



Outcomes and Associated Factors Among Adult Patients Admitted to Adult Intensive Care Unit, Retrospective Cohort Study

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ABSTRACT

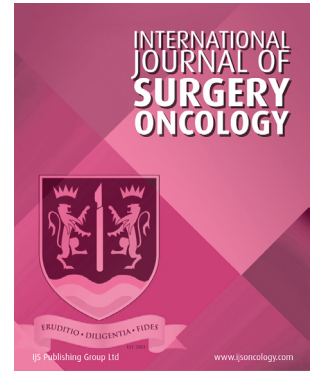
Background: Intensive care unit represent a multidisciplinary and inter-professional specialty dedicated to the total management of patients with acute life threatening condition. Now a day the care is advancing; however, in resource limited country like Ethiopia the care is very poor if any and mortality still high because of numerous reasons.

Objective: To determine outcome with its associated factors of adult patient admitted to adult intensive care unit (AICU), Ambo University Referral Hospital, and Ambo, Ethiopia.

Method: After obtaining ethical clearance, a retrospective institution-based cohort study was used. Data were retrieved from all intensive care unit (ICU) admitted patients (from September 2019 to December 2021) using a pre-tested structured questionnaire and the collected data was entered into Epi info and transported to SPSS for analysis. Risk factors and their associations were assessed by logistic regression, bivariate and multivariate logistic regression was used, P value 0.05 on multivariate logistic regression was considered statistically significant.

Result: Five hundred and fifty patients have been admitted to the intensive care unit. However; only 390 patients had completed data and were analyzed. Majority 203 (52.1%) of participants were men and 155 patients were supplied by the medical service. The overall mortality rate was 46.9%, and significantly associated with Glasgow coma scale < 9 (AOR = 3.7, P value < 0.001), patient with coexisting disease (AOR = 2.2, P value 0.001). AOR = 1.9, P-value 0.011). mechanical ventilation requirements (AOR = 2.6, P-value 0.001) and patients who stayed less than four days in intensive care are more likely to die than patients who stayed longer than four days (AOR = 2.4, P value < 0.001).

Conclusion and recommendation: The overall death rate in the intensive care unit is high and patient with low Glasgow coma scale, coexisting disease, need of mechanical ventilation short duration of stay are associated with mortality in intensive care unit. Therefore; we recommend the improvement of acute intensive care through the expansion of care, the provision of emergency equipment, drugs and human resources from different disciplines.



COHORT STUDY



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Highlights

- In our study the overall mortality rate was 46.9%.
- GCS, comorbidity, need of MV& vasopressor are associated with ICU mortality.
- Intensive care unit mortality was still high in resource limited country.

BACKGROUND

Intensive care, also called critical care, constitute a multidisciplinary and inter-professional specialty dedicated to the full management of patients with or at risk of development, dysfunction for organ development, acute, threatening [1]. It is important to be capable to predict the outcome of patients admitted to an intensive care unit (ICU) so that scarce sources can be more optimally utilized [2].

Critical care medicine has grown considerably over the past decades and now consumes a substantial share of the income of many countries around the world (nearly 1% of gross domestic product [GDP] in the United States [3]. The worldwide occurrence of mortality in ICU has more or fewer levels from nine to 61%. An international study recruiting 13, 796 individuals from Africa, Asia, America, Europe, and Oceania found out that the prevalence of mortality in ICU become 18.2% [4]. Other evidence from Sub-Saharan Africa showed that mortality in ICU was ranged from 27% to 61% [4–6] The mortality is very high in the low-income country which is as high as 61% as compared to developed countries which varied from 9 to 18% [5, 7, 8]. The rate of ICU mortality in Ethiopia varied from region to region ranging from 27 to 38% [9, 10].

Abnormal vital signs, elderly patients, patients on mechanical ventilation, acute respiratory failure, readmission in intensive care, length of stay in intensive care and sepsis are risk factors for mortality in intensive care unit [4, 11–17] In addition to this patient aspiration, Glasgow coma scale (GCS), patients on antibiotic for prolonged time and cardiac arrest are independent risk factors for intensive care unit (ICU) mortality [18, 19].

