SCHOOL OF GRADUATE STUDIES

TREATMENT OUTCOME OF ACUTE KIDNEY INJURY AND ASSOCIATED FACTORS AMONG PATIENTS ADMITTED IN THE INTENSIVE CARE UNIT OF HIWOT FANA COMPREHENSIVE SPECIALIZED HOSPITAL, HARAR, EASTERN ETHIOPIA.

MSC THESIS

MENBERE DEBELE

AUGUST, 2025

HARAR, ETHIOPIA

HARAMAY UNIVERSITY

SCHOOL OF GRADUATE STUDIES

TREATMENT OUTCOME OF ACUTE KIDNEY INJURY AND ASSOCIATED FACTORS AMONG PATIENTS ADMITTED IN THE INTENSIVE CARE UNIT OF HIWOT FANA COMPREHENSIVE SPECIALIZED HOSPITAL, HARAR, EASTERN ETHIOPIA.

A Thesis Submitted to the College of Health and Medical Sciences, School of Graduate Studies, Haramaya University, in Partial Fulfillment of the Requirements for the Degree of Master of Clinical Pharmacy.

Major Advisor: Mr. Shambel Nigussie (MSc, Assistant Professor)

Co-advisors: Mrs. Tigist Gashaw (MSc, Assistant Professor)

Mr. Amas Siraj (MSc clinical pharmacy)

AUGUST, 2025

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APPROVAL SHEET

HARAMAYA UNIVERSITY

SCHOOL OF GRADUATE STUDIES

I hereby certify that I have read and evaluated the thesis entitled "Treatment Outcome of Acute Kidney Injury and Associated Factors among Patients Admitted in the Intensive Care Unit of Hiwot Fana Comprehensive Specialized Hospital in Harar, Eastern Ethiopia" prepared under my guidance by Menbere Debele. I recommend that it be submitted as fulfilling the thesis requirement.

_____	_____	_____
Major Advisor	Signature	Date
_____	_____	_____
Co-advisor	Signature	Date

As a member of the Board of Examiners of the M.Sc. Thesis Open Defense Examination, I certify that I have read and evaluated the Thesis prepared by Menbere Debele and examined the candidate. I recommend that the thesis be accepted as fulfilling the thesis requirements for the degree of Master's in Clinical Pharmacy.

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STATEMENT OF THE AUTHOR

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Date: _____

School of Pharmacy: _____

Signature: _____

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LIST OF ABBREVIATIONS AND ACRONYMS

ACE	Angiotensin-Converting Enzyme
ARBs	Angiotensin Receptor Blockers
AKD	Acute Kidney Diseases
AKI	Acute Kidney Injury
CI	Confidence Interval
ESRF	End-Stage Renal Failure
ICU	Intensive Care Units
KDIGO	Kidney Disease Improving Global Outcomes
NSAIDs	Non-Steroidal Anti-Inflammatory Drugs
OR	Odds Ratio
RRT	Renal Replacement Therapy
SSA	Sub-Saharan Africa
SD	Standard Deviation
SEA	Southeast Asia
SPSS	Statistical package for social science software

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ABSTRACT

Background: The incidence of acute kidney injury (AKI) in intensive care units has risen over the past decade, affecting an estimated 13 million people annually and leading to 1.7 million deaths worldwide. Despite its significant impact, no prior study has been conducted in the study area. Therefore, this study aimed to assess the treatment outcomes of AKI and its associated factors among patients admitted to the intensive care unit of Hiwot Fana Comprehensive Specialized Hospital, Eastern Ethiopia

Methods: A hospital-based cross-sectional study was conducted among 308 ICU patients with acute kidney injury at Hiwot Fana Comprehensive Specialized Hospital, Eastern Ethiopia. Medical records from September 1, 2019, to August 30, 2023, were reviewed. Multivariable logistic regression was applied to identify factors associated with poor outcomes, reported as adjusted odds ratios (AOR) with 95% confidence intervals. Variables with a p-value < 0.05 were considered statistically significant.

Results: A total of 308 patient records were reviewed. Of these, 181 (58.2%) were male, and 160 (51.9%) were aged 40–65 years (mean age: 44.5 ± 14.6). Poor treatment outcomes occurred in 58.1% (95% CI: 52.4–63.7). Factors significantly associated with poor outcomes included urban residence (AOR=2.22; 95% CI: 1.16–4.25), central intensive care unit admission (AOR=2.70; 95% CI: 1.41–5.19), oliguria (AOR=3.26; 95% CI: 1.76–6.04), stage III acute kidney injury (AOR=15.8; 95% CI: 1.56–159.6), and need for renal replacement therapy (AOR=11.6; 95% CI: 3.41–39.6).

Conclusion: The study revealed that over half of ICU patients with acute kidney injury experienced poor treatment outcomes (58.1%). Significant predictors included urban residence, ICU admission, oliguria, stage III AKI, and need for renal replacement therapy. These findings highlight the urgent need for early detection and timely interventions to improve patient survival.

Keywords: acute kidney injury, associated factors, cross-sectional, Eastern Ethiopia, treatment outcome

1. INTRODUCTION

1.1. Background:

Acute kidney injury (AKI) is an acute decline in renal function with multifactorial causes and complex pathophysiology, contributing significantly to global morbidity and mortality (Sengthavisouk Noot et al. 2020). It is often underdiagnosed due to the absence of obvious symptoms. In intensive care units (ICUs), severe AKI is common and independently increases mortality risk by impairing multiple organs, including the heart, lungs, liver, brain, and immune system. Studies show it worsens cardiac function, doubles the risk of respiratory failure, and heightens infection susceptibility (Lydia 2023).

Classification of AKI, etiology, or subtypes is complex and lacks standardized definitions or consensus criteria to define AKI in the ICU. Based on the need for diagnostic standardization, risk, injury, failure, loss, and end stage (RIFLE) was introduced in 2004, then, the classifications of acute kidney injury network (AKIN) in 2007 and kidney disease: Improving global outcomes (KDIGO) in 2012 were used to define and classify AKI based on the level of serum creatinine and urine output (UO) (Oweis Ashraf et al. 2020).

