	16	6.7%
trauma	3	1.3%

Table 2 Source of admission of of Patients Admitted to ICU Center of St. Paul's

Source of admission	Hospital	
	Frequency (N)	Percent %
Adult emergency	161	67.1
Medical ward	41	17.1
Surgical ward	10	4.2
Gynecology and obstetrics ward	14	5.8
Recovery room	7	2.9
other	7	2.9
Total	240	100.0

Millennium Medical College, Addis Ababa, Ethiopia from september 2021 to september 2023.

Patterns of admission Categories

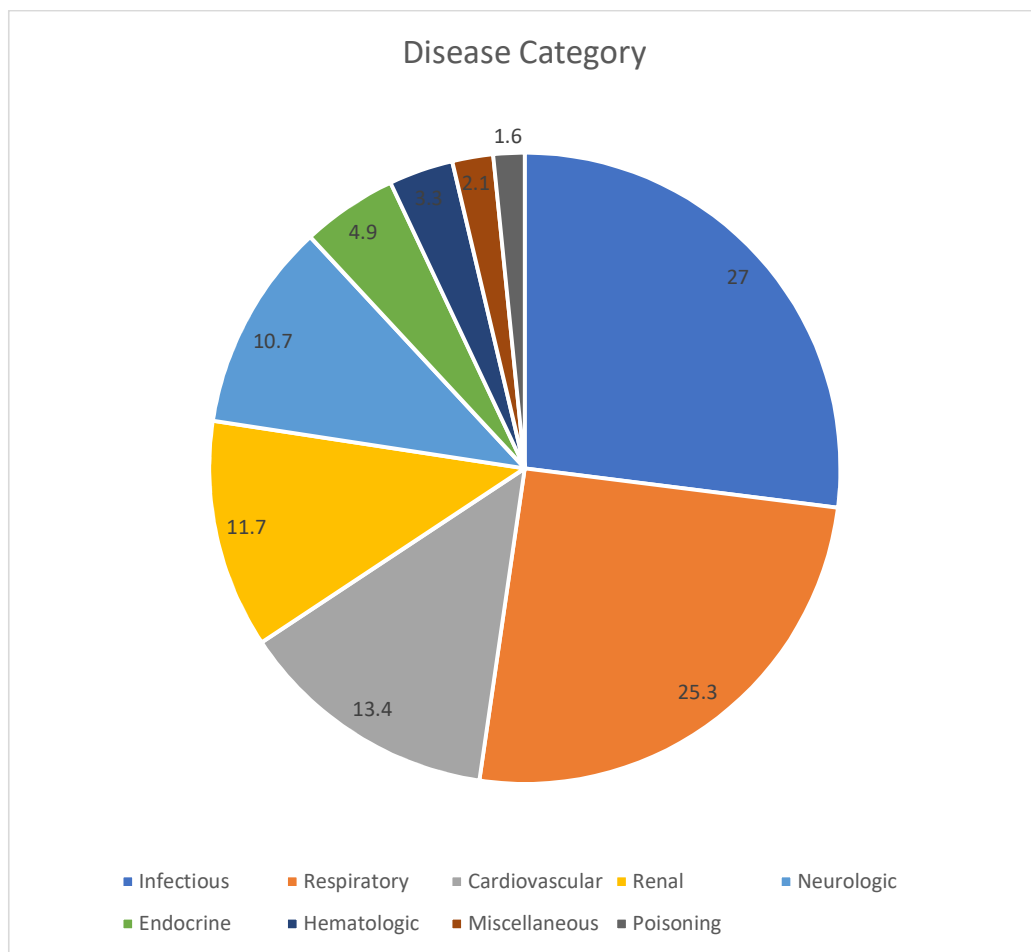


Figure 2 Frequency of Common Illness Among Patients Admitted to ICU of St. Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia from september 2021 to september 2023.

Key: Miscellaneous conditions: Gastrointestinal disorder, post-operative conditions, Trauma, Malignancy, Tetanus.

Table 3 Distribution of Common Specific Admission Diagnosis Among Patients Admitted to ICU of St. Paul's Hospital Millennium Medical College, Addis Ababa Ethiopia from september 2021 to september 2023.