The case is much worse in poor resource settings. Thus knowing the incidence and associated factors of ICU mortality rate is vital, focusing on evaluation of requirements and monetary planning. To our knowledge; so far there is no previous study carried out dealing on morbidity and mortality in ICU at study area. Therefore; the goal of this study look at possible contributing factors to ICU mortality and to perceive regain for development in care.

METHODS

STUDY AREA AND PERIOD

This retrospective cohort study was conducted at Ambo university referral hospital, Ethiopia from September

2019 – May 2021. Ambo university referral hospital is a teaching hospital located in Oromia National Regional State, West Shewa, about 112 km from Addis Ababa, Western Ethiopia. Based on 2019 report of West Shewa District Health Office there were 2,448,272 inhabitants [20] and Ambo Referral University Hospital Intensive Care Unit (AURH ICU) is the only ICU started in September 2019 as a six bed intensive care capacity with six mechanical ventilators, one defibrillator, four monitors non-invasive hemodynamics, an ultrasound machine and a portable X-ray machine. The ICU is an open intensive care system managed by the internal medicine department. Currently, the ICU has a team consisting of a specialist in critical care medicine, internal medicine, senior anesthesiologists, 2 critical care and 8 clinical nurses, anesthesiologists and other health professionals depending on the needs of individual cases. The intensive care unit provides intensive care service not only for internal medicine cases but also for surgical and obstetrics cases. This study registered in research registry at www.researchregistry.com with Research Registry UIN: researchregistry7604 and the methodology is reported according to SROSS guidelines 2021 [21].

STUDY DESIGN

Institutional based retrospective cohort study.

SOURCE AND STUDY POPULATION

Source of population

All patients who were admitted to intensive care unit.

Study population

All intensive care unit admitted patient who will be candidate for inclusion criteria.

INCLUSION AND EXCLUSIVE CRITERIA

- ✓ Age greater than 17

Exclusion criteria

- ✓ Unknown clinical outcome during patient discharge
- ✓ Those who died on arrival (since patient do not get adequate care in the ICU)
- ✓ Covid-19 patient

VARIABLES

Dependent variable

Clinical Outcome (survived or not survived)

Independent variable

Socio-demographic variables

- Age,
- Gender
- Residency

Variable during patient admission

- Clinical diagnosis at admission
- Presence of comorbid illness
- Supply of admission
- Frequency of ICU admission
- Vital sign at admission
- Length of ICU stay

Management of patient during intensive care unit stay

- Mechanical ventilator
- Use of vasopressor
- Fluid resuscitation

OPERATIONAL DEFINITION

- ✓ **Clinical outcome:** In this research, clinical outcome indicated either patients survived or not survived at the time of discharge for the purposes of this study, we considered ICU survivors, including patients who improved and were discharged, transferred to wards, and those who left against medical advice. Those who died in intensive care were classified as non-survivors. Due to the possible effect of a disease on multiple organ systems, cases were grouped systematically according to the immediate reason for admission to intensive care or the approach applied in similar relationships to the inside and outside Ethiopia

SAMPLING TECHNIQUES

All patients who were admitted in critical care unit from September 2019 to April 2021, who had completed data were included (*Figure 1*).

DATA COLLECTION PROCEDURES

Twenty-six patients had incomplete recording data and their recordings could not be located. A total of 550/390 (70.9%) of all ICU admissions over 17 years of age were included in the study. records of all patients observed consecutively during the study period were included in the study. Daily ICU patient records were

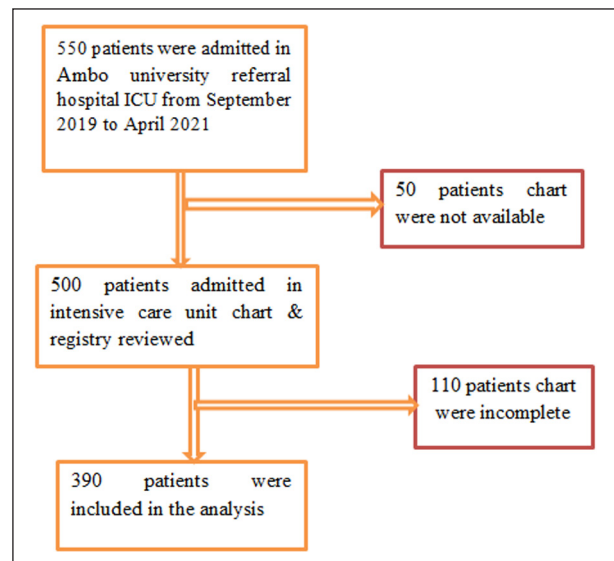


Figure 1 Diagram illustrating records series technique amongst patients admitted to intensive care unit from September 2019 to April 2021.