KDIGO AKI as an increase in serum creatinine by ≥0.3 mg/dL within 48 hours, an increase to ≥1.5 times baseline within 7 days, or urine output <0.5 mL/kg/h for 6 hours; AKI staging is as follows: Stage 1 – creatinine 1.5–1.9× baseline or ≥0.3 mg/dL rise, or urine output <0.5 mL/kg/h for 6–12 hours; Stage 2 – creatinine 2.0–2.9× baseline or urine output <0.5 mL/kg/h for ≥12 hours; Stage 3 – creatinine ≥3.0× baseline, ≥4.0 mg/dL, or initiation of dialysis, or urine output <0.3 mL/kg/h for ≥24 hours (Bayrakci Nergiz et al. 2022).

AKI is classified into three types: prerenal (≈60%), caused by hypo-perfusion of structurally normal kidneys; intrinsic renal (≈40%), resulting from structural damage to the renal parenchyma; and post-renal, due to urinary tract obstruction (Sang Ling et al. 2020). Common causes include major surgery, septic shock, hypovolemia, and cardiogenic shock (Srisawat Nattachai et al. 2019).

Multiple risk factors contribute to AKI. Patient susceptibility and exposures are risk factors for AKI. Important AKI predictors like patients age, chronic kidney disease (CKD), patient

comorbidity such as diabetes Miletus, hypertension, cardio vascular disease (CVD), chronic obstructive pulmonary disease (COPD), covid-19, trauma and HIV infection are common risk factor (Jiang Li et al. 2019). Exposure to sepsis, surgery, nephrotoxic drugs and shock are specific modifiable risk factors that predisposes patient to AKI (Oweis Ashraf O et al. 2020). Additional risk factors for AKI in critically ill patients include renal ischemia, heart failure, liver disease, hypovolemia from bleeding or severe dehydration, urinary obstruction from kidney stones, an enlarged prostate, or a pelvic tumor (such as an ovarian or bladder tumor), as well as certain medications like NSAIDs or ACE inhibitors, sepsis, glomerulonephritis, and infection (Batwie Raghad et al. 2022).

There is no FDA-approved pharmaceutical therapy to mitigate the effects of AKI or hasten recovery. Effective treatment for AKI recovery depends on early diagnosis and suitable preventive actions (Matuszkiewicz-Rowińska et al. 2020). The primary goals of AKI interventions are to stop additional declines in renal function. The most effective prevention strategies for AKI include limiting exposure to nephrotoxic medications and maintaining adequate hydration with isotonic fluids (Pickkers Peter et al. 2022).

Managing AKI in critical care is challenging, involving careful fluid and electrolyte management, avoidance of nephrotoxic drugs, and timely kidney support. AKI often requires renal replacement therapy (RRT), particularly in severe or prolonged cases, as it is associated with high mortality in critically ill patients (Kellum John A et al. 2021). Supportive management, including RRT, nutritional support, blood pressure control, and fluid optimization remains the mainstay to prevent or reduce complications (Xiao Z et al. 2022).

A retrospective observational study conducted at China found that out of 119 patients admitted to the intensive care unit, 51 (42.8%) experienced AKI, with moderate cases occurring in 14.3% of cases and severe cases in 28.6% of cases (10.1% in stage 2 and 18.5% in stage 3) during hospitalization (Cheng Yichun et al. 2021). Different studies have describe AKI to the development of short-term and long-term outcomes such as acute kidney disease (AKD), CKD, end stage kidney disease, longer hospitalization time, CVD, and other complications, suggesting that even a short episode of acute kidney injury might lead to long term morbidity and mortality (Haredasht et al. 2023). Therefore, the aim of these study aimed to assess treatment outcome of acute kidney injury and associated factor among adult ICU patients of HFCSH.

1.2. Statement of the problem: -

The incidence of AKI in ICUs has risen worldwide over the past decade due to higher patient acuity and better recognition. AKI affects approximately 13 million people annually, causing 1.7 million deaths, and occurs in 20–200 per million in the community, 7–18% of hospitalized patients, and about 50% of ICU admissions (Magboul Salma Mohammed et al. 2020). In ICUs, AKI affects 20–50% of patients and is associated with high mortality, longer ICU stays, and increased healthcare costs (Melo Fernando deassis et al. 2020). Despite being a global public health concern, epidemiological data on AKI in Ethiopia are limited, partly due to its occurrence across multiple healthcare settings. AKI significantly increases hospital costs and contributes to morbidity and mortality (Abinet Abebe et al. 2021).

Severe AKI is common in ICU patients, with a multinational study reporting that 57% developed AKI within a week, 39% had severe AKI (Lydia 2023), and 13.5% required kidney replacement therapy (Lydia 2023). In Sub-Saharan Africa, AKI prevalence is unclear, but mortality is likely high due to limited healthcare access. Available epidemiological data are sparse and heterogeneous, complicated by differences in patient populations, diagnostic criteria, and reporting methods (Kahindo Charles Kangitsi et al. 2022).

AKI is a frequent and serious complication in ICU patients, contributing significantly to morbidity and mortality. Despite advances in medical care, outcomes are influenced by factors such as age, comorbidities, illness severity, and AKI type.

AKI treatment outcomes range from recovery to poor outcomes and death. However, most studies focus on AKI prevalence rather than treatment outcomes and their associated factors. In Ethiopia, particularly at Eastern Ethiopia, evidence on ICU AKI treatment outcomes and contributing factors is limited. Generating such evidence is crucial for improving AKI care and guiding strategies to reduce morbidity and mortality. Therefore, this study aims to assess AKI treatment outcomes and identify associated factors among adult ICU patients at HFCSH, Eastern Ethiopia.

1.3. Significance of the study

This study is expected to provide important insights into the treatment outcomes of AKI among adult ICU patients at Hiwot Fana Comprehensive Specialized Hospital (HFCSH). Understanding

these outcomes, along with the factors that influence them, might be help healthcare providers and hospital administrators identify gaps in current AKI management practices and implement targeted interventions to improve care for patients.

The findings may also support the Harari Regional Health Bureau in developing evidence-based policies, protocols, and resource allocation strategies aimed at reducing AKI-related morbidity and mortality among patients. Moreover, the study can serve as a reference for other healthcare institutions in Ethiopia and Sub-Saharan Africa, where data on AKI treatment outcomes among patients are limited. Researchers and public health organizations can use the results to guide future studies, design preventive measures, and improve the overall quality of critical care services for patients in the region.