Specific Diagnosis	Frequency (N)	Percent (%)
Sepsis	34	14.2
AMI	17	7.1
Renal Failure	16	6.7
Stroke	15	6.3
septic shock	12	5.0
CHF	15	6.3
DKA	10	4.2
Acute respiratory disease syndrome (ARDS)	12	5.0
TB	9	33.8
poisoning	8	3.3
GBS	9	3.8
status epilepticus	7	2.9
bronchial asthma	6	2.5
RVI	5	2.1
arrythmia	6	2.5
malignancy	4	1.7
cardiogenic shock	5	2.1
meningitis	5	2.1
Preeclampsia	5	2.1
Other	36	25.7
Total	240	100

Key: Other conditions: PTE, SLE, Tetanus, CLD, Aortic Dissection, CVT, UAWO.

Table 4 Distribution of Admission Vital Signs Among Patients Admitted to ICU center of st paul hospital from september 2021 to september 2023.

Variable	Frequency	Percent (%)
Pulse Rate (bpm)		
>100	173	72.1%
<60	6	2.5%
60 - 100	59	24.6%
no pulse	1	0.4%
Systolic blood pressure (mmHg)		
≥ 90	202	84.2%
<90	38	15.9%
Respiratory Rate (bpm)		
≥ 20	150	62.5%
<12	6	2.5%
12-20	80	33.3%
agonal/gasping	3	1.3%
Peripheral oxygen saturation (SPO2)		
<90%	56	23.3%
90-100%	184	76.7%
Temperature (°C)		
< 36.5	10	4.2%
>37.5	60	25.0%
36.5 - 37.4	169	70.4%
Mental Status		
confused	42	17.5%
conscious	77	32.1%
lethargic	48	20.0%
unconscious	73	30.4%

Table 5 Distribution of Common Comorbidity Among Patients Admitted to ICU of St. Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia from september 2021 to september 2023.

Variable	Frequency(N)	Percent (%)
comorbidity		
Yes	161	76.1
No	79	23.9
Hypertension	64	19.3
Diabetic Mellites	47	14.2
Cardiovascular Disease	34	10.3
Retro viral infection	16	4.8
Chronic kidney Disease	15	4.5
Tuberculosis	15	4.5
Malignancy	11	3.3
Bronchial asthma	9	2.7
Stroke	6	1.8
COPD	3	0.9
liver disease	2	0.6
Other	30	9.1
Total	331	100

Table 6 Management and procedure related data of Patients Admitted to ICU of St. Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia from september 2021 to september 2023.

Variable	Frequency (N)	Percent (%)
Respiratory support		
Invasive mechanical ventilation	185	77.1%
Noninvasive mechanical ventilation	55	22.9%
Length of ICU stay		
<24hr	32	13.3%
24hr - 4 days	84	35.0%
≥4 days	124	51.7%
Number of days on Mechanical ventilation		
<24hr	10	4.2%
24-3days	36	15.0%
3-7 days	72	30.0%
7-30days	67	27.9%
≥30 days	0	0.0%
Procedure		
	Frequency	Percent
Chest tube insertion	14	5.6
pericardiocentesis	1	0.4
Cardioversion	11	4.4
CPR	35	14.0
Tracheostomy	29	11.6
Total	90	36
Treatment		
	Frequency	Percent
inotropic/vasopressor_	97	19.5%
Transfusion	38	7.6%
Dialysis	42	8.4%
Use of sedation	56	11.2%
Antibiotic	190	38.2%
Anticoagulation	75	15.1%

