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Mortality and its Associated Factors Among Patients Admitted in Intensive Care Unit of Injibara General Hospital, Awi Zone, North West, Ethiopia, 2021

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MORTALITY AND ITS ASSOCIATED FACTORS AMONG PATIENTS ADMITTED IN INTENSIVE CARE UNIT OF INJIBARA GENERAL HOSPITAL, AWI ZONE, NORTH WEST, ETHIOPIA, 2021

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STUDY AREA……INJIBARA

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ABSTRACT

Background: Globally, critical illness causes up to 45 million deaths every year, especially the burden is highest in low-income countries. Sub-Saharan Africa bears a disproportionate high global burden of disease compared with the rest of the world. Although some studies were conducted on prevalence and associated factors of intensive care unit mortality in Ethiopia, still there are limited data on factors associated with mortality among intensive care unit admitted patients in Ethiopia including the study area.

Objective: To assess the magnitude of mortality and its associated factors among patients admitted in intensive care unit of Injibara General Hospital, Awi Zone, Ethiopia, 2021

Methods: An institution based retrospective cross-sectional study was conducted between September/10/2021 to October/10/2021, simple random sampling was employed to select sample size of 422. Data were collected through pre tested data collection checklist by trained data collectors. Data were coded and entered in to Epi data version 3.1. Then cleaned and exported in to SPSS version 20 for analysis. Bi variable and multivariable logistic regression analysis were employed. Variables having P-value < 0.25 during bi-variable analysis were entered into multivariable analysis. Finally, adjusted odds ratio with 95% Confidence Interval at p-value < 0.05 was considered as statistically significant.

Results: Total patients participated were 421 with a response rate of 99.7%, the overall intensive care unit mortality was 37.8% with (95%CI:33-42). In the multivariable analysis patients age 20-40years(AOR=1.13,95%CI:1.1-3.79), >60years(AOR=3.1,95%CI:1.68-6.6), time of admission (AOR=2.13, 95%CI:1.32-3.43), NG tube feeding (AOR=0.29, 95%CI:0.17-0.48), inotropes support (AOR=0.086, 95%CI:0.04-0.16) and length of stay >14days (AOR=0.27, 95%CI: 0.1-0.74) were showing statistically significant association with intensive care unit mortality.

Conclusions and recommendations: The overall mortality was high and age, time of admission, tube feeding, inotropes support and length of stay were shown statistically significant association with intensive care unit mortality. Therefore, improving tube feeding, giving inotropes timely to decrease mortality among critically ill patients admitted to intensive care unit.

Key words: Intensive care unit, Length of stay, Mortality, Re-admission and time of admission

LIST OF ABBREVIATIONS AND ACRONYMS

AOR……..Adjusted Odds Ratio

ARHB……. Amhara Regional Health Bureau

CBC…….…..Complete Blood Cell

CBHI…….Community Based Health Insurance

CI…….….Confidence Interval

COR…….…..Crude Odds Ratio

GCS…….. Glasgow Coma Scale

HCT……..…Hematocrit

HIV…….Human Immunodeficiency Virus

ICU…… Intensive Care Unit

IGH……..Injibara General Hospital

LOMV…….….Length of Mechanical Ventilation

LOS……..Length of Stay

MV……...Mechanical Ventilation

NG…….……Nasogastric

SPSS…….Statistical Product and Service Solutions

WBC……....White Blood Cell

WHO……World Health Organization

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1. INTRODUCTION

1.1.Background

An intensive care unit (ICU) is an organized system for the provision of care to critically ill patients in the ICU patients get intensive and specialized medical and nursing care and multiple modalities of physiologic organ support to sustain life during a period of life-threatening medical conditions (1). The world's first ICU was established at the municipal Hospital of Copenhagen, in 1953 by the Danish anesthetist Bjørn Ibsen, during the polio pandemic (2).

Provision of intensive care services is growing globally, likewise the service is increasing in Ethiopia, but it is not well studied to date, on the other hand, there is a decline in death at the ICU in the developing countries in the world, but it is still high as compared to the developed countries. So, intensive care training of health workers and management with better medications are needed to reduce death at the ICU and expansion of ICU care to the other wards is required in order to optimize critical patients care and create more space for cardiovascular and other chronic medical problems cases whose number is on the rise and leads to increase ICU mortality (3, 4).

The journey toward excellent global critical care in 2050 is less likely to be easy but is certainly going to be an exciting and interesting one due to global epidemiological data regarding outcomes for patients in ICUs are limited, but are important in understanding the worldwide burden of ICU mortality (5). A comprehensive multifaceted approach is needed to improve the delivery of critical care service globally, and such efforts are likely to translate to major improvement in patient outcome in the ICU (6). Amhara regional health bureau(ARHB) plan to reduce ICU mortality less than 30% and expand ICU service to reduce ICU mortality(7).

1.2. Statement of the problem

Mortality in the ICU is a global burden, globally critical illness causes up to 45 million deaths every year, it is highest in low-income countries and it varies across the world depend on ICU infrastructure, staff availability and training pattern and cause of ICU admission (8, 9). Crude ICU mortality rates were higher in patients admitted to ICUs in upper-middle income countries than to ICUs in high-income countries (5).

Globally epidemiological data regarding outcomes for patients in ICUs are scarce, but are important in understanding the worldwide burden of critical illness (5). Similarly, mortality in the ICU has been associated to many risk factors, identification of these risk factors potentially contributes to predict and reduce mortality rates in the ICU (10).

The practice of ICU care in Sub-Saharan Africa is challenging and can have a significant impact on the lives of people in the region. As a result, Sub-Saharan Africa bears a disproportionate high burden of disease which causes ICU mortality compared with the rest of the world (11). Likewise, Patients from low-income countries were not adequately receive mechanical ventilation during the ICU stay than patients in upper-middle or high income countries these causes poor ICU outcome (9).

Intensive care medicine is a developing discipline in almost all least developed countries and it is face a financial restraints due to inadequate insurance and national health systems together with severe logistic and educational problems account for high morbidity and mortality rates in ICUs of least developed countries (12). In Ethiopia over two fifth of the patients admitted to ICU were died, this is due to a limited infrastructure, personnel and resource which contribute to high ICU mortality (13).

Even if critically ill patients were admitted to the ICU to reduce morbidity and mortality associated with acute illness, trauma or surgical procedures many report showed there were poor outcomes of patients admitted to ICU (4, 13-16). Similarly, ICU mortality varied from region to region in Ethiopia, but the body of evidence on ICU mortality and its predictors is uncertain that needs further study (10).

Previously some studies were conducted on the prevalence and associated factors of mortality among ICU admitted patients in referral and above level hospitals, however, there is limited data on general hospitals ICU and on factors like laboratory investigations, health professionals evaluate the patient and therapeutic intervention given for patients related to ICU mortality in Ethiopia including the study area. Therefore, this study was designed to assess mortality and its associated factors among patients admitted in ICU of Injibara General Hospital (IGH), Awi Zone, Ethiopia.

1.3. Significance of the study

The study will be important for patients admitted at ICU and clinicians for predicting and controlling of factors related to mortality. It will be important for policy makers and strategy designers to design strategies based on the recommendations for appropriate interventions to reduce the future burden of mortality and associated factors of mortality among patients admitted at ICU. Also it will be important for ARHB and Ministry of Health to develop appropriate programs for prevention and control intervention. Lastly it will be important for researchers as a source of evidence for further study.