used to collect data in a form prepared for this purpose. The registry included the number of patient records, date of admission, age, gender, admission address and diagnosis, length of hospital stay, retroviral status, and treatment outcomes. In cases where register data was incomplete or deemed ambiguous, patient records were obtained from the graphics room to supplement the data to be collected. All registry data and graphic data have been collected by nurses.

Data quality control

To assure the quality of the data, data collectors were trained, and the investigator was made a regular supervision and follow up. In addition, regular checkup for completeness and consistency of the data were made on daily basis. Once the data was collected and checked for completeness, consistency and accuracy, it was sorted, categorized and summarized

DATA ANALYSIS AND INTERPRETATION

Data was cleaned, edited and entered into Epi info. Version 7 and analyzed using SPSS software. Characteristics of study participants were analyzed using descriptive statistics. After multicollinearity was checked using $IF < 10$ and Tolerance test > 0.1 , variables having p value ≤ 0.2 at bivariate logistic regression analysis were fitted into multivariable logistic regression. Bivariate and multivariate logistic regression was used to identify the association between dependent and independent variables. Multiple logistic regressions with a calculation of adjusted odds ratios were used to determine the influence of covariant on mortality. Statistical

significance was considered at a p value of < 0.05. Odds ratio with 95% confidence interval was used to show the strength of association between independent and dependent variables.

RESULT

PATIENT DEMOGRAPHIC CHARACTERISTICS OF PATIENTS ADMITTED IN INTENSIVE CARE UNIT

Of the 550 consecutive patients admitted during the study period, 390 patients were analyzed. Of the total number of patients admitted to the adult intensive cares unit, 203 (52.1%) were men and 187 (47.9%) were women. The average age of the participants was 48.39 years. ± 21.57 years. Of the study participants, 116 (29.7%) were geriatric patients. The majority of them hospitalized 155/390 patients from the medical service (39.7%) followed by emergencies 128/390 patients (32.8%). Of all participants 215 of them are from Rular part west shawa zone and the rest were from urban area (Table I).

VARIABLES	CATEGORIES	FREQUENCY	PERCENTAGES
Age	<65	214	70.3%
	65-96	116	29.7%
Gender	Male	203	52.1%
	Female	187	47.9%
Residency	Rular	215	55.1%
	Urban	175	44.9%

Table I Patient demographic characteristics of patients admitted in intensive care unit.

INTERVENTION MADE DURING INTENSIVE CARE UNIT STAY

Of the 390 patients, 290 (74.4%) had mechanical ventilation and the remaining 100 (25.6%) were not on mechanical ventilation. The mean length of stay in intensive care was 4.37 ± 3.37 with a minimum length of stay 1 and maximum 23 (Figure II). Out of 390 patient 177(45.6%) needs vasopressor and 255 (65.4%) were sedated during their stay.

SUPPLY OF INTENSIVE CARE UNIT ADMISSION AT AMBO UNIVERSITY REFERRAL HOSPITAL (FIGURE III)

Vital sign during admission of study participant in intensive care unit

Vital Sign on Admission of Patients Admitted to the ICU: In this study, most patients had unstable vital signs during hospitalization, 198 (50.8%) patients had an elevated heart rate. Majority of patients had altered blood pressure (high or low). In addition, 70.3% of patients had less than 90% saturation. Regarding the level of consciousness of the patients upon arrival at the ICU, 107 (27.4%) patients were GCS above 13, the others presented with a disturbed mental state (Table II).