1.4. Objectives

1.4.1 General objective

To determine the treatment outcomes of acute kidney injury and its associated factors among adult patients admitted from 01 September 2019 to 30 August 2023, in the ICU of HFCSH, Eastern Ethiopia.

1.4.2. Specific objectives

- To assess the treatment outcome of acute kidney injury among adult patients admitted to the ICU of HFCSH, Eastern Ethiopia
- To identify factors associated with the treatment outcome of acute kidney injury among adult patients admitted to the ICU of HFCSH, Eastern Ethiopia

2. LITERATURE REVIEW

2.1. Treatment outcome of acute kidney injury among adult ICU patients

According to a systematic review and meta-analysis of studies on acute kidney injury in intensive care units in developed and developing countries, the length of ICU stays ranged from 1 to 22 days in developed countries in 71.6% (43/60) of the studies and from 5 to 23 days in 69.6% (23/33) of the studies in developing countries. The length of hospital stays for patients with AKI showed that 58.3% (14/24) of the studies in developed countries had stays longer than 15 days. For patients from developed and developing countries, the weighted mean lengths of ICU stays were 7.2 and 12.2 days, respectively, while the weighted mean lengths of hospital stays were 15.5 and 23.6 days, respectively (Melo Fernando deassis et al. 2020).

Among 50 ICU patients who were the subject of a cross-sectional study in India, which found that 62% of the patients had conservative therapy, 24% got hemodialysis, and 14% underwent peritoneal dialysis. Eighty percent of patients made a full recovery, fourteen percent recovered partially, and six percent passed away. Most patients with intrinsic renal insufficiency made full recoveries. Pre-renal failure patients, on the whole, only made partial recoveries. Pre-renal AKI was where the majority of fatalities were observed. Patients who got conservative medical treatment recovered completely. Patients who had eGFR less than 10 passed away, whereas those who had eGFR greater than 10 made a full recovery (Bhavana Tipparapu et al. 2022).

A multicenter study conducted in Beijing shows that renal replacement therapy (RRT) was used to treat a total of 281 individuals, among these patient treated with RRT 172 (61.8 %) were recovered, 109 (38.8 %) ICU mortality and Anuria/oliguria (71.9%, 201/281), severe metabolic acidosis (25.6%, 72/281), hyperkalemia (21.7%, 61/281), and fluid overload (20.3%, 57/281) were the top four causes for starting RRT (Sengthavisouk Noot et al. 2020). Based on a retrospective study performed on 173 patients at King Abdulaziz University Hospital (KAUH), the overall mortality rate was 89%. (Jiang Li et al. 2019).

A prospective multicenter study done in Thailand showed that AKI occurred in 2471 of 4668 patients (52.9%), the hospital mortality rate increased according to the stage of AKI (patients with no AKI accounts 15% mortality rate, AKI Stage-1 about 29% mortality rate, AKI Stage- 2, 33% mortality rate and AKI Stage-3, accounts 51% mortality rate with $P < 0.001$) (Srisawat

Nattachai et al. 2019). Another prospective study conducted in Egypt claims 120 participants or 37.4% of the 321 participants who were AKI-free at the start of the study became AKI after the first 24 hours after ICU admission. In this cohort, 30-day mortality was high. 120 deaths, or 22.5%, happened overall throughout the 30-day follow-up period. With 109 deaths in the first 15 days and 11 deaths in the next 15 days of the trial, mortality rates were particularly high in the first 15 days of an ICU stay. No matter what stage of AKI they were in or when it happened, people with AKI had a higher risk of dying. (Abd ElHafeez et al. 2017).

Prospective observational study done Jimma University among 203 participants showed 12.8% (n = 26) in-hospital mortality rate and more than 65% causes of AKI deaths were Glomerulonephritis and hypovolemia. Among 203 participants 108 patients (53.2%), who had improved renal function, were discharged. 13% of patients who were discharged with sustained reversal and the remaining 40.2% with late reversal had improved renal function. 11.30 days on average passed before a late reversal occurred. The late reversal lasted for either eight or twenty-one days at the most. 62 patients (30.5%) were discharged with non-recovered AKI. Three (1.5%) patients self-discharged, while the remaining four (2% of patients) were referred for additional evaluation and treatment (Abinet Abebe et al. 2021).

2.2. Factors associated with the treatment outcome of acute kidney injury among adult ICU patients

According to a retrospective study performed on 173 patients at King Abdulaziz University Hospital (KAUH), the mean baseline and last SCr levels were greater in those who died, and they were older. However, these differences did not achieve statistical significance (p 0.05 for all). Patients' comorbidities and mortality did not significantly correlate. AKI brought on by COVID-19 was strongly linked with mortality (p = 0.039) (Jiang Li et al. 2019). AKI at ICU admission was associated with a similar risk of death to that of ICU-acquired AKI (HR 2.74; 95% CI 1.45-5.17 vs 2.14; 1.02–4.48; P = 0.41) (Abd ElHafeez et al. 2017).

A cross-sectional study conducted in Sudan with 105 ICU patients, the following characteristics increased the likelihood that a patient developed AKI: gender, age > 60, sepsis, hypovolemia, hypertension, diabetes mellitus, chronic heart illnesses, pulmonary disorders, cancer, mechanical ventilation, and renal replacement therapy (RRT). The significant predictors for developing AKI in subjects admitted to the ICU were: sepsis (OR 7.5 [95% CI 3-19.7]; P = 0.001), hypovolemia

(OR 5.1 [95% CI 2-15.7]; P = 0.001), chronic cardiovascular diseases (OR 3.4 [95% CI 1.2-9.4]; P = 0.017), age > 60 years (OR 2.7 [95% CI 1.2-6.3]; P = 0.018), diabetes mellitus (OR 2.6 [95% CI 1.2-6]; P = 0.02), hypertension (OR 2.4 [95% CI 1.2-5.4]; P = 0.028), and RRT (OR 0.2 [95% CI 0.15-0.3]; P = 0.001) (Magboul Salma Mohammed et al. 2020).