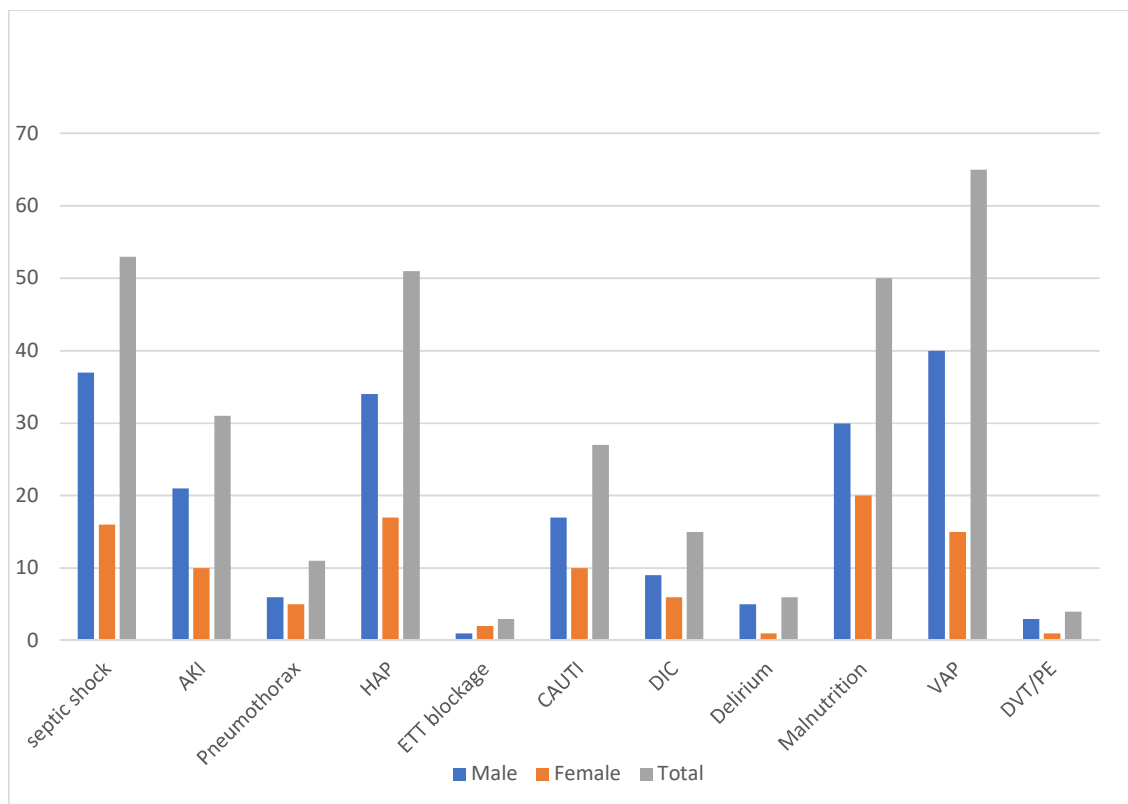


Figure 3 Distributions of ICU associated complications among patients admitted to ICU of St. Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia from september 2021 to september 2023.

Table 7 Distribution of patients' complication on the bases of ICU length of stay, and days on Mechanical Ventilator in ICU of St. Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia from september 2021 to september 2023.

	DVT/ PE	Cardia c arrest	Septic shock	AKI	pneumotho rax	Bed sore	CAUTI	HAP
Length of ICU stay								
<24h r	0	9(3.8%)	3(1.3%)	0	0	0	0	2(0.8%)
24- 4days	0	5(2.1%)	20(8.3%)	9(3.8%)	1(0.4%)	4(1.7%)	6(2.5%)	21(8.8%)
≥4da ys	8(3.4%)	11(4.6%)	30(12.5%)	22(9.2%)	10(4.2%)	12(5%)	21(8.8%)	28(11.7%)
Days on mechanical ventilation								
<24h r	0	4(2.2%)	0	0	0	0	0	0
24- 3days	0	4(2.2%)	8(4.3%)	2(1.1%)	0	0	1(0.5%)	3(1.6%)
3- 7days	0	5(2.7%)	23(12.4%)	8(4.3%)	3(1.6%)	1(0.5%)	10(5.4%)	16(8.6%)
7- 30da ys	8(4.3%)	7(3.8%)	17(9.2%)	18(9.7%)	8(4.3%)	14(7.6%)	14(7.6%)	22(11.9%)

Table 8 Laboratory, complication, and management-related data of patients admitted to ICU Center of St. Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia from 2021, to september 2023.

creatinine	frequency	percent
<1.1	155	64.6
>1.1	85	35.4
Total	240	100.0
Albumin	Frequency	Percent
3.5-5.5	164	68.3
2.5-3.5	52	8.3
<2.5	10	2.9
not done	14	5.8
Total	240	100.0
hemoglobin	Frequency	percent
>12	127	52.9
<12	113	47.1
Total	240	100.0
Platelet	Frequency	Percent
>150000	182	75.8
<150000	58	24.2
Total	240	100.0
Leucocyte count	Frequency	percent
<4000	10	4.2
4000-12000	109	45.4
>12000	121	50.4
Total	240	100.0
Electrolyte	Frequency	Percent
potassium	71	26.0%
sodium	62	22.7%
calcium	4	1.5%
all normal	136	49.8%