Diagnosis during patient admission intensive care unit

The highest mortality rate (20.5%) was observed in 2020; the lowest mortality rate (13.6%) was observed in 2019. (Figure IV)

MORTALITY AMONG PATIENTS ADMITTED TO INTENSIVE CARE UNIT. SEPTEMBER 2019 TO APRIL 2021, (N = 390)

Our primary outcome incidence of intensive care unit mortality, 183 patients died considering the mortality

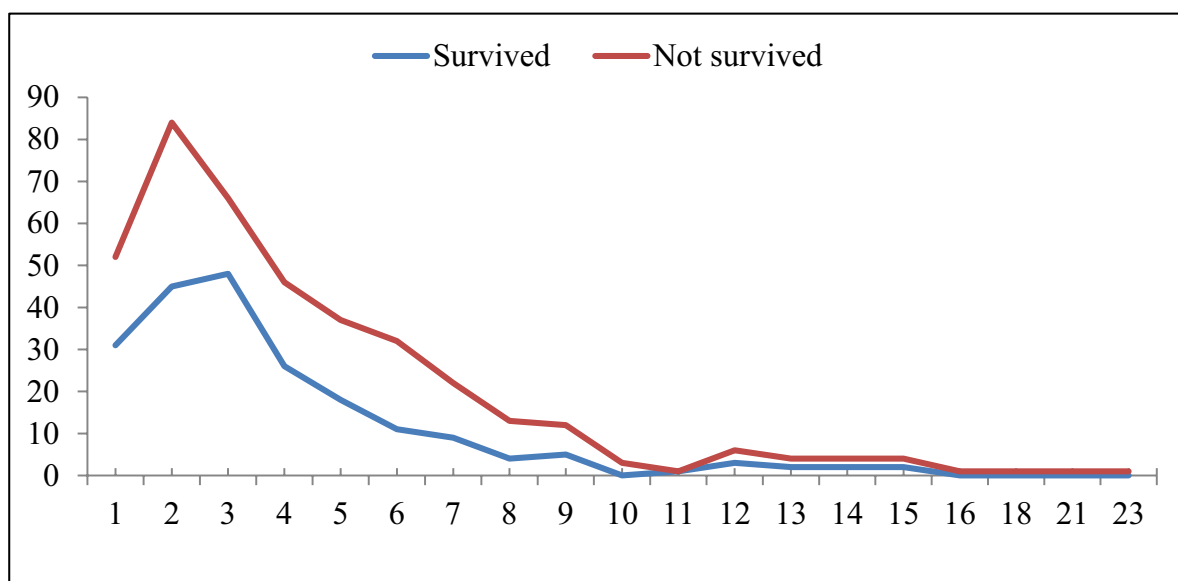


Figure II Length of ICU stay between survivor and non-survivor among patients admitted to intensive care unit between September 2019 to April 2021, (N = 390).

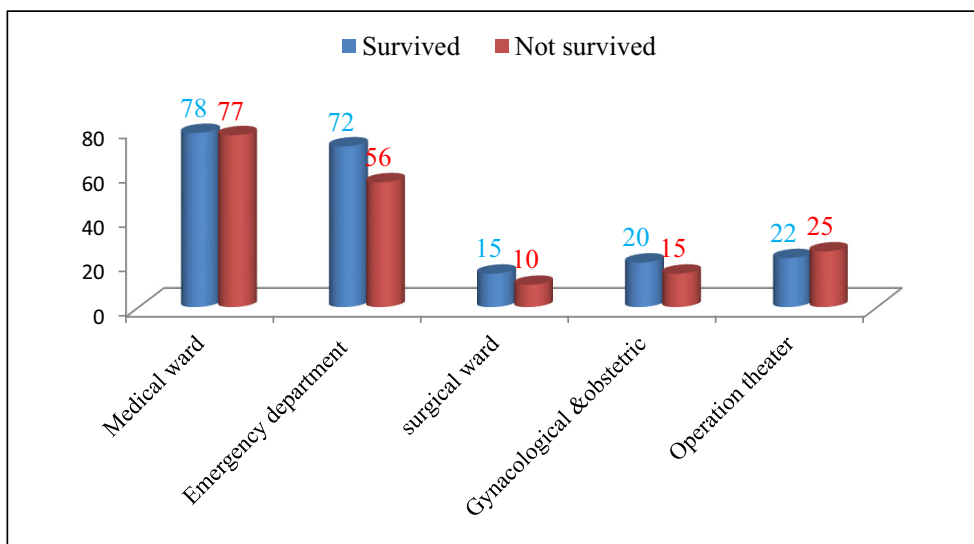


Figure III Bar graph showing Supply of intensive care unit admission in intensive care unit from September 2019 to April 2021.