A prospective observational study about the risk factors for AKI was conducted at Jimma Medical Center shows that on bivariate analysis, hyperkalemia (HR= 12.1, CI: 5.23-27.99 p=0.000), stage of AKI 3 (HR= 12.27, CI: 2.74-49.8, p=0.003), length of hospital stays (HR=0.05, CI: 0.02-0.13, p=0.000), duration of AKI > 7 days (HR=4.28, CI: 1.05-18.3, p=0.049), sepsis (HR=8.11, CI: 3.69-17. According to a multivariate study, individuals with AKI lasting longer than seven days had a seven times greater risk of dying within thirty days than patients with AKI lasting less than seven days (AHR=7.046; CI: 1.37-36.08, p=0.019). The 30-day death rate was nine times greater in patients with stage 3 AKI (AHR=9.60; CI: 1.175-28.52, p=0.035) and hyperkalemia (AHR=3.61; CI: 1.17-11.71, p=0.032) than it was in patients with less severe stages of AKI and patients without hyperkalemia, respectively. Contrarily, patients who spent more than or equal to seven days in the hospital (AHR= 0.19, CI: 0.05–0.73, p=0.012) had an 81% reduced risk of dying than those who stayed there for less than seven days. Patients who required RRT had a marginally higher risk of dying (AHR= 2.15, CI: 1.04-4.76, p=0.06) (Abinet Abebe et al. 2021).

2.3. Conceptual framework

The conceptual framework of this study was developed from reviewed different literatures. It shows different factors associated to AKI treatment outcome. The factors can be generally grouped in to three categories sociodemographic factors, medical or comorbidity factors and clinical or laboratory factors.

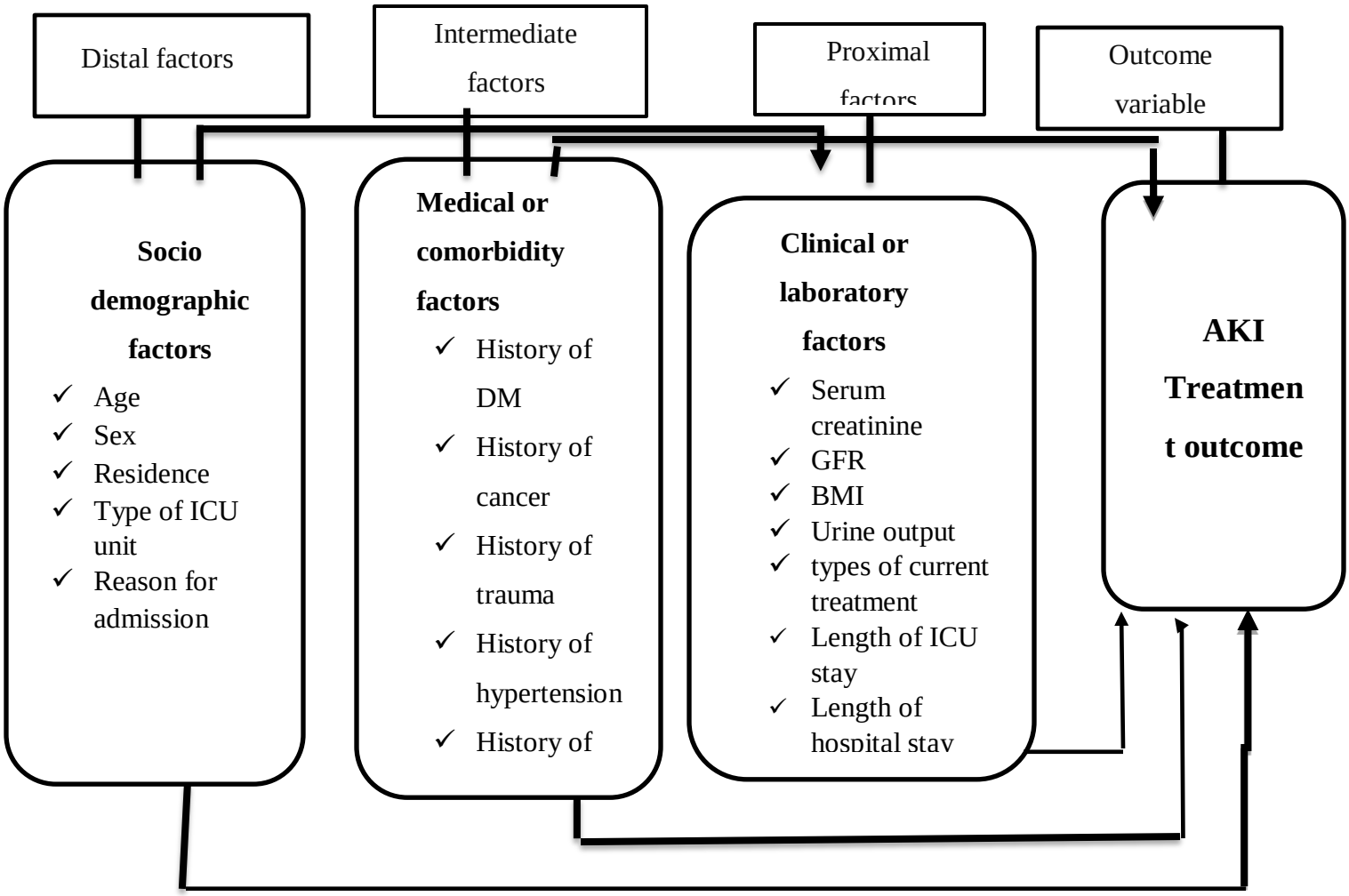

Figure 2: Conceptual framework of treatment outcome of acute kidney injury and its associated factors among adult patients admitted in the ICU (constructed by the investigator from reading of different literatures)

3. METHODOLOGY

3.1. Study area/setting and study period

This study was conducted at Hiwot Fana Comprehensive Specialized Hospital (HFCSH) in Harar, Eastern Ethiopia. Harar, the capital of the Harari region and one of the oldest cities in the country, is located 526 km southeast of Addis Ababa. According to the 2019 Central Statistical Agency census, Harar had a projected population of 263,657, of whom 98,854 were female. The city has four hospitals: one private and three government hospitals, including one military and two public hospitals (Ethiopian Public Health Institute - EPHI et al. 2021).

HFCSH, a referral hospital affiliated with Haramaya University College of Health and Medical Sciences, provides a range of services including outpatient, inpatient, and emergency care. Its inpatient services comprise internal medicine, surgery, gynecology and obstetrics, pediatrics and neonatology, and oncology departments, serving approximately 3 million people from Eastern Ethiopia. The study was conducted from February 2, 2024, to March 15, 2024.

3.2. Study design

A hospital-based cross-sectional study design was employed.