2. LITERATURE REVIEW

2.1. Prevalence of mortality

Mortality in ICU is a global burden (8, 9). A cross sectional study conducted among patients in the hospital of Sergipe, northeastern Brazil from 2017-2018 identified a 21% ICU mortality rate (10).

The ICU mortality rate is high in most African countries as it compared to the other developed countries. Such as; studies in Kenya, Uganda, Nigeria and Botswana reported 26.6%, 27.8%, 34.6% and 42.8% ICU mortality respectively (17-20). Another study in Western Kenya also showed high ICU mortality with (53.6%) (21). On the other hand a study in South Africa revealed that 19.7% ICU mortality (22).

In Ethiopia, different studies showed that the mortality rate is relatively high as to other Africa countries, Studies done in Jimma two studies showed ICU mortality of 37.7% & 50.4%, Addis Ababa 39%, Mekelle 27%, Hosanna 46.42%, Gondar 38.7% and recently a multi-center cohort study among three teaching referral hospital ICUs in southern Ethiopia (Dilla, Wolaita sodo and Hawassa) Universities showed the overall ICU mortality rate was 46.8%, all these studies showed ICU mortality was high (4, 13-16, 23, 24).

2.2.Factors associated with mortality

2.2.1. Socioeconomic and demographic factors

A retrospective study conducted in yemen showed a significant statistical relationship between the death in ICU with the age, Similarly studies in Brazil, Jimma, Southern Ethiopia, Addis Ababa showed older age was significantly associated with ICU mortality (3, 10, 14, 16, 17, 21, 25). Likewise, a study in Uganda showed from all ICU admission age group 18-60yrs account high ICU mortality (19).

A study conducted in Jimma showed that higher ICU mortality in males (23). On the contrary, study conducted in Gondar reported higher ICU mortality among females (16).

2.2.2. Clinical characteristics of study patients

A cross sectional study conducted in Brazil showed that modifiable factors associated with higher mortality in the ICU were admission from inpatient units (10). Similarly, study in Brazil showed readmissions to the ICU were strongly related to poor ICU outcomes (19). A study in Europe, Asia & Americas showed Sepsis was associated with high ICU mortality rates in all countries (5). Another study in China showed night time admission was significantly associated with poor ICU outcomes (26). On the contrary, study in Kaohsiung Medical University Hospital showed that non-office-hour admissions to medical ICU were not significantly associated with poor ICU outcome compared with office-hour admissions (27).

A study in South Africa showed overall majority of patients had at least one co-morbidity and the most common co-morbidity was cardiovascular disease, followed by infectious disease, HIV and respiratory disease that lead to poor ICU outcome (22).

Likewise, a retrospective study in western Kenya showed majority of ICU admission from Operating theater and majority of ICU mortality occur from medical ward to ICU admitted patients (21). Similarly, a study conducted in kenya showed that from all admission patients from medical ward is high admission and high mortality in ICU (17).

A retrospective study in yemen showed there was a significant statistical relationship between the death in ICU with length of stay and average hospitalization was 1-7 days and the most common causes of death were from circulatory system disorders, followed by renal failure (3).

A prospective study in Uganda showed the diagnosis categories associated with the highest number of ICU deaths were admission following surgery (including trauma), medical conditions and traumatic brain injury (25). Likewise, study conducted in South Africa showed there was a significantly higher proportion of trauma and infectious disease in the emergency admission group and there were a number of significant differences noted between the elective and emergency admissions, due to ICU mortality was significantly higher in the emergency admission group than in the elective admission group (22). A retrospective study in Western Kenya showed HIV status was not associated with ICU mortality (21).

A longitudinal study conducted in Jimma showed that major causes of ICU admission was cardiovascular origin and there were significant deaths among admissions in the ICU and major

co-morbidities that cause ICU mortality were infectious disease (23). Similarly, a multi-center cohort study among three teaching referral hospital ICUs in Ethiopia from June 2018 to May 2020 showed that the majority of independent predictors of ICU mortality were cardiac arrest, aspiration, infection, unstable vital signs at admission and being on a mechanical ventilator all these lead to poor ICU outcome (15).

Study in Mekelle showed high number of deaths among communicable diseases cases compared with non-communicable disease cases in ICU. On the other hand, there was an epidemiologic transition from the once by far the commonest diseases like infectious diseases to non-communicable diseases like cardiovascular diseases which causes frequent ICU admission and mortality (4, 14).

Institutional based cross sectional study in Nigist Eleni Mohammed Memorial Hospital of Hosanna showed that early admitted and conscious patients were more likely survive than the others and over two fifth of the patients admitted to ICU was died (13).

A retrospective observational study conducted at Jimma University Specialized Hospital showed major causes of ICU mortality included trauma, cardiac disease, acute abdominal presentations, septic shock, tetanus and hysterectomy secondary to uterine rupture (24).

Similarly, a study conducted in University of Gondar comprehensive specialized hospital showed that length of intensive care unit stay and mental status at admission were strongly associated with clinical outcome of patients admitted to medical intensive care unit but ICU mortality was not significant among source of admission (16).

2.2.3. Therapeutic intervention given during ICU stay

A cross-sectional study in Brazil showed mechanical ventilation and tube feeding were significantly associated with ICU mortality (10). Another study in China showed patients who received vasopressor had an increased risk of ICU mortality (28).

A study in Uganda showed that mortality of patients whose lungs were mechanically ventilated decreased significantly over time (25). Similarly, study in Nigeria showed that a total of (16.7%) patients admitted into ICU received invasive mechanical ventilation during their stay, while (64%) of these patients died on admission (18). Likewise, a retrospective study in western Kenya

showed that mechanical ventilation and vasopressor support were significantly associated with ICU mortality (21).

Also, a study conducted at University of Gondar comprehensive specialized hospital showed that patients need for mechanical ventilator were strongly associated with clinical outcome of patients admitted to medical intensive care unit (16).

2.2.4. Health professionals evaluate the patient and give care at ICU admission

A retrospective study conducted in a medical ICU of a tertiary medical center in Rochester showed that, differences in intensivist-to-ICU bed ratios, ranging from 1:7.5 to 1:15, were not associated with differences in ICU or hospital mortality (29). Another study showed that Nurse staffing levels were associated with patient outcomes mainly mortality in critical care units (30). A study conducted in reviewing the literature and identifying and critiquing existing studies examining the use of nurse practitioner and physician assistant in acute and critical care settings, support was found for their involvement in patient care management, reinforcement of practice guidelines, education of patients, families and ICU staff, and research and quality initiative to reduce mortality in ICU (31).