VARIABLES	CATEGORIES	FREQUENCY	PERCENTAGE
Heart rate	<60bpm	30	7.7%
	60-100bpm	162	4.5%
	>100bpm	198	50.8%
Spo2	<90	275	70.3%
	>90	116	29.5%
SBP	<90	193	49.5%
	90-140	128	32.8%
	>140	69	17.7%
DBP	<60	216	54.1%
	60-90	125	32.1%
	>90	54	13.8%
Temperature	<35.5	166	42.6%
	35.5-38	145	37.2%
	38	79	20.3%
GCS	<9	193	49.5%
	9-13	90	23.1%
	>13	107	27.4%

Table II Vital sign of patients during admission in intensive care unit.

rate of 46.9% and the immediate cause of death in the majority of patients was a patient with coexisting disease 109/390 (27.9%).

MULTIVARIABLE LOGISTIC REGRESSION SHOWING THE FACTORS ASSOCIATED WITH MORTALITY AMONG PATIENTS ADMITTED TO INTENSIVE CARE UNIT FROM SEPTEMBER 2019 TO APRIL 2021, (N = 390)

Bivariate logistic evaluation proven that oxygen saturation, Glasco coma scale during admission readmission, patient

with coexisting diseases, use of vasopressor, want for mechanical ventilation and period of ICU stay have been appreciably related to the outcome of in ICU. However, in a multivariate evaluation spo2 and readmission have not been associated with patient death in ICU.(Table III)

DISCUSSION

The ICU death rates at this Ethiopian teaching hospital reflect the challenges ICU delivery faces in the developing world. Late presentation in hospital secondary to poor access to health care plays a predominant role. This is confused by inadequate staffing, training, diagnostics and intervention limitations. Despite limited resources, simple and cost-effective measures can improve morbidity and mortality [8].

The mortality rate in low-income countries is very high, up to 61% compared to developed countries, this rate ranges from 9 to 18% [4, 5, 8] The overall mortality rate in Ambo university referral hospital intensive care unit was 46.9% which is similar in study done in southern part of Ethiopia mortality rate 46.8 [18] but in contrast to our study another study done in Ethiopia Ayder comprehensive specialized hospital the overall mortality rate was 27%, this variation could be explained as Care of critically ill patients is challenging in resource-limited settings, where the burden of illness and mortality from potentially treatable conditions is higher than in resource-rich settings. Barriers to providing quality critical care in these settings include a lack of epidemiological data and contextual evidence for medical decision-making, gaps in health systems organization and resources, and institutional barriers to implementation. implementing life-saving interventions [6].

In this study patient with GCS < 9 are risk factor for intensive care unit mortality like other studies [11, 22]. This could be level of disturbance of consciousness is related

VARIABLES	COR	AOR	95% CONFIDENCE INTERVAL	P VALUE
Spo2 at admission	<90%	1.3	0.76–2.23	0.34
	≥90%	1	1	
GCS	<9	3.7	2.12–6.53	<0.0001*
	9–13	1	1	
	>13	1	1	
Readmission	Yes	2.3	0.99–5.19	0.052
	No	1	1	
Coexisting	Yes	2.2	1.413–3.523	0.001*
	No	1	1	
Use of vasopressor	Yes	1.9	1.156–3.075	0.011*
	No	1	1	
Mechanical ventilation	Yes	2.6	1.511–4.456	0.001*
	No	1	1	
Length of stay in ICU	≤4	2.4	1.471–3.82	<0.0001*
	>4	1	1	

Table III Multivariable logistic regression showing the factors associated with mortality among patients admitted to intensive care units from September 2019 to April 2021, (N = 390).