3.3. Population

3.3.1. Source population

All medical records of adult patients who developed AKI in central ICU, and medical ICU of HFCSH.

3.3.2. Study population

All medical records of adult patients who had fulfilled inclusion criteria and developed AKI after admitted between 01 September 2019 to 30 August 2023, in central ICU, and medical ICU in HFCSH.

3.4. Inclusion and exclusion criteria

3.4.1. Inclusion criteria

All adult patients who had been diagnosed with AKI after admission, and patients with complete

medical records, were included in this study.

3.4.2. Exclusion criteria

Patients who were discharged within 24 hours, discharged against medical advice, or who were pregnant were excluded. Additionally, records of patients who had undergone renal transplantation or had a prior diagnosis of chronic kidney disease (CKD) stages 3–5 were excluded.

3.5. Sample size determination

The required sample size for the primary objective was calculated using the single population proportion formula. The calculation assumed a 95% confidence level, 5% margin of error, and a 12.8% mortality proportion from AKI, based on a study conducted at Jimma University (Abinet Abebe et al. 2021).

$$n = \frac{(Z^2) * p(1-p)}{d^2}$$

Where:

n = minimum sample size required for the study

Z = standard normal distribution (Z=1.96) with a confidence interval of 95%

P = Hospital mortality from AKI (P = 12.8%)

D = is a margin of error (d=0.05)

$$n = \frac{(1.96^2) * 0.128\ (1-0.128)}{(0.05)^2} = \frac{(1.96^2) * 0.128\ (0.872)}{(0.05)^2} = 171.5$$

171.5≈ 172

Sample Size Determination for the Second Objective

The sample size for the second specific objective had determined by considering factors that were significantly associated with the outcome variable, confidence level of 95%, margin of error of 5%, power of 80% and ratio of exposed to unexposed 1:1 using STATCALC of Epi Info Version 7.2.5.0.

Table 1: Sample size determination for factors associated with treatment outcome of acute kidney injury among adult patients admitted in the ICU of HFCSH in Harar, Eastern Ethiopia

Variable	Proportion of exposed	Proportion of non-exposed	Confidence level	Power	Total sample size	Reference
Hyperkalemia	42.1 %	6.1%	95%	80%	72	(Abinet Abebe et al. 2021)
Stage of AKI	17.4 %	5.8 %	95%	80%	280	
Length of hospital stay	5.1 %	65.4 %	95%	80%	52	

Since the calculated sample size for the first specific objective was less than the second objective, the second objective's sample size was taken as the total sample size of the study, which is 280. By adding a non-response rate of 10%, the final sample size was 308.

3.6. Sampling procedure /technique

A simple random sampling method was employed. Eligible medical records were numbered, and a lottery-based randomization technique was applied using Microsoft Excel to select the records for review from the medical records room.

3.7. Data collection method

3.7.1. Data collection instrument

Data were collected using a structured data abstraction checklist, developed by the investigator after reviewing relevant studies, to obtain information on socio-demographic characteristics, AKI treatment outcomes, and associated factors.

The checklist was contains two main parts

- **Part 1: -** The socio-demographic characteristics of the AKI patients, related to age, sex, residency, reason for admission.
- **Part 2: -** Treatment outcome related

3.7.2. Data collectors and supervisors

Four pharmacists and one supervisor from the hospital participated during data collection.

3.7.3. Data collection procedures

Between September 1, 2019, and August 30, 2023, a retrospective review of medical records was conducted at HFCSH. Adult patients (aged ≥19 years) diagnosed with AKI based on KDIGO

criteria and admitted to the emergency ICU, medical ICU, or central ICU were included using simple random sampling. Records of patients who stayed in the ICU for at least 24 hours were evaluated, and for those with multiple ICU admissions, only the first hospitalization was considered.

3.8. Variables

3.8.1. Dependent variable

Treatment outcome of acute kidney injury (poor or good)

3.8.2. Independent variable

Socio-demographic factors: age, sex, marital status, residency, reason for admission, and types of ICU unit.

Medication types: angiotensin converting enzyme inhibitors, **angiotensin II receptor blockers**, Nonsteroidal anti-inflammatory drugs, aminoglycosides, and diuretics.

Clinical and laboratory variables: baseline urine output, vital signs, and serum creatinine.

Medical and comorbidity factors: history of DM, cancer, hypertension, heart problem, chronic obstructive pulmonary disease, surgery

3.9. Operational definitions

Treatment Outcome of AKI: In this study, AKI treatment outcomes were categorized as either **good** or **poor**

Good Treatment Outcome: Patient discharged with improvement in kidney function, as confirmed by renal function tests and physician assessment.

Poor Treatment Outcome: Includes in-hospital death, prolonged hospital stay due to AKI, referral to other institutions, or non-recovery of kidney function.

Recovery: Reversal of AKI at hospital discharge or return to baseline kidney function.

Late Reversal: Reversal of AKI occurring after seven days.

Sustained Reversal: Reversal of AKI within seven days.

Non-Recovery: AKI does not return to premorbid or baseline kidney function.

Referral: Patient referred to another health facility for specialized management of AKI.

Comorbidities: Medical conditions that coexist with AKI.

Duration of AKI: Number of days AKI was present, from the first day the patient met AKI criteria until recovery or end of follow-up.

Prolonged Length of Hospital Stay: Hospital stay of seven days or longer due to AKI.

3.10. Data quality control

The data collection tool was refined following a pretest conducted on 5% of the sample at Jugal Hospital. Data collectors received two days of training on the use of the tool, sampling methods, extraction of relevant information from patient charts, and ethical considerations, including confidentiality and proper data handling. The principal investigator and supervisors reviewed all collected data for completeness, accuracy, clarity, and consistency immediately after collection, ensuring readiness for analysis. Throughout the process, data collectors were closely supervised, and regular meetings were held with the supervisors and principal investigator to address any issues encountered during data collection.

3.11. Methods of data analysis

After data collection, the completed tools were checked for completeness, coded, entered, and cleaned using Epi Data version 7.2.5.0, and then exported to SPSS version 24 for analysis. Descriptive statistics were used to summarize the data, presenting categorical variables as frequencies and percentages, and continuous variables as means with standard deviations. Binary logistic regression was performed to examine the association between independent variables and AKI treatment outcomes, with crude odds ratios (CORs) and 95% confidence intervals (CI) reported. Variables with a p-value < 0.25 in the bi-variable analysis were considered for multivariable logistic regression to control for potential confounders. Adjusted odds ratios (AORs) with 95% CI were calculated to assess the strength of association after adjustment. Variables with a p-value < 0.05 were considered statistically significant.