Clinical Outcome of patients admitted to ICU

The overall mortality of the ICU was 108(42.9 %) of this 61(59.2%) were males and 42(40.8%) were female. The proportion of death among males was higher than females. However, there was no significant sex difference in patient's clinical outcome. Age-related increases in mortality were observed in this study, 23.3% were older than 60 years, and 1.9% were younger than 20 (figure 4). Out of 240 ICU admissions, 47 Patients (45.6 %) died after they stayed for more than 4days in the ICU.

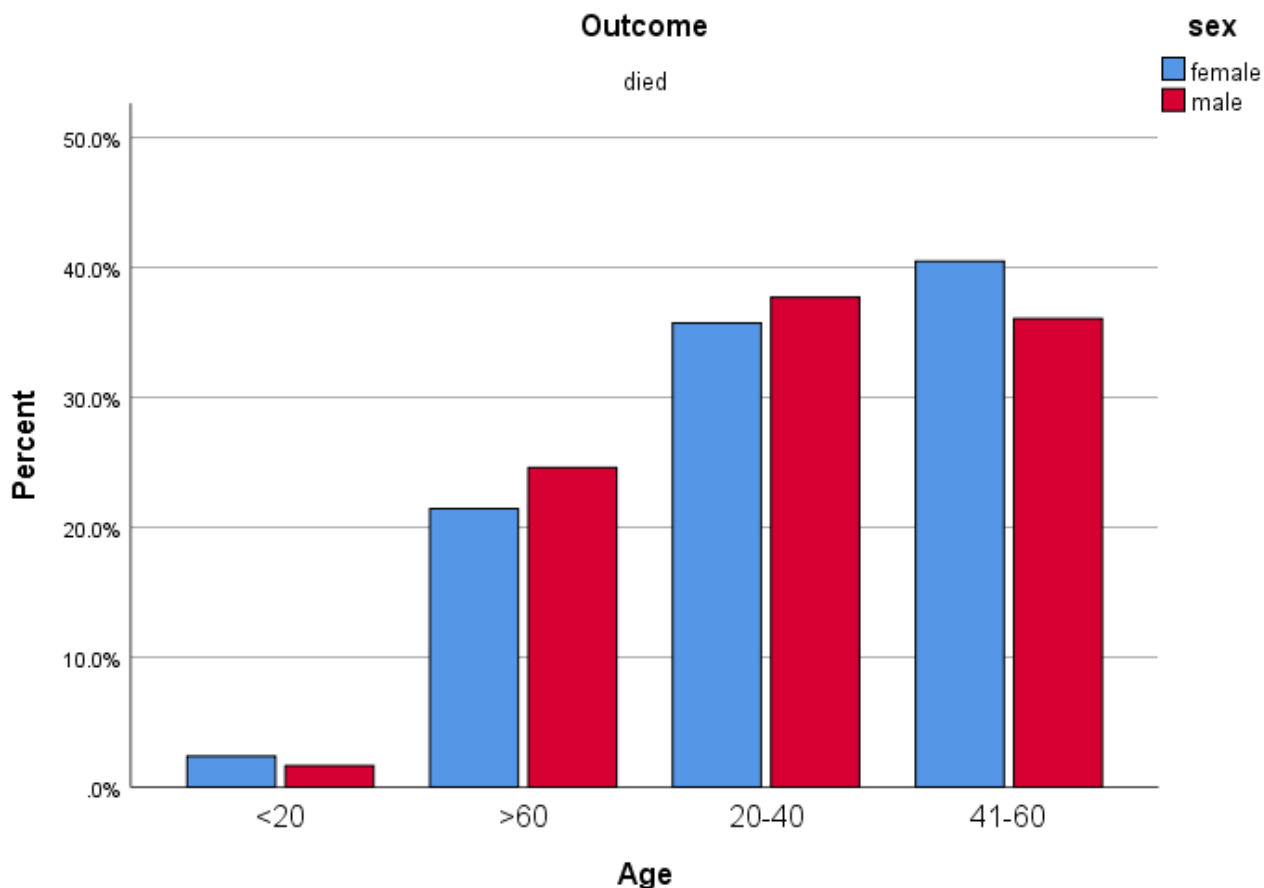


Figure 4 Proportion of death based on age and sex of patients admitted to ICU center of St. Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia from September 2021, to September 2023.