Key: *Significantly associated at P < 0.05, 1.00: reference.

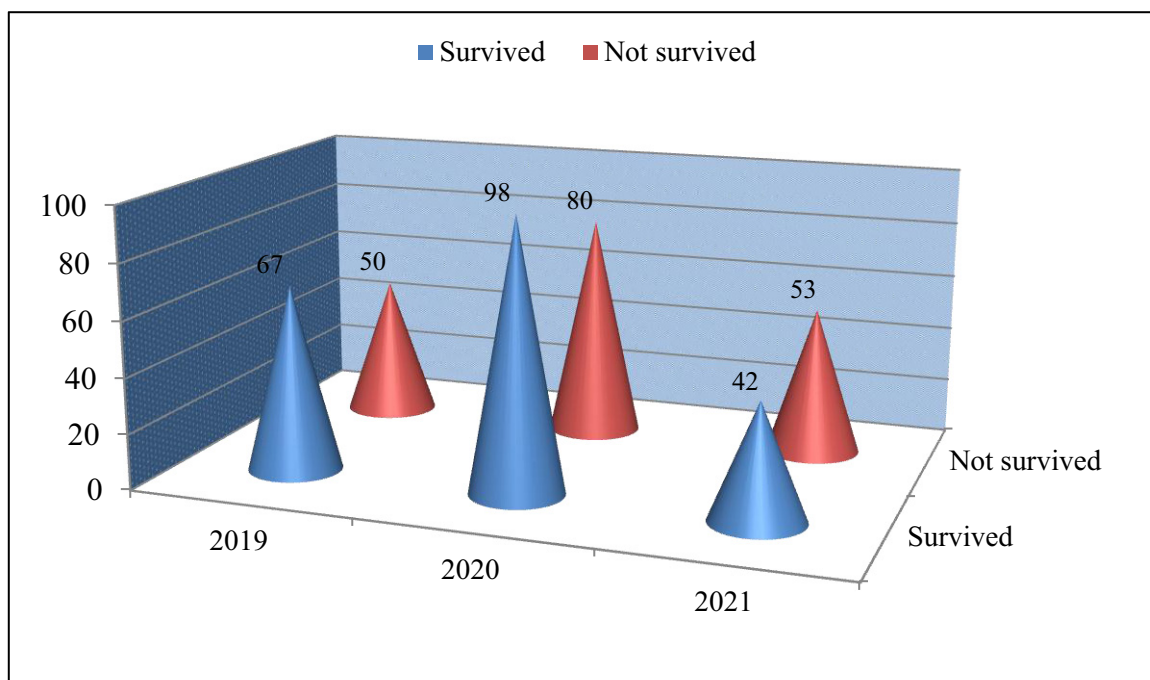


Figure IV Distribution of intensive care unit mortality rate in different year.

to severe decompensated disease, cerebral hypoperfusion due to sepsis, blood loss, intoxication and neurological disorders. In addition to this, patients with abnormal mental status may not protect their airway, which further increases the risk of respiratory and infectious diseases [7].

In our study use of vasopressors were associated with patient mortality in intensive care unit similar to other studies [5, 23] this might be explained as due to

vasopressors, serious adverse effects of vasopressors are digital and muscle ischemia, tachyarrhythmias, and atrial fibrillation (increased risk of cerebrovascular accident) [24].

This study found that the need for mechanical ventilation is an independent risk factor for ICU mortality (AOR: 2.6, P = 0.001) that was similar to studies in Hindawi, Gondor and Jimma in which the mechanical ventilator was an independent risk factor for death [7,

19, 25]. The possible explanation for this association could be related to the fact that mechanical ventilation is started for patients with respiratory failure, unable to protect the airway and hemodynamics instability. Additionally, patients requiring intubation and a mechanical ventilator are more vulnerable to ventilator-associated pneumonia and other hospital-acquired infections, further compromising clinical outcomes in critically ill patients [7, 26, 27]. In addition, these patients who were on mechanical ventilator were presented with unstable vital sign and comorbid conditions which might be increased the odds of in ICU mortality.