3.12. Ethical considerations

Ethical approval was obtained from the Institutional Health Research Ethics Review Committee of the College of Health and Medical Sciences of Haramaya University. An official letter was also secured for HFCSH. Informed, voluntary, written, and signed consent was obtained from the head of HFCSH before the data collection. The information obtained from patient medical record cards was kept confidential, and the name of the patient and other information that specifically identifies the patient was not be recorded

3.13. Information dissemination

The study findings will first be presented and defended in an open public thesis defense at Haramaya University. Following this, both soft and hard copies of the thesis will be submitted to the School of Graduate Studies at Haramaya University, the Harari Regional Health Bureau, and HFCSH. Additionally, the results will be shared with governmental and non-governmental organizations interested in AKI treatment outcomes and associated factors. Finally, the study findings might be submitted for publication in a professional journal to serve as a reference and baseline for future research.

3.14. Limitations of the study

This study has several limitations. First, it was conducted at a single site, which may limit generalizability. Second, the sample size was relatively small. Third, data were extracted from medical records, and some key factors for GFR calculation were missing. Fourth, mortality rates among AKI patients were not compared with non-AKI patients. Finally, the retrospective cross-sectional design did not allow for patient follow-up.

4. RESULTS

4.1. Socio-demographic and baseline characteristics of the patient

A total of 308 ICU patients were included in the study, with 172 (55.8%) admitted to the medical ICU and 136 (44.2%) to the central ICU. The majority were male (181, 58.2%), and most patients (160, 51.9%) were aged 40–65 years, with a mean age of 45.6 ± 14.6 years; only 24 patients (7.8%) were older than 65 years. Most patients (203, 65.9%) resided in rural areas. Slightly over half (52.6%) had at least one comorbid condition, with cardiovascular disease (88, 54.3%), diabetes mellitus (37, 22.8%), and liver disease (24, 14.8%) being the most common (Table 2).

Table 2: Socio-demographic and baseline characteristics of AKI patients admitted to the ICU at HFCSUH, Harar, Eastern Ethiopia (n = 308).

Variables parameters	**Frequency**	**Percent**
Type of ICU units		
CICU	136	44.2
MICU	172	55.8
Sex		
Female	127	41.2
Male	181	58.2
Residences		
Rural	203	65.9
Urban	105	34.1
Age (years)		
<40	124	40.3
40-65	160	51.9
>65	24	7.8
No of patient per co-morbid	162	52.6

CICU: central intensive care unit, MICU: medical intensive care unit, ICU: intensive care unit.

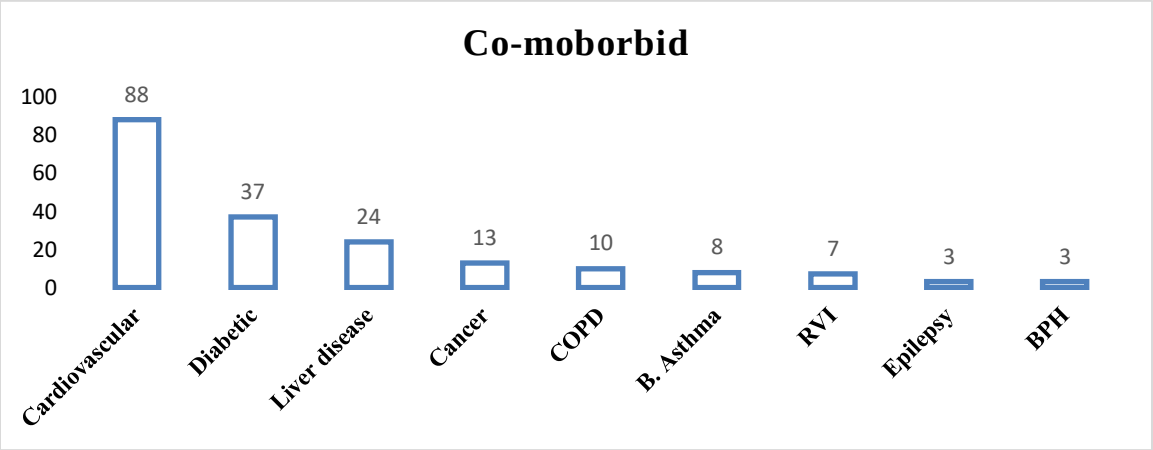

Figure 2: Comorbid conditions among AKI patients admitted to the ICU at HFSCUH, Harar, Eastern Ethiopia.

4.2. Reason for admission to the ICU

In this study, the most common reasons for ICU admission were infection (167, 54.2%), cardiovascular disease (38, 12.3%), trauma (26, 8.4%), respiratory illnesses (18, 5.8%), and neurological disorders (16, 5.2%) (Table 3).

Table 3: Reasons for admission to the ICU among AKI patients admitted at HFCSUH in Harar, Eastern Ethiopia [308].

Variables parameters	Frequency	Percent
Reason for ICU admission		
Infection	167	54.2
Cardiovascular disease	38	12.3
Trauma	26	8.4
Pulmonary diseases	18	5.8
Neurological disorder	16	5.2
Gastrointestinal disease	6	1.9
Malignancies	5	1.6
Obstetric/gynecological	3	1
Other*	31	10.1

ICU: intensive care unit. Other*...hepatic (18), shock (6), burn (2), small bowel obstruction (1), bladder outlet obstruction (1), renal disease (1), uremic encephalopathy (1), uremic gastropathy (1)

4.3. Clinical and laboratory findings of the patient

In this study, the baseline mean serum creatinine was 0.87 ± 0.22 mg/dl, hemoglobin 9.96 ± 2.44 g/dl, and blood urea nitrogen (BUN) 165.9 ± 100.3 mg/dl. At the time of AKI diagnosis, the mean serum creatinine was 2.52 ± 2.27 mg/dl. Most patients were classified as stage 1 (66.2%) or stage 2 (24.4%), with 173 (56.2%) presenting as oliguric. Pre-renal AKI was identified in 271 patients (88%). The leading etiologies of AKI were septic shock (109, 35.4%), hypovolemic shock (41, 13.3%), and hemorrhagic shock (32, 10.4%) (Table 4).