2.2.5. Laboratory results at ICU admission

Laboratory results are the most important factors associated with patient outcome, A longitudinal cohort study in Naples showed in persons with chronic kidney disease stages 3 and 4, urine creatinine declines at a rate of 16 mg/d per year, these lower urine creatinine excretion leads to greater risk of kidney failure and patient mortality (32). Similarly, study conducted in the University Medical Center Groningen, the Netherlands, showed low urinary creatinine execration rate is associated with smaller body dimensions and more severe heart failure and is associated with an increased risk of adverse outcome (33). On the other hand, study conducted in the Netherlands, between January 1993 and December 2010 showed, lower post-transplant urinary creatinine execration rate was inversely associated with an increased risk of mortality(34). Another prospective study in Israel, from January 2000 and June 2005 showed, elevated blood urea nitrogen (BUN) and BUN/creatinine ratio on admission are independent predictors of long-term mortality in patients with acute ST-elevation myocardial infarction (35).

A Study showed that Sepsis represents an important global health burden due to its high mortality and morbidity, CBC parameters detain great potential. Specially, alteration of CBC parameters might represent an alert for clinicians, which should confirm the suspicion of sepsis with more specific laboratory and clinical investigations (36).

3. CONCEPTUAL FRAMEWORK

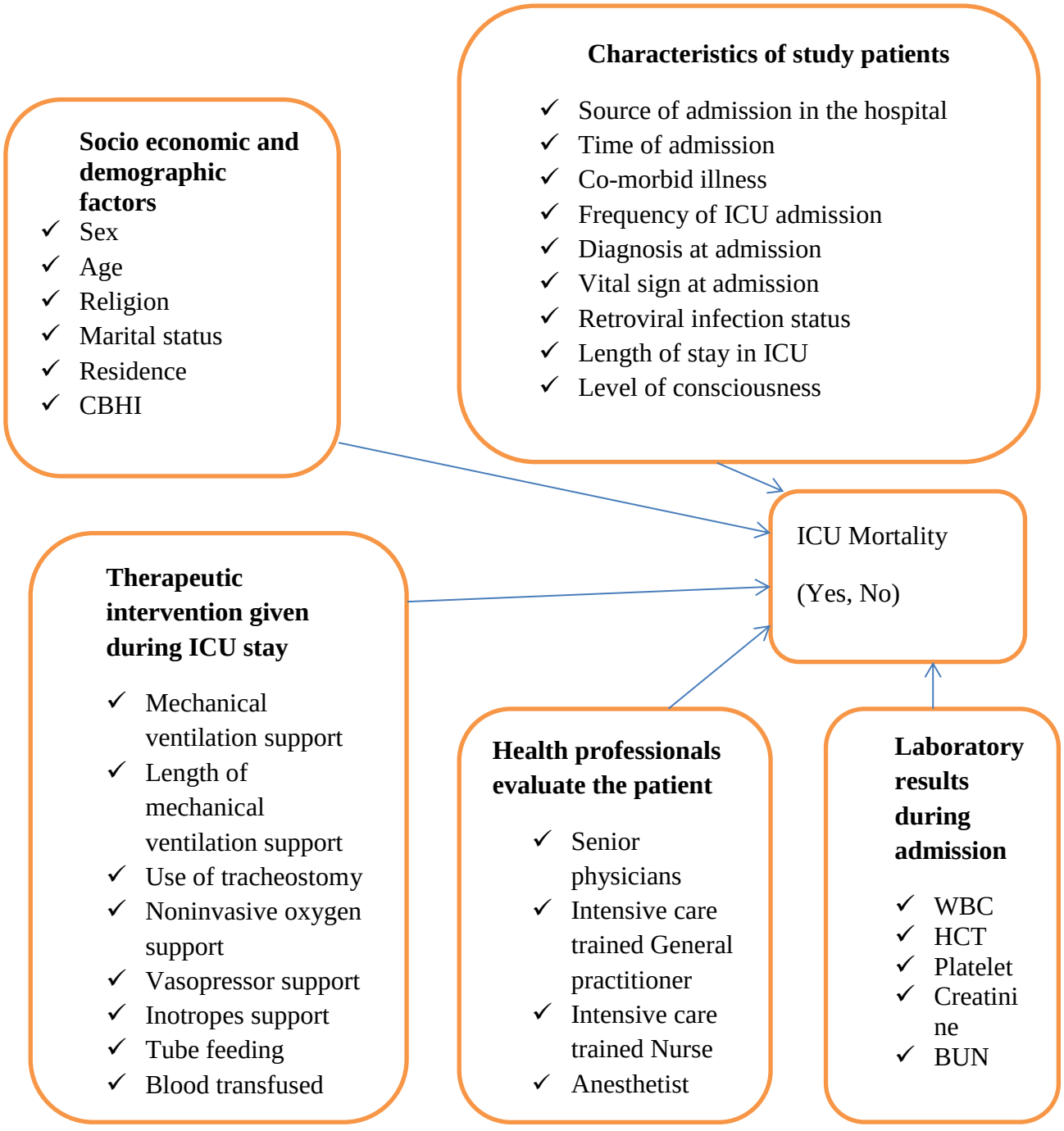

Figure 1: Conceptual Frame-work is adapted from different literatures and modified for magnitude and associated factors of mortality among patients admitted at ICU in Injibara General Hospital, Awi Zone, North West, Ethiopia, 2021.

4. OBJECTIVES

4.1. General objective

- To assess magnitude of morality and its associated factors among patients admitted in intensive care unit of Injibara General Hospital, Awi Zone, North West, Ethiopia, 2021.

4.2. Specific objectives

- To determine the magnitude of mortality among patients admitted in ICU of Injibara General Hospital, Awi Zone, Ethiopia, 2021.
- To identify factors associated with mortality among patients admitted in ICU of Injibara General Hospital, Awi Zone, Ethiopia, 2021.

5. MATERIALS AND METHODS

5.1. Study design and period

Institution based retrospective cross-sectional study was employed from September-10-2021 to October-10- 2021

5.2. Study Area

The study was conducted in Injibara General Hospital, Awi zone, Amhara National Regional State, Northwest, Ethiopia.

Injibara town is the administrative center of Awi zone and it is located at a distance of 446 km from Addis Ababa and 142 km from Bahir Dar. It has an altitude of 2560 meter above sea level and situated predominantly in mountainous location. Injibara was constructed since 1991 at a place called Kosober by locals, at the junction of Highway from Addis Ababa to Bahir Dar. Based on figures from the 2015 census, Injibara town has an estimated total population of 21,065, of whom 10,596 are males and 10,469 are females (37). IGH is located at Injibara town and it was established on February 2016, it serves for more than 1.5 million population. IGH ICU was started its service on December 2017 and more than 30 patients were admitted monthly and more than 300 patients were admitted yearly, until now it delivered service for 980 patients, it was staffed with 12 nurses, 2 general practitioners, 1 Internist and equipped with 6 beds, 6 patient monitors, 5 mechanical ventilators, 2 defibrillators, 6 perfusers, and it serves for pediatrics, medical, surgical and obstetrics cases.

5.3. Population

5.3.1. Source population

The source population for this study were all patients admitted in ICU of IGH.

5.3.2. Study population

The study population was all patients admitted in ICU of IGH from December-15-2017 to Augest-30-2021.

5.4. Inclusion and exclusion criteria

5.4.1. Inclusion criteria

All ICU admitted patients from December-15-2017 to Augest-30-2021 were included in this study.

5.4.2. Exclusion criteria

Incomplete data on ICU registration book were excluded from this study.