Table 9 immediate causes of Death among patients admitted to ICU center of St. Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia from september 2021, to september 2023.

Immediate causes of Death	Frequency	Percent
Refractory septic shock	54	50.0%
Multi organ failure	30	27.8%
Respiratory failure	9	8.3%
Massive PE	5	4.6%
Arrhythmia	4	3.7%
Brain herniation	6	5.6%
Total	108	100%

Factors associated with mortality

In this study, twenty-Four variables, namely sex, age category, Address ,source of admission, disease characteristics, length of ICU stay, duration of mechanical ventilation , presence of comorbidity, Systolic blood pressure, pulse rate, respiratory rate, axillary temperature, peripheral oxygen saturation, baseline leukocyte count, baseline platelet count, and baseline hemoglobin count ,albumin level, baseline creatinine, complication during ICU stay, treatment received during ICU stay were included in the regression model. To determine the factors associated with mortality while controlling possible confounders, independent variables that yielded a p-value of ≤ 0.25 in binary logistic regression were exported to a multiple regression model to compute an adjusted odds ratio to quantify the strength of association with the dependent variable.

The odds ratio (OR) for the primary outcome and the 95% CI were reported. The variance inflation factor was calculated for continuous data, and the Hosmer-Lemeshow test was performed for each analysis. A variance inflation factor of 10 was deemed the maximum acceptable value.

Hence, variables, like: Age category, source of admission, presence of comorbidity, history of diabetes mellitus, chronic kidney disease, tuberculosis, retroviral infection, systolic blood pressure, baseline leukocyte count, baseline platelet count and baseline hemoglobin count, presence of complication like septic shock ,ETT blockage ,cardiac arrest ,bed sore ,AKI , the need for invasive respiratory support ,low Albumin level ,length of ICU stay, duration of mechanical ventilation ,baseline mental status during ICU admission were observed in the bivariate regression analysis to be associated with death.

After running a multivariable logistic analysis, the only variables that showed statistically significant association with mortality were the presence of a comorbidity DM, Length of ICU stay, low albumin level, low GCS, infectious disease category and vasopressor need during ICU stay were strongly associated for adverse outcome (Table 10).

Table 10. Multivariate analysis of factors associated with the outcome of patients admitted in ICU of St Paul Hospital, Addis Ababa Ethiopia, from september 2021to september 2023 (*n = 240).

*Number of patients,AOR Adjusted Odds Ratio, CI Confidence Interval, COR Crude Odds Ratio.

Variable	Death		COR (95%CI)	P value	AOR (95%CI)	P value
	Yes (%)	No (%)				
mental status at admission						
Unconscious (GCS<8)	48(20%)	25(10.4%)	3.120(1.418-6.863)	0.005	4.889(1.419-16.840)	0.012
Disease category at admission						
Infectious disease	73(30.4%)	58(24.2%)	3.314(1.924-5.708)	0.000016	2.795(1.124-6.951)	0.027
Albumin level						
Severe hypoalbuminemia (<2.5)	9(3.8%)	9(3.8%)	17.836(2.203-144.388)	0.007	21.862(1.324-361.06)	0.031
Comorbidity						
DM	30(29.1%)	18(13.1%)	2.717(1.414-5.220)	0.003	4.732(1.602-13.978)	0.005
Treatment received						
Vasopressor/inotropes	79(33.1%)	18(7.5%)	22.708(11.513-44.787)	0.000001	26.644(11.043-64.28)	.000001
Length of ICU stay						
<24days	24(10%)	8(3.3%)	4.915(2.042-11.832)	0.0003	4.188(.975-17.996)	0.05

6. Discussion

The care of people in critical illness necessitates large financial, human, and infrastructure resources. Usually, these resources are limited in low-income Countries[7].

In this study, the overall mortality rate in ICU found to be 42.9%. This finding is higher in the study setting. In previous research, the death rate in St. Paul was 39%.