Table 4: Clinical and laboratory-related findings of patients admitted to the ICU of HFCSUH in Harar, Eastern Ethiopia.

Variable parameters	Frequency	Percent
Urine output		
>400 ml/day	135	43.8
<400 ml/day	173	56.8
Stage of AKI during diagnosis		
Stage-1	204	66.2
Stage-2	75	24.4
Stage-3	29	9.4
Types of AKI		
Pre-renal	271	88
Intrinsic	26	8.4
Post-renal	11	3.6
Causes of AKI		
Septic shock	109	35.4
Hypovolemic shock	41	13.3
Hemorrhagic shock	32	10.4
Sepsis	31	10.1
Heart failure	17	5.5
Hepatic disease	14	4.5
Cardiogenic shock	6	1.9
Unknown	32	10.4
Other*	26	8.74
Need RRT	71	23.3
Duration of AKI		
<7	285	92.5
≥7	23	7.5
Serum creatinine level: mean (SD)		
During admission,	0.87 ± 0.22	
At diagnosis of AKI	2.52 ± 2.27	
At discharge	2.19 ± 2.24	
Hemoglobin level: mean (SD) and range)		
At admission	9.96 ± 2.44 (2.20-18.4)	
At discharge	9.86 ± 2.24 (4.6-16.6)	
BUN: mean (SD)		
During admission	165.9 ± 100.3	
At discharge	163.4 ± 117.1	

AKI: Acute kidney injury, ICU: intensive care unit, N: number/frequency, RRT: renal replacement therapy, SD: standard deviation, %: percent. Others*…pre-renal azotemia (7), bladder outlet obstruction (7), burn (2), uremic encephalopathy (1), uremic gastropathy (1), acute tubular necrosis (1), chemotherapy (1), anti-diuretics (1), hypertensive emergency (1), nephroscorsis (1), obstructive uropathy (1), obstructive nephropathy (1), pyourelo-nephrosis (1).

4.4. Outcomes of AKI and medication-related information

In this study, AKI outcomes were classified as **good** for patients who recovered at discharge and **poor** for those who died in the hospital, were referred to other institutions, or stayed ≥7 days due to AKI. Among the 308 ICU patients with AKI, 179 (58.1%; 95% CI: 52.4–63.7) experienced poor outcomes, while 143 (41.9%) had good outcomes. Of the poor outcomes, 117 (38%) died, 16 (5.2%) were referred, and 19 (6.1%) had prolonged ICU stays ≥7 days due to AKI. The mean total hospital stay was 12.2 ± 9.04 days, ICU stay was 5.6 ± 4.6 days, and AKI duration was 3.04 ± 3.15 days. Renal replacement therapy was required in 71 patients (23.1%). Most patients had received antibiotics (250, 81.2%), diuretics (91, 29.5%), and calcium channel blockers (32, 10.4%) prior to ICU admission (Table 5).

Table 5: Outcomes of AKI and medication-related information among patients admitted to the ICU of HFCSUH in Harar, Eastern Ethiopia.

Variable	Total N (%)	CICU N (%)	MICU N (%)
Outcomes of AKI			
Died	117 (38)	70 (**22.7)**	47 (15.3)
Recovered	175 (56.8)	59 (19.2)	116 (37.7)
Referral	16 (5.2)	7 (2.3)	9 (2.9)
Prolonged ≥7 days due AKI	23 (7.5)	11 (3.6)	12 (3.9)
Need for RRT	71 (23.1)	34 (11)	37 (12)
Medication used before ICU admission			
Antibiotics	250 (81.2)	113 (36.7)	137 (44.5)
Diuretics	91 (29.5)	25 (8.1)	66 (21.4)
CCB	32 (10.4)	7 (2.3)	25 (8.1)
Chemotherapy	4 (1.3)	3 (1)	1 (0.3)
ACEIs	14 (4.5)	5 (1.6)	9 (2.9)
NSAIDs	28 (9.1)	17 (5.5)	11 (3.6)
Others*	33 (10.7)	12 (3.9)	21 (6.8)
Length of ICU stay (days) (mean with standard deviation)			5.6 ± 4.6
Length of total hospital stay (days) (mean with standard deviation)			12.2 ± 9.04
Number of drugs taken per patient in ICU			7.57 ± 2.607
Number of drugs taken per patient during hospital			9.10 ±2.465

ACEIs: angiotensin converting enzyme inhibitors, AKI: Acute kidney injury, CCB: calcium channel blocker, CICU: intensive care unit, MICU: medical intensive care unit, N: number/frequency, NSAIDs: non-steroid anti-inflammatory drugs, RRT: renal replacement therapy, SD: standard deviation, percent. Others*…...anti-acid (6), insulin (5), bronchodilators (4).anticoagulants (3), anti-tuberculosis (2), ant pain (3), corticosteroid (1), anti-retroviral therapy (1), anti-fungal (1), anti-epileptics (1), anti-dyslipidemia (4), potassium (2).

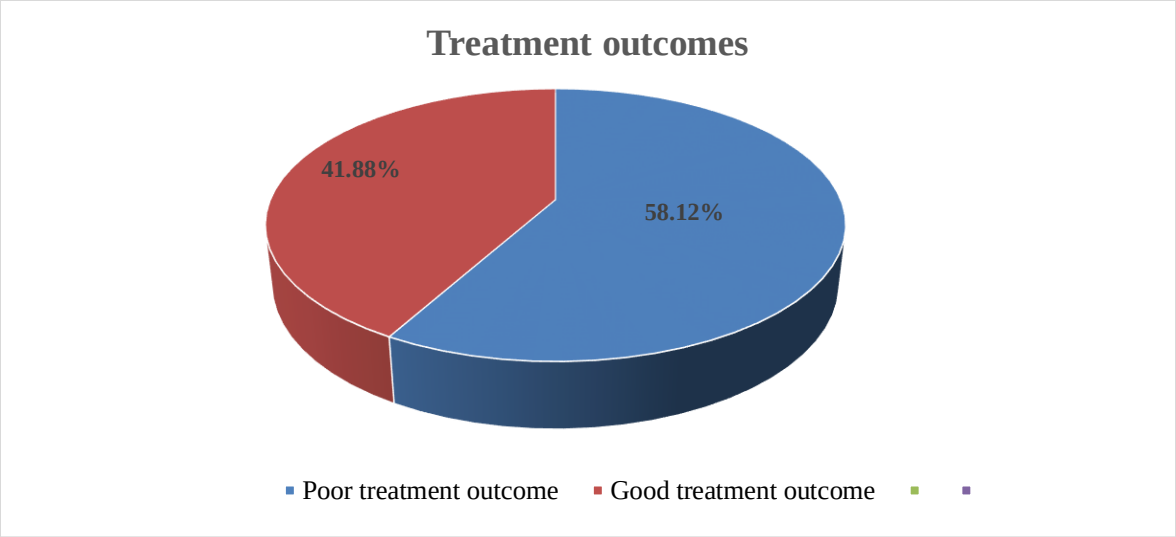

Figure 3: Outcomes of AKI among patients admitted to the ICU of HFCSUH in Harar, Eastern Ethiopia [308].