5.5. Variables

5.5.1. Dependent variable

- ✓ ICU mortality (Yes, No)

5.5.2. Independent variables

- ➢ Socio economic and demographic factors

- ✓ Sex
- ✓ Age
- ✓ Religion
- ✓ Marital status
- ✓ Residence
- ✓ CBHI status

- ➢ Clinical characteristics of study patients

- ✓ Source of admission in the hospital to ICU
- ✓ Underlying disease or co-morbidities
- ✓ Frequency of ICU admission
- ✓ Diagnosis at ICU admission
- ✓ Category of admission diagnosis
- ✓ Vital sign at admission
- ✓ Retroviral infection status
- ✓ Mental status at admission
- ✓ Length of stay in ICU

- ➢ Therapeutic intervention given during ICU stay

- ✓ Mechanical ventilation support
- ✓ Length of mechanical ventilation support
- ✓ Vasopressor support
- ✓ Noninvasive oxygen support
- ✓ Tube feeding
- ✓ Inotropes support
- ✓ Blood transfused
  - ➢ Health professionals evaluate the patient and give care at ICU admission
- ✓ Senior physician
- ✓ Intensive care trained General practitioner
- ✓ Intensive care trained Nurse
- ✓ Anesthetist evaluate intubated patient
  - ➢ Laboratory investigation results during admission
- ✓ WBC
- ✓ HCT
- ✓ Platelet
- ✓ Creatinine
- ✓ BUN
- ✓ Na
- ✓ K
- ✓ ALT
- ✓ AST
- ✓ RBS

5.6. Operational and term definitions

Died: Patients who are not alive at the time of discharge (13).

Clinical outcome: In this research, clinical outcome indicated either patients survived or died at the time of discharge (13).

Co-morbidity: The presence of one or more additional medical conditions often co-occurring with a primary medical condition.

Vasopressor support: The use of drugs that constrict blood vessels and/or increase the contractility of the heart.

ICU: Is an organized system for the provision of care to critically ill patients that provides intensive and specialized medical and nursing care (1).

Length of stay in the ICU: Time from admission to discharge from ICU

Re-admission to ICU: Admission to ICU more than once

Intensive care trained: Professionals take ICU service training and certified

5.7. Sample size determination

By considering the primary and secondary objectives sample size was estimated as follows :

Sample size for the first specific objective was calculated by using single population proportion with an assumption of 95% confidence level, 5% level of significance and the sample size formula was given by the single population proportion formula (p- is the best estimate of prevalence from a previous study -was taken from an institutional based cross sectional study design was conducted in ICU of Nigist Eleni Mohammed Memorial Hospital of Hosanna from January 2015 to January 2016 showed the overall ICU mortality rate was 46.42% (13), and recalculating by adding 10% non-response rate, the final sample size was 422.

$n = [(z\alpha/_2)2 \times pq]/d2$

$= [(1.96)2 \times 0.4642(1-0.5358)]/ (0.05)2$

$=383$

10% of 383 was 38.3 then 383 + 38.3=421.3 =422

Here n was the minimum required sample size, Zα/2 was the value under standard normal table for a given confidence interval (1.96 for 95% CI) and d was the margin of error (0.05).

Sample size for the second specific objective was calculated using Epi-Info version-7 statistical software (Table 1).

Table 1: Sample size calculation for the second specific objectives from significant variables of different literatures, 2021

S.no	Factor identified	Categories	AOR	Exposed (%)	%Unexposed	Sample size using (Epi info7) (a)	Non-response rate =a*10% (b)	Total Sample size = a+b (c)	Reference
1	Vasopressor support	yes(Ref, No)	7.98	43.4	56.6	101	10.1	112	(21)
2	Mental status at admission	Abnormal mental status(Ref, Conscious)	2.8	40.7	59.3	233	23.3	257	(16)
3	MV	Yes(Ref, No)	5.57	75.8	24.2	112	11.2	124	

Then the final sample size was the largest of all sample size, 422 which was calculated for the first specific objective.

5.8. Sampling technique

From IGH ICU registration logbook totally 980 patients were admitted in ICU from December-15- 2017 to Augest-30- 2021, and 900 patients had complete data. So, first list all of ICU admitted patients except those excluded to be sampled, then computer random number generation method simple random sampling technique was employed to select 422 patients.

5.9. Data collection tools and procedures

Data collection checklist were used to collect data. The checklist consists of information on socioeconomic and demographic characteristics(3, 16), clinical characteristics of study patients (4, 5, 10, 11, 14, 17, 19, 21, 22, 38), health professionals evaluate the patients (29-31), laboratory results during admission(32, 33, 35, 36) and therapeutic intervention given during ICU stay (9, 10, 16-19, 21, 22, 25, 28) and the checklist was adapted from literatures. The checklist was prepared in English. Pretest was done on 5% of the sample population at Debre Markos referral hospital ICU. Data were collected by four BSc nurses and supervised by one general practitioner. Data collectors took selected patients medical record number and patients' charts were picked by record keepers based on medical record number and reviewed by data collectors, at the end of data collection patients' charts were replaced with its original place properly.

5.10. Data management and analysis

The data were checked for completeness, consistency, coding and then it was entered into Epi Data software version 3.1. All statistical tests were performed using SPSS version 20 software. Descriptive statistics were carried out and categorical variables were reported as frequencies and percentages whereas; mean, was used for continuous variables. Summary tables and charts were also used to describe the study population by explanatory variables. Since the outcome variable (mortality) is binary, binary logistic regression model was fitted. So that 95% confidence interval, odd ratio and p- value were calculated. The goodness of fit of the final logistic regression model was checked using the Hosmer-Lemeshow technique and it was p-value of 0.59, in which p-value of >0.05 indicates a good model. Both bi-variable and multivariable logistic regression analysis were performed to determine the association between explanatory and outcome variables. First bi-variable analysis was done for each independent variable with dependent variable to select the candidate variables for multi-variable analysis, then significant variables observed in the bi-variable analysis with p-value <0.25 were subsequently included in the multivariable logistic regression analysis. Multicollinearity of the independent variables were also checked by observing variance inflation factor (VIF). Finally, adjusted odds ratio (AOR) with 95% Confidence Interval at p-value < 0.05 was considered as statistically significant.

5.11. Data quality assurance

Training was given for data collectors and supervisors about the objectives, process of the data collection. Five percent of the total sample size was pretested in randomly selected patient charts admitted in ICU of Debre Markos Referral Hospital and the necessary adjustment was done accordingly. The principal investigator has supervised and reviewed every data collection procedure, data collection checklist for completeness and logical consistency and correction were made. The principal investigator has collected the completed data collection checklist every day and has been responsible for the coordination and on spot supervision of overall data collection process.

5.12. Ethical considerations

Ethical clearance was obtained from Institutional review board of Bahir Dar University; College of Medicine and Health Sciences, Ethical Review Committee. Permission was obtained from chief clinical officer and chief executive officer of IGH to conduct this study and to access the medical record. All the collected data were kept confidential and no one except the members of the research team have access to the collected information. All papers of the study were kept in a secured place under lock and computer records kept locked with passwords and the name or other personal information was not notified in any report. The obtained data was only used for study purpose.