This discrepancy may result from variations in the study year and sample size. The study's sample size is relatively small compared to the previous study, which reported different mortality rates for each of the five years of the study, The highest mortality rate (45.8%) was observed in 2010; the lowest mortality rate (27.7%) was observed in 2008.

Additionally, there was a difference in the admission diagnosis between the two studies, with sepsis and infectious disease category being the most common admission category in this study and DKA and circulatory disease being the most common admission category and specific disease, respectively in the previous study and lower fatality ratio has been observed in this disease. However, this study is comparable to study conducted in the same setting with sepsis and septic shock patients, mortality was 41.8%[7, 8]. This finding is also similar with studies done in Uganda (40.1%) [30] and Tanzania (41.1%)[7, 8]. However, this result is higher than, Mekelle, Ethiopia (27%), Jimma (37.7%) and Scandinavian countries (9.1%)[12, 31]. This gap may be the result of inadequate infrastructure, training, and medical equipment (ABG-analyzer machine, portable dialysis machine, and portable x-ray service)[30, 32]. In addition, the absence of high dependency units in the study area may be a contributing factor to the high mortality rate[30, 32]. On the other hand, in this study the mortality rate was lower than the previous studies done in other parts of Ethiopia Hosanna

(46%), Kenya (53.6%). Burkina Faso (63.6%) and Nigeria (68.4%)[6, 9, 28, 33]. This could be due to the difference in admission diagnosis, Poly trauma and traumatic brain injury were the main diagnosis of admission in the previous studies. The discrepancy might also attributable to methodological aspects, including study design and patient population.

In this study majority of the patients were males 132 (55%) while females account about 108 (45%) which is similar with the one-year retrospective study done at Jimma university medical center 134 (53.17%) were males and 118 (46.38%) females [9], similar result has

been observed in studies done other African countries Kenya, Uganda, Tanzania, and Nigeria ([6, 7, 9, 32]). But there is no association between gender and patient outcome ($p=0.68$). In the current study, majority of patients were adults and they belong to age group of 20-40 years. Study result is in accordance with the previous studies done in other sub-Saharan counties as the median age of patients in Kenya (29 years) and Tanzania (34 years) respectively[9, 32]. The majority of the young patients had respiratory and infectious disease diagnoses, which could raise the risk of ICU admission in this age group.

Contrarily, the patient's population in this study was younger than the developed nation as the mean age of ICU admission in Scandinavian countries 59.3 years, and Korea 64.7 years[31, 34]. It is possible that the majority of patients in the aforementioned studies were admitted due to age-related degenerative and concomitant diseases, which accounts for the disparity.

In the current study, majority of patients 124(51.7%) stayed in ICU for more than 4 days which is similar to the other African countries[6, 7, 9]. Out of 240 patients, 32(13.3%) where stayed in ICU 24 hours or less and of this 24(10%) were died. In addition, patients who stayed in ICU for less than 24hrs were 4 times more likely to die than patients who stayed four or more days with ($AOR = 4.188$, $p < 0.05$) which is comparable with the study done in Uganda[7]. However, this result was different from the study conducted in Hosanna[28], the length of ICU stay was more than 14 days with ICU mortality ($OR = 4.113$, $P < 0.039$). This discrepancy might be explained due to late arrival to ICU and delay in intervention, shortage of crucial emergency drugs, absence of airway management equipment's in the medical ward. Furthermore, vital signs of the patients on admission to the MICU were found to be poor, which may show a gap in the continuity of care from the admission source to ICU. Early death might also be explained by a limited number of ICU bed since the World Federation of Societies of Intensive and Critical Care Medicine recommends the ICU need to have at least 5% of total hospital beds. Besides, shortage of functional mechanical ventilator which delays and denied admission of critically ill patients to ICU. The observed discrepancy might be the result of widespread absence of pre-hospital service in the country. The cumulative effect of late presentation and poor critical care setting will result in death of patients within few days of ICU admission[35].

Infectious illness accounted for 27% of all ICU admission followed by respiratory disease (25.3%) and cardiovascular disease which accounted for 13.4% of all ICU admission This is

similar to the previous studies conducted in JUSH, Addis Ababa, Uganda[7, 29]. However, it is different from a study done in St. Paul, Jimma, Mekelle, Gondor [10-12, 15] and in Nigeria where post-operative care were the main reason for admission([36]). The difference can be due to majority of admission was young age population with the commonest indication for ICU admission were pneumonia leading to respiratory failure.