4.5. Factors associated with poor outcomes

4.5.1. Bivariate analysis

Bivariate logistic regression was performed for all independent variables, and those with a p-value < 0.25 were included in the multivariate logistic regression analysis. Variables selected for multivariate analysis included sex, age, residence, type of ICU admission, reason for admission (pulmonary disease, trauma, shock), comorbidities, urine output, AKI stage, cause of AKI (septic shock, hypovolemic shock, sepsis), need for renal replacement therapy, AKI type, hemoglobin levels at admission, and pre-ICU medications such as ACE inhibitors, diuretics, and antibiotics (Table 6).

Table 6: Bivariate analysis of factors associated with poor outcomes among AKI patients admitted to the ICU at HFCSUH, Harar, Eastern Ethiopia.

Variables		COR	P-value	Variables		COR	P-valu
Sex	Female	1		Urine output < 400 ml/ day	No	1	
	Male	1.92 (1.21-3.04)	**0.006**		Yes	4.15(2.56-6.71)	**0.000**
Age (years)	<40	1		Stage of AKI	Stage-1	1	
	40-65	1.72(1.07-2.77)	**0.025**		Stage-2	2.84(1.6-5.0)	**0.000**
	>65	3.09(1.15-8.34)	**0.025**		Stage-3	30.9(4.12-231)	**0.001**
Residences	Rural	1		**Cause of AKI**			
	Urban	0.73(0.46-1.17)	**0.197**	Septic shock	No	1	
Types of ICU	MICU	1			Yes	2.9(1.75-4.86)	**0.000**
	CICU	2.16(1.35-3.45)	**0.001**	Hypovolemic shock	No	1	
Reason of admission					Yes	0.4(0.21-0.80)	**0.009**
Pulmonary disease	No	1		Hemorrhagic shock	No	1	
	Yes	0.34(0.12-0.93)	**0.035**		Yes	0.92(0.44-1.92)	0.821
Gastrointestinal disease	No	1		Sepsis	No	1	
	Yes	1.45(0.26-8.05)	0.670		Yes	0.48(0.23-1.0)	**0.058**
Cardiovascular disease	No	1		Need RRT	No	1	
	Yes	0.99(0.49-1.97)	0.976		Yes	18.7(6.6-52.9)	**0.000**
Cancer	No	1		Type of AKI	Pre-renal	1	
	Yes	2.93 (0.32-26.4)	0.340		Intrinsic	2.6(1.0-6.80)	**0.043**
Infection	No	1			Post-renal	2.2(0.55-8.2)	0.275
	Yes	1.30 (0.83-2.05)	0.252				
Neurological disease	No	1		Hemoglobin levels at admission	>11.5mg/dl	1	
	Yes	0.96 (0.32-2.83)	0.940		< 11.5 mg/dl	1.73(1.03-2.9)	**0.037**
Trauma	No	1		Taken ACEIs before admission	No	1	
	Yes	1.69 (0.71-4.02)	**0.234**		Yes	4.56(1.0-20.7)	**0.049**
Obstetric/gynecological	No	1		Taken diuretics before admission	No	1	
	Yes	1.45(0.13-16.1)	0.764		Yes	1.7(1.0-2.85)	**0.041**
Shock	No	1		Taken NSAIDs before admission	No	1	
	Yes	0.35 (0.06-1.96)	**0.234**		Yes	1.13(0.51-2.5)	0.770
Comorbid	No	1		Taken Antibiotics before admission	No	1	
	Yes	1.69 (1.07-2.68)	**0.023**		Yes	0.56(0.3-1.04)	**0.065**

4.5.2. Multivariate analysis

Multivariate logistic regression analysis showed that poor outcomes among ICU patients with AKI were significantly associated with living in an urban area (AOR = 2.22; 95% CI: 1.16–4.25), admission to the CICU (AOR = 2.70; 95% CI: 1.41–5.19), urine output <400 ml/day (AOR = 3.26; 95% CI: 1.76–6.04), stage III AKI (AOR = 15.8; 95% CI: 1.56–159.6), and requiring RRT (AOR = 11.6; 95% CI: 3.41–39.6) (Table 7).

Table 7. Multivariate analysis of factors associated with poor outcomes among AKI patients admitted to the ICU at HFCSUH, Harar, Eastern Ethiopia.

Variables		Poor treatment outcomes		AOR	P-value
		No	Yes		
Sex	Female	65	62	1	
	Male	64	117	1.36 (0.71-2.61)	0.347
Age (years)	<40	63	61	1	
	40-65	60	100	0.95 (0.49-1.81)	0.873
	>65	6	18	2.50 (0.67-9.38)	0.174
Residences	Rural	78	121	1	
	Urban	51	58	2.22 (1.16-4.25)	**0.017**
ICU unit	MICU	86	86	1	
	CICU	43	93	2.70 (1.41-5.19)	**0.003**
Reason for admission					
Pulmonary disease	No	117	173	1	
	Yes	12	6	0.56 (0.16-1.96)	0.363
Trauma	No	121	161	1	
	Yes	8	18	2.51 (0.72-8.72)	0.148
Shock	No	125	177	1	
	Yes	4	2	0.77 (0.10-5.70)	0.797
Urine output < 400 ml/ day	No	82	53	1	
	Yes	47	126	3.26 (1.76-6.04)	**0.000**
Comorbid	No	71	75	1	
	Yes	58	104	0.54 (0.27-1.07)	0.078
Stage of AKI	Stage