6. RESULTS

6.1. Socioeconomic and demographic characteristics

A total of 421 patients were participated in this study with a response rate of 99.7%, among those females account slightly more than half 212(50.4%) of patients. The mean age of patients was 40.2 ± SD 21.7, the highest admission was among the age group 20-40 years with 40.4%. Nearly half 212(50.4%) of patients were rural in residency (Table 2).

Table 2: Socioeconomic and demographic characteristics among ICU admitted patients in IGH (N=421), 2021

Variables	Frequency	Percentage
Sex		
Male	209	49.6
Female	212	50.4
Age		
<20 years	67	15.9
20-40 years	170	40.4
41-60 years	96	22.8
>60 years	88	20.9
Ethnicity		
Awi	229	54.4
Amhara	152	36.1
Gumuz	25	5.9
Others	15	3.6
Religion		
Orthodox	360	85.5
Muslim	29	6.9
Others	32	7.6
CBHI		
Yes	214	50.8
No	207	49.2
Marital status		
Single	139	33
Married	206	48.9
Others	76	18.1
Residence		
Rural	212	50.4
Semi Urban	91	21.6
Urban	118	28

* n- Frequency

6.2. Clinical characteristics of study patients

This study showed that patients duty hour admission accounted 206(48.9%) from total admission, more than one third 151(35.9%) of study patients had underlying disease at the time of admission, of which 74(49%) had Cardiovascular co-morbidities underlying disease followed by respiratory disease category co-morbidities with 30(19.9%). From all patients 54(12.8%) were readmitted to ICU. Three fourth, 319(75.8%) of the patients had 7-14 days length of stay in ICU, mean ± SD LOS was 5.46 ± 6.77, The leading cause of admission diagnosis was cardiogenic shock with 86(20.4%) followed by septic shock 72(17.2%) (Table 3).

Table 3: Clinical characteristics of patient among ICU admitted patients in IGH, Ethiopia (N=421), 2021

Variables	Frequency	Percentage
Source of admission to ICU		
Medical ward	132	31.4
Pediatrics ward	25	5.9
Surgical ward	40	9.5
Gyn/Obs ward	29	6.9
Emergency department	182	43.2
Operation room	13	3.1
Time of admission to ICU		
Duty hour	206	48.9
Working hour	215	51.1
Underlying disease		
Yes	151	35.9
No	270	64.1
Category of underlying disease		
Cardiovascular disease	74	49
Respiratory	30	19.9
Renal disease	2	1.3
Infectious disease	23	15.2
Neurological disease	4	2.6
Endocrine disease	10	6.6
Others	8	5.3
Retroviral infection status		
Reactive	24	5.7
Unknown	219	52
Non-reactive	178	42.3
Frequency of admission		
First admission	367	87.2
Readmission	54	12.8
Length of stay in ICU		
<7 days	69	16.4
7-14 days	319	75.8
>14 days	33	7.8
Mental status / GCS at admission		
<8	49	11.6
8-12	83	19.7
>12	289	68.6
Spo_2		
<93%	362	86
>93%	59	14

Temperature		
<36.5	235	55.8
36.5-37.5	86	20.4
>37.5	100	23.8
Diagnosis of ICU admission		
Sever TBI	24	5.7
Sever pneumonia	34	8.1
ARDS	49	11.6
Septic shock	72	17.2
Cardiogenic shock	86	20.4
Hypovolemic shock	28	6.7
Sever Bronchial asthma	19	4.5
Myocardial infarction	23	5.5
Others	86	20.4
Category of admission diagnosis		
Trauma	38	9
Non traumatic surgical illness	39	9.3
Obstetrics complication	22	5.2
Cerebral vascular accident	11	2.6
Cardiac illness	62	14.7
Respiratory illness	121	28.7
Poisoning	52	12.4
Organ failure	17	4
Others	59	14

*ARDS-acute respiratory distress syndrome *TBI-Traumatic Brain Injury * %--percentage

*n-frequency *Spo_{2-} percutaneous oxygen saturation

6.3. Therapeutic intervention given at ICU

Less than half, 176(41.8%) of the study patients were intubated and mechanically ventilated and from all intubated patients 134(31.8%) of patients were 7-14 days LOMV, of total patients 73(17.3%) were got blood transfused, of total admission 197(46.8%) of patients were got NG tube feeding (Table 4).

Table 4: Patients therapeutic intervention given at ICU among ICU admitted patients in IGH, Ethiopia (N=421), 2021

Variables	Frequency	Percentage
Mechanical ventilation		
Yes	176	41.8
No	245	58.2
Mode of ventilator		
A/C VCV	43	10.7
A/C PSV	41	9.7
SIMV	48	11.4
PRVC	44	10.5
LOMV		
<7 days	25	5.9
7-14 days	134	31.8
>14 days	17	4
Inotropes support		
Yes	267	63.4
No	154	36.3
Vasopressor support		
Yes	84	20
No	337	80
DVT prophylaxis given		
Yes	151	35.9
No	270	64.1
Blood transfused		
Yes	73	17.3
No	348	82.7
Tube feeding		
Yes	197	46.8
No	224	53.2
GIT ulcer prophylaxis given		
Yes	341	81
No	80	19
Non invasive O_2 support		
Yes	317	75.3
No	104	24.7

*A/C VCV-Assist control volume controlled ventilation
*A/C PSV-Assist control pressure support ventilation
*SIMV-Synchronized intermittent mandatory ventilation
*PRVC-Pressure regulated volume control
*DVT-Deep vein thrombosis
* GIT-gastrointestinal tract

6.4. Health professionals evaluate the patient and give care at ICU admission

More than two third of the study patients 297(70.5%) were evaluated by senior physician at the time of admission and 281 (66.7%) of patients were evaluated by intensive care trained general practitioners, nearly all 405(96.2%) of the study patients were given care by intensive care trained nurses (Table 5).

Table 5: Health professionals evaluate the patient and give care at ICU among ICU admitted patients in IGH, Ethiopia (N=421), 2021

Variables	Frequency	Percentage
Senior physician evaluate the patient		
Yes	297	70.5
No	124	29.5
Intensive care trained GPs evaluate the patient		
Yes	281	66.7
No	140	33.3
Intubated patients intubate & evaluated by anesthetist		
Yes	172	40.9
No	4	1
Intensive care trained nurse give care		
Yes	405	96.2
No	16	3.8

*GPs- general practitioners

6.5. Laboratory results at ICU admission

Of total admission patients with WBC count >10×10^3/µL accounted 178(42.3).From total admission 179 (42.5%) of participants were HCT <36%, and 122(29%) of patients were platelet count <150×10^3/µL, from all admitted patients with creatinine level >1.2 mg/dl accounted 77(26.4%) (Table 6).

Table 6: Laboratory results at ICU admission among ICU admitted patients in IGH, Ethiopia (N=421), 2021

Variables	Frequency	Percentage
WBC		
<5×10^3/µL	72	17.1
5-10×10^3/µL	171	40.6
>10×10^3/µL	178	42.3
HCT		
<36%	179	42.5
36-52%	224	53.2
>52%	18	4.3
PLT		
<150×10^3/µL	122	29
150-400×10^3/µL	255	60.6
>400×10^3/µL	44	10.5
Creatinine		
<0.5 mg/dl	60	14.3
0.5-1.2 mg/dl	250	59.4
>1.2 mg/dl	111	26.4

*WBC--White blood cell *HCT-Hematocrit *PLT-Platelet

6.6. Prevalence of ICU mortality

A total of 421 patients were enrolled in the study of which 159(37.8%) with (95%CI:33-42) were died in the ICU of IGH.