In the current study, there was higher case fatality ratio of septic shock (91.7%), cardiogenic shock (60%), AMI (64.7%), stroke (53.3 %) and ARDS (50%) which is similar from studies done in Mekelle, septic shock (58%) and Addis Ababa, severe pneumonia (56.4%)([11]).

Patients with an infectious disease category at the time of ICU admission have a 2.78-fold increased chance of dying in the ICU with AOR 2.795(1.124-6.951) and Pvalue=0.000016. This is comparable with the studies done in Addis Ababa[37]. Sepsis and septic shock are associated with high mortality and morbidity in developing countries[17]

This study revealed that patients admitted with an abnormal mental status were more likely to die than conscious patients. From total ICU admission about 73(30.4%) patients were Unconscious among this 48 (46.6%) were died and this study shows presence of association between conscious status on admission and patient outcome. For those unconscious patients, the odds of ICU mortality was (AOR 4.889 = 95% CI: 1.419-16.840) times higher than those conscious patients and this result is comparable to study done in Wellega, Hassana and Ethiopia[38-40]. The conscious disturbance is connected to severe decompensated disease, cerebral hypoperfusion due to sepsis, Septic shock, poisoning, renal failure and neurological disorders. In addition, in this study, sepsis and septic shock was the most common cause of abnormal mental status followed by stroke.

When comparing patients who received vasopressor therapy to those who did not, patients who received vasopressor were 22.708 times more likely to die than those who didn't receive (AOR=26.644(11.043-64.28), P value =.000001). This study is comparable with previous studies [41-43]. It must be noted that only the sickest patients receive inotropes and vasopressors, and randomization is nearly impossible in these circumstances. Since refractory septic shock is the most common immediate cause of death in this study, the association between the use of vasoactive medications and increased mortality may simply reflect the severity of the initial illness. The risk of dying from septic shock rises steadily as the need for vasopressor therapy increases. When two or more pressors are given at full dose, mortality rises to 80%–90%.

According to the present study results, the rates of mortality, length of ICU stay, and duration of mechanical ventilation were significantly higher among diabetic patients than nondiabetic patients. This study is similar to systematic review and meta-analysis study that was conducted in the 23-country[44]

However ,it is different from study conducted at the Hospital of Sun Yat-sen University in Guangzhou, China, where it was discovered that people with comorbid DM did not have a higher 28-day death rate when compared to people without the condition, and comorbid DM had a protective effect in patients with sepsis, even with glucose ≥ 200 mg/dL, compared with non-diabetic patients with sepsis [45, 46].

likewise, clinical experience has shown that diabetes mellitus (DM) is associated with poor clinical outcomes and life-threatening infections. These associations are produced by immunological abnormalities, metabolic disorders, and reduced immune cell activity brought on by hyperglycemia[47].To fully comprehend the factors influencing the overall impact of diabetes mellitus on the prognosis of sepsis, more research is desperately needed.

This study examined the relationship between serum albumin level and ICU mortality. Serum albumin levels decreased after ICU admission in both survivors and non-survivors.

Out of all the patients whose albumin levels are measured, 164 (68.3%) have normal levels, 62 (31.7%) have hypoalbuminemia, and 10(4.2%) have severe hypoalbuminemia (<2.5 mg/dl).this study revealed Patients with hypoalbuminemia has a high ICU mortality rate (Adjusted OR 21.862, 95% CI (1.324-361.06), P value <0.03%).the result of this study is comparable with multiple studies This prospective observational studies found that the morbidity and mortality in intensive care units increased exponentially when serum albumin levels were low [48-51].

This study examined albumin levels at the time of admission and how changes in albumin levels during ICU admission related to mortality. Following ICU admission, serum albumin levels dropped in both survivors and non-survivors.

Out of all the patients whose albumin levels are measured, 164 (68.3%) have normal levels,62(31.7%) have hypoalbuminemia, and 10 (4.2%) have severe hypoalbuminemia (<2.5 mg/dl).this study revealed Patients with hypoalbuminemia has a high ICU mortality rate (Adjusted OR 21.862, 95% CI (1.324-361.06), P value <0.03%).the result of this study is comparable with multiple studies This prospective observational studies found that the morbidity and mortality in intensive care units increased exponentially when serum albumin levels were low [48-51].