In this study, the average length of stay in the intensive care unit was 4 days, similar to some studies [5, 27]. In our study, Out of 390 patients, 248(63.6%) where stayed in ICU 4 days or less. Of these, 98 (39.5%) patients died during the indicated period, accounting for 53.6% of ICU overall mortality. Additionally, patients who stayed in the ICU for less than 4 days were 2.4 times more likely to die than patients who stayed in the ICU for more than 4 days (AOR = 2.4, $p < 0.001$). Study in Gondar and Uganda. [27, 28]. However, our end result changed into distinct from the examine carried out in Jimma, this imply period of ICU live changed into four days, which changed into ICU live greater than four days strongly related to ICU mortality [8]. Differences in the average length of stay in the intensive care unit include delayed admission to the intensive care unit and delayed intervention, lack of essential medicines for emergency treatment such as anticoagulants, antiarrhythmic drugs, and antibiotics, and lack of airway equipment. In addition, the vital signs and overall clinical condition of patients admitted to the adult intensive care unit were very poor, so it is possible that the continuity of care from the emergency room, internal medicine, and surgery to the intensive care unit was cut off. The cause of premature death may also be due to the limited number of ICU beds, as the World Federation of Intensive Care Societies and Critical Care Medicine recommends that ICUs make up at least 5% of all beds. In addition, there is a shortage of functional ventilators that delay hospitalization of critically ill patients and prevent them from entering the intensive care unit [27, 29].

In our study patient admitted with coexisting disease other than their acute illness during admission was risk factor for intensive care unit mortality (AOR= 2.2, P value 0.0001) this is comparable in study done by RI Docking et al and H. Haftu et al [30, 31]. this could be due to Comorbidities have been shown to have significant impact on the clinical course, complications and outcomes in the ICU [32].

CONCLUSION AND RECOMMENDATION

The overall mortality rate of (AURH ICU) was high (46.9%), low GCS, need of mechanical ventilation, use of vasopressor, less than four days intensive care unit stay and patient with

coexisting diseases are associated factors for ICU mortality. Improvement of acute intensive care through the expansion of care, the provision of emergency equipment, drugs and human resources from different disciplines.

LIMITATION OF THE STUDY

Although this study provided information on clinical outcomes and associated factors in critically ill patients admitted to AURH ICU, some limitations could be addressed in another study. Due to the nature of the study design, the retrospective study based on ICU chart and registry, only limited data were retrieved. Therefore, the necessary variables, which help to identify risk factors independent of the clinical results of patients admitted to intensive care, were not collected. In addition, data on physiological and laboratory variables needed to calculate severity and prognostic score such as Sequential Organ Failure Assessment (SOFA), Simplified Acute Physiology Score (SAPS), and Acute Physiology and Chronic Diseases classification system (APACHE); to predict ICU mortality were not collected due to the impossibility of locating them in the available written chart and ICU registers.

RESEARCH REGISTRATION

1. Name of the registry: [Researchregistry.com](https://www.researchregistry.com)
2. Unique identifying number or registration ID: research registry 7604

ABBREVIATIONS AND ACRONYMS

AICU: Adult intensive care unit, **AOR:** Adjusted odd ratio, **AURH:** Ambo university referral hospital, **AURH ICU:** Ambo university referral hospital intensive care unit, **GCS:** Glasgow coma scale, **GDP:** Gross domestic product, **ICU:** Intensive care unit, **NIBP:** Noninvasive blood pressure, **SPSS:** Satirical package for social science

GUARANTOR

Zenebe Bekele

DATA ACCESSIBILITY STATEMENT

Data is available on request.

ETHICS AND CONSENT

The study was commenced after ethical clearance is obtained from Ambo university College of Medicine and

Health Science. Permission was obtained from Ambo university referral hospital to conduct the research. Patient identification number was recoded. Confidentiality of information obtained was fully secured or assured.

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COMPETING INTERESTS

The authors have no competing interests to declare.


AUTHOR CONTRIBUTIONS

ZB, HJ and **MH** have made substantial contributions to conception, design, analysis, and interpretation of data, participated in the critical review, and editing of the manuscript drafts for scientific merit and depth.

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