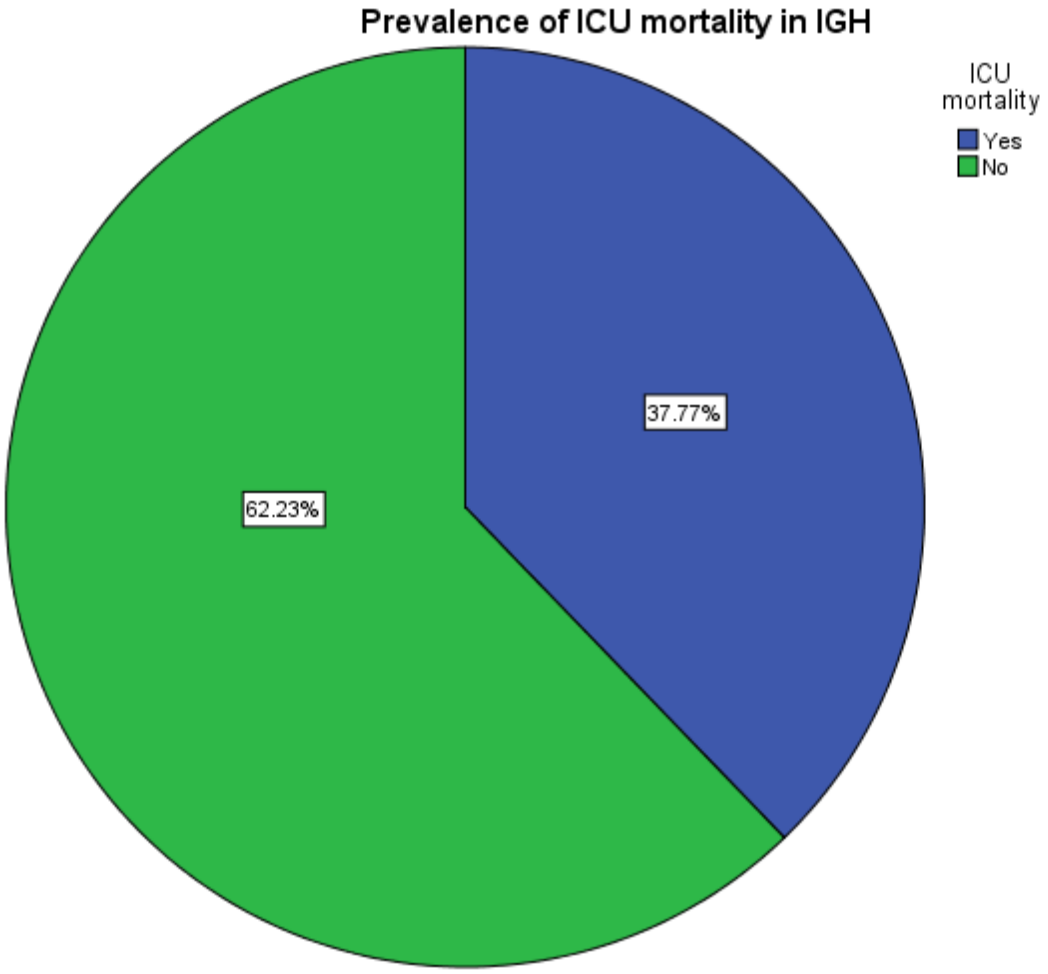

Figure 2: Prevalence of ICU mortality among ICU admitted patients in IGH, Awi Zone, Ethiopia (N=421), 2021

6.7. Factors associated with ICU mortality

Variables whose bi-variable analysis with p-value <0.25 was a candidate for multivariable analysis, variables significant at bi-variable analysis were; DVT prophylaxis given, Time of admission, frequency of admission, CBHI status, inotropes support, tube feeding, age & LOS.

Variables significantly associated at multivariable analysis with p-value <0.05 were: Patients age (20-40 years, >60 years) and patient time of admission to ICU was shown statistically positive significant association with ICU mortality. Whereas inotropes support, tube feeding and LOS >14 days were shown statistically negative significant association with ICU mortality.

The present study revealed that patients admitted to ICU with age 20-40 years were 1.13 times more likely to death compared to patients admitted with age <20 years (AOR=1.13,95%CI:1.10-3.79,P=0.023).

According to this study result patients admitted to ICU with age >60 years were 3.1 times more likely to death compared to patients admitted with age <20 years (AOR=3.1,95%CI:1.68-6.6,P=0.001).

A result of this study showed that patients mortality in ICU with NG tube feeding were reduced by 71% compared to non NG tube feeding patients (AOR=0.29, 95%CI:0.17-0.48, P<0.001).

Our study revealed that patients with duty hour admission were 2.13 times more likely to death compared to patients with working hour admission (AOR=2.13, 95%CI:1.32-3.43, P=0.002).

A result of this study showed that patients mortality in ICU with inotropes support were reduced by 91.4% compared to patients not supported with inotropes (AOR=0.086, 95%CI:0.04-0.16, P<0.001).

According to our study result patients mortality in ICU with LOS in ICU >14 days were reduced by 73% compared to patients ICU LOS 7-14 days (AOR=0.27, 95%CI: 0.1-0.74, P=0.01) (Table 7).

Table 7: Bi-variable and multivariable logistic regression predicting COR and AOR for mortality among ICU admitted patients in IGH, Ethiopia (N=421), 2021

Variables	ICU mortality		COR	AOR	P-value
	Yes(n)	No(n)	with (95%CI)	with (95%CI)	
Age					
<20 years	15	52	1	1	
20-40 years	60	110	1.89(1.24-2.8)	1.13(1.10-3.79)	0.023*
41-60 years	42	54	2.69(0.65-3)	1.54(0.77-3.1)	0.21
>60 years	42	46	3.16(1.55-6.44)	3.10(1.68-6.6)	0.001*
CBHI status					
Yes	91	123	1.51(1.01-2.24)	1.26(0.77-2.08)	0.35
No	68	139	1	1	
DVT prophylaxis given					
Yes	51	100	0.76(0.50-1.16)	0.42(0.81-2.49)	0.21
No	108	162	1	1	
Inotropes support					
Yes	72	195	0.28(0.18-0.43)	0.086(0.04-0.16)	<0.001*
No	87	67	1	1	
Frequency of admission					
Readmission	32	22	2.74(1.53-4.92)	1.55(0.76-3.16)	0.22
First admission	127	240	1	1	
Tube feeding					
Yes	50	147	0.35(0.24-0.78)	0.29(0.17-0.48)	<0.001*
No	109	115	1	1	
Time of admission to ICU					
Duty hour	102	104	2.71(1.8-4.08)	2.13(1.32-3.43)	0.002*
Working hour	57	158	1	1	
LOS					
7-14days	129	190	1	1	
<7 days	22	47	0.68(0.26-0.75)	0.44(0.14-1.32)	0.14
>14 days	8	25	0.47(0.2-0.98)	0.27(0.1-0.74)	0.01*

*Statistically significant <0.05. 1= Reference

7. DISCUSSIONS

The overall ICU mortality was considerably high and this result was in line with some previous studies but it was also lower and higher than other previous studies. Adult and old age patients and patients admitted in the ICU at duty hour were more likely to die in the ICU. While, patients with inotropes support, patients with NG tube feeding and patients with increased LOS in ICU were decreased ICU mortality

This study revealed that about 37.8% with (95%CI:33-42) of patients admitted to ICU were died which was higher than a study conducted in Ayder comprehensive specialized Hospital, South Western Kenya, South Africa, Uganda and Northeastern Brazil ICU mortality of 27%, 26.1%, 19.7%, 27.8% and 21% respectively (4, 12, 17, 22, 23). This discrepancy might be due to lack of senior sub-specialist physicians like; intensivists, cardiologists and anesthesiologists, shortage of mechanical ventilators and other necessary medical equipment and supplies including drugs used in ICU of IGH.