7. Strength and Limitations

7.1 Strengths

- The study tried to touch a timely clinical area, where there is a scarcity of data in study setting that describes outcomes along with contributing factors

7.2 Limitations

- Some important variables that can potentially affecting mortality were not consistently available for all patients, and hence, they were not included in the final model. This included sequential organ failure assessment (SOFA), Simplified Acute Physiology Score (SAPS) and Acute Physiology and Chronic Health Disease Classification System (APACHE) difficult to tell severity and prognosis of patients.
- Observational nature of the study design implies number of possible unmeasured confounders could affect the outcome.
- Longer follow up such as hospital mortality were not evaluated.
- Finally, the study was conducted at a single center, and thus, the study doesn't represent other region thus, the findings may not be generalizable

8. Conclusion and Recommendation

8.1 Conclusion

This study showed a high mortality rate in the study setting, claiming the lives of half of ICU-admitted patients. Commonest cause of Death was refractory septic shock, Infectious disease being the commonest admission diagnosis. Patients with DM comorbidity, shorter Length of ICU stay, low albumin level, low GCS, infectious disease category at admission and vasopressor need during ICU stay were strongly associated with mortality.

8.2 Recommendation

According to the results of this study, the following recommendations can be forwarded.

For healthcare professionals

Meticulous care and aggressive management of patients, particularly those with Infectious disease category, underlying DM comorbidity, unconscious patients at admission and low albumin level.

Physician should calculate the daily calorie need based on the patient's diagnosis and energy requirements together with nutritionist.

Institution based sepsis protocol for early identification of sepsis and early initiation of management.

For local health policymakers

Local policymakers and other concerned stakeholders should devise mechanisms such as delivering capacity-building training and providing healthcare equipment along with customizing the existing guidelines to enhance the quality of care and reduce in-ICU morbidity and mortality, particularly during similar viral pandemics.

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10. Annexes

QUESTIONNAIRE:

1.Socio-demographic Characteristics of Patients admitted to ICU

Age =

Sex = M___F___

Address

- a) Addis Ababa
- b) Oromia
- c) Amhara
- d) SNNP
- e) Siddama
- f) Others, specify_____

2.Source of admission

- a) Adult emergency
- b) Medical ward
- c) Surgical ward
- d) Recovery room
- e) Others, specify_____

3.Disease characteristics

- a) medical
- b) surgical
- c) trauma

4.Presence of Comorbidities

- a) HTN

- b) DM
- c) Renal failure
- d) Malignant condition
- e) Asthma/COPD
- f) Cardiovascular disease
- g) Liver disease
- h) Others (specify)

5. Vital sign on admission

- a. HR (per minute) at admission
- b. SBP (mmHg) at admission
- c. RR (per minute) at admission
- d. SpO2 (%) at admission

6.mental status at admission

- a) Conscious
- b) Confused
- c) Lethargy
- d) unconscious

7.specific diagnosis at admission

8.Respiratory support

- a. Invasive mechanical ventilation
- b. Noninvasive ventilation

9.Initial laboratory indices of patients at ICU admission

- a. CBC
- b. Serum albumin
- c. Serum Creatinine

10. Complications during ICU stay of patients

- a) Pulmonary embolism
- b) Deep vein thrombosis

- c) Myocardial infarction
- d) ETT tube blockage
- e) Unplanned extubation
- f) Cardiac arrest
- g) DIC
- h) Septic shock
- i) Liver injury
- j) AKI
- k) Gastrointestinal hemorrhage
- l) Pneumothorax
- m) Hospital-acquired pneumonia
- n) Urinary tract infection (CAUTI)
- o) Bed sore
- p) Others(specify)

11.Treatment received during ICU stay

- a) Inotropic/Vasopressor need
- b) Transfusion
- c) Dialysis
- d) Use of sedation
- e) Antibiotic
- f) Others _____

12.Procedure done during ICU stay

- a) Chest tube insertion
- b) Pericardiocentesis
- c) Cardioversion
- d) CPR
- e) Others specify _____

13.Length of ICU stay

14. Duration of mechanical ventilation

15. Outcome

- a. Died
- b. Survived