The finding of this study was in line with studies conducted in St. Paul's Hospital Millennium Medical College, Jimma University Specialized Hospital, University of Gondar Comprehensive Specialized Hospital and University of Nigeria Teaching Hospital with ICU mortality of 39%, 37.7%, 38.7% and 34.6% respectively (10, 14, 16, 18).

But, it is lower than the study conducted at Southern Ethiopia teaching Hospitals, Nigist Eleni Mohammed Memorial Hospital of Hosanna, Jimma University Specialized Hospital and National Referral Hospital in Western Kenya ICU mortality of, 46.8%, 46.42%, 50.4 and 53.6% respectively (13, 15, 21, 23). This might be related to some complicated and critically ill patients were referred to referral hospitals from IGH and referral hospitals received critically ill patient from district and general hospitals.

According to findings of this study; Patients age, time of admission, tube feeding, inotropes support & LOS were shown statistically significant association with ICU mortality. Similarly study in Yemen showed there was a significant statistical relationship between the death in the ICU with age and LOS (3). Likewise A cross-sectional study in Brazil showed tube feeding were significantly associated with ICU mortality (10).

The present study revealed that patients admitted to ICU with age 20-40 years were 1.13 times more likely to death compared to patients admitted with age <20 years, according to this study, relatively higher proportions of admitted and died patients were found between the age group of 20 and 40 years of age. A similar finding was reported by other studies in University of Gondar Comprehensive Specialized Hospital as there was a predominantly young-age ICU population (16). The overall adult population predominance and high mortality in this study might be because of high prevalence of trauma which likely occurred due to the nature of work exposing majority of adult on the increased level of participation in high-risk activities.

The present study revealed that patients admitted to ICU with age >60 years were 3.1 times more likely to death compared to patients admitted with age <20 years. Likewise, a retrospective study conducted in Yemen showed a significant statistical relationship between the death in ICU with the age and most patients were in the age group of ≥70 years at the time of death (3). Similarly studies in Brazil, Jimma, Southern Ethiopia, Addis Ababa showed older age was significantly associated with ICU mortality (3, 10, 14, 16, 17, 21, 25). These increased older age mortality might be related to most of older aged patients were had comorbidities and decreased immune system that aggravate patients mortality in the ICU.

According to our study result patients mortality in ICU with NG tube feeding was reduced by 71% compared to non NG tube feeding. A cross-sectional study in Brazil showed tube feeding was significantly associated with ICU mortality (10). This might be due to NG tube feeding prevents feeding related aspiration especially for patients with decreased level of consciousness and also it enables adequate and balanced diet by solving poor intake related problems and reduce ICU mortality.

Our study showed that patients with ICU duty hour admission were 2.13 times more likely to death in the ICU compared to patients with working hour admission. Similarly, a retrospective study in Mainland China showed night time admission was associated with poor ICU outcomes (26). On the contrary, study in Taiwan showed that non-office-hour admissions to ICU were not associated with poor ICU outcomes compared with office-hour admissions (27). Duty hour admission was associated with poor ICU outcomes, this might be related to shortage of onsite senior physician and limited number of overall clinicians and limited number of services due to man power at duty hour and also might be related to differences in staffing coverage related to

financial issues. But, study in Taiwan contradict this study, this might be due to equal distribution of ICU service and staffing at all time in Taiwan.

A result of this study showed that patient mortality in ICU with inotropes support were reduced by 91.4% compared to not supported with inotropes. This was due to inotropes prevent death by weaken the force of muscular contraction or increasing the force of muscular contraction of the heart (negatively or positively).

This study also showed that patients mortality in ICU with LOS in ICU >14 days were reduced by 73% compared to patients ICU LOS 7-14 days. Study conducted in University of Gondar comprehensive specialized hospital showed that length of ICU stay <4 days was strongly associated with clinical outcome of patients(16). Similarly, a retrospective study in Yemen showed there was a significant statistical relationship between the death in ICU with LOS and; Most of the deaths occurred in patients who were hospitalized in the ICU for 1-7 days (3). According to this study result patients with increased LOS in the ICU were reduced ICU mortality this is due to, when patient got good acute critical care support they pass the critical time and become stable that increase the chance of stay more days, this leads to good prognosis by getting appropriate investigations, differential diagnosis and treatment as they stay more days.

8. STRENGTHS AND LIMITATIONS

8.1. LIMITATIONS

Due to incomplete data on charts, variables related to Physiologic and laboratory variables necessary to calculate severity and prognostic score such as sequential organ failure assessment were lacking.

Limitation of this study in addition, our results were obtained from a single medical center and may not be generalized to other medical centers.

9. CONCLUSIONS

This study finding showed the prevalence of ICU mortality was considerable high when we compared with to ARHB ICU mortality plan and patients; age, tube feeding, time of admission, inotropes support and LOS were significantly associated with mortality of ICU patients.

Adult and old age patients and patients admitted in the ICU at duty hour were more likely to die in the ICU. While, patients with inotropes support, patients with NG tube feeding and patients with increased LOS in ICU were decreased ICU mortality.

10. RECOMMENDATIONS

Based on the findings of this study, the following recommendations are included:-

- **Clinicians better to;**
  - ✓ Closely follow and give care for adult and older age patients admitted at ICU.
  - ✓ Give appropriate NG tube feeding especially for patients with not adequately and properly feed orally.
  - ✓ Improving the acute critical care services by fulfilling emergency and critical care medical supplies help to pass critical time and to stay patients more days and good prognosis.
  - ✓ Give inotropes timely for patients need inotropes support.
- **ARHB and IGH administrative bodies:** better to improve duty hour staffing, service and working environment.
- **Researchers:** better to do another prospective study to address other factors as well as to study the factors that have been shown to be associated with mortality in depth.

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12. ANNEX

Annex I: Information Sheet

Title of the research: Mortality and its associated factors among patients admitted in intensive care unit of Injibara General Hospital, Awi zone, Amhara region, Ethiopia, 2021

Principal Investigator: Tadele Tilahun Misikir

Objective: To assess the magnitude of mortality and its associated factors among patients admitted in intensive care unit of Injibara general hospital, Injibara, Ethiopia, 2021.

Procedure and Participation: The method of the research is hospital based retrospective cross-sectional study and the data is collected with patient chart review through structured data collection checklist by trained data collectors. The expected duration of the chart contact with the data collector will take 25 to 30 minutes. Chart particular selection is affirmed by the sampling frame through the procedure of simple random sampling technique which provides an equal chance of selection.

Confidentiality: To establish secured safeguards of the confidentiality of research data, will use codes during the data collection period instead of using names. The original data will be locked in cabinets until the data analysis carryout and no person shall access except the principal investigator and the supervisor for data checking and cleaning purposes. The use of information for any purpose other than that to the study purpose is unethical to the patients.

Benefit: The research does not have a short term financial, health care and capacity building benefit to the research participant but in the long run it will help the concerned organization and policymakers to have a policy consideration and direction and formulation of strategy based on the recommendations and the findings. Moreover, the research work will help as baseline data in the field.

Potential risks: There is no potential risk that may cause any harm on study patients.

Annex II: Permission letter

Bahir Dar university school of public health, department of health systems management and health economics

Title of the research: Mortality and its associated factors among patients admitted in intensive care unit in Injibara General Hospital, Awi zone, Amhara region, Ethiopia, 2021

I have read and understand all about the objective and the process of the study. I am permitted to collect data on patient medical chart. I have understood that all collected information will be kept strictly confidential. Therefore I am permitted to collect data for this study.

Chief executive officer signature _____date_____

Chief clinical officer signature _____date_____

Data collector signature _____date_____

Annex III: Data collection Checklist

Data collection checklist on mortality and its associated factors among patients admitted in intensive care unit of Injibara General Hospital, Awi zone, Amhara region, Ethiopia, 2021

Part1: Socio economic and demographic factors

101. Sex	1. Male 2. Female
102. Age	_____years
103. Ethnicity	1. Awi 2. Amhara 3. Gumuz 4. Others
104. Residence	1. Rural 2. Urban 3. Semi Urban
105. Religion	1. Orthodox 2. Muslim 3. Others
106. Marital status	1. Single 2. Married 3. Others
107. Community Based Health Insurance (CBHI) status	1. Yes 2. No

Part2: Clinical characteristics of study patients

201.Source of admission to ICU in the hospital	1. Medical ward 2. Pediatrics ward 3. Surgical ward 4. Gynecology and Obstetrics ward 5. Emergency department 6. Operation room
202.Time of admission to ICU	1. Duty hour 2. Working hour
203. Underlying disease (Co-morbidities)	1. Yes 2. No
204. If the answer of 303 is yes specify	_____
205. Frequency of admission to ICU	1. First admission 2. Readmission (2 times and above)
206. Diagnosis at ICU admission	_____
207. Urine output in the first 24 hours after ICU admission	_____ml
208. Retroviral infection status	1. Reactive 2. Non-reactive 3. Unknown
209. Vital sign at ICU admission	RR _____breath/minute PR_____ beat/minute T^o _____c^o Bp _____ mmHg Spo_2 _____%
210. Glasgow coma scale at ICU admission	_____score
211. Length of stay in ICU	_____days

*Spo_{2}-- percutaneous oxygen saturation *T^o--Temperature *RR--Respiratory rate *PR--pulse rate

Part3: Therapeutic intervention given at ICU stay

301.Intubation and mechanical ventilation	1. Yes 2. No
302.If the answer for 301 is yes-- Length of mechanical ventilation	_____days
303. If the answer for 301 is yes— Ventilator mode	1. Assist control volume control ventilation 2. Assist control pressure support ventilation 3. Synchronized intermittent mandatory ventilation (SIMV) 4. Pressure regulated volume control (PRVC) 5. Others(specify)_____
304. Use of tracheostomy	1. Yes 2. No
305. Noninvasive oxygen support	1. Yes 2. No
306. Vasopressor support	1. Yes 2. No
307. Inotropes support	1. Yes 2. No
308.Gastro intestinal ulcer prophylaxis is given	1. Yes 2. No
309. Deep vein thrombosis prophylaxis is given	1. Yes 2. No
310. Blood transfused	1. Yes 2. No
311. Tube feeding	1. Yes 2. No

Part4: Health professionals evaluate and giving care for the patient at ICU admission

401. Patient is evaluated by senior physician	1. Yes 2. No
402. Patient is evaluated by intensive care trained general practitioner	1. Yes 2. No
403.Patient care is given by intensive care trained nurse	1. Yes 2. No
404. Intubated patient is evaluated by Anesthetist	1. Yes 2. No

Part5: Laboratory investigation results during ICU admission

501.WBC count	_____10^3/µL
502.Hematocrit	_____%
503.Platelet	_____10^3/µL
504.Creatinine	_____mg/Dl
505.BUN	_____mg/dL
506.Sodium	_____mmol/L
507.Potassium	_____mmol/L
508.ALT(SGPT)	_____IU/L
509.AST(SGOT)	_____IU/L
510.Random blood sugar	_____mg/dL

Part6: Patient outcome

601. ICU mortality	1. Yes 2. No

Name of data collector _____ sign_____ date_____

BAHIR DAR UNIVERSITY COLLEGE OF MEDICINE AND HEALTH SCIENCES

SCHOOL OF RESEARCH AND GRADUATE STUDIES

(DEPARTMENT OF HEALTH SYSTEMS MANAGEMENT AND HEALTH ECONOMICS)

THESIS APPROVAL SHEET

Students

Name: - Tadele Tilahun Misikir Sign. _____ Date: _____

The following graduate faculty members certify that this student has successfully presented the necessary written final thesis and oral presentation for partial fulfilment of the thesis requirements for the degree of masters of public health in **General Master's in Public Health**

Approved by:

Advisors name:

1. Dr. Gebremariam Getaneh (MD, MPH, ASST PROF) Signature: _____ Date: _____

2. Mrs. Tsion Adebabay (BSc, MPH) Signature: _____ Date_____

Examiner:

Name:-Mr. Habtamu Alganeh (MPH, ASST PROF)

Signature_____ Date: _____

Department Head:

Name:-Mr. Habtamu Alganeh (MPH, ASST PROF)

Signature_____ Date: _____

BAHIR DAR UNIVERSITY COLLEGE OF MEDICINE AND HEALTH SCIENCES

SCHOOL OF RESEARCH AND GRADUATE STUDIES

(DEPARTMENT OF HEALTH SYSTEMS MANAGEMENT AND HEALTH ECONOMICS)

THESIS APPROVAL SHEET

Students

Name: - Tadele Tilahun Misikir Sign. _____ Date: 12-12-14

The following graduate faculty members certify that this student has successfully presented the necessary written final thesis and oral presentation for partial fulfilment of the thesis requirements for the degree of masters of public health in **General Master's in Public Health**

Approved by:

Advisors name:

1. Dr. Gebremariam Getaneh (MD, MPH, ASST PROF) Signature: _____ Date: 12/12/14

2. Mrs. Tsion Adebabay (BSc, MPH) Signature: _____ Date 12/12/14.

Examiner:

Name:-Mr. Habtamu Alganeh (MPH, ASST PROF)

Signature _____ Date: 12-12-14

Department Head:

Name:-Mr. Habtamu Alganeh (MPH, ASST PROF)

Signature _____ Date: 12-12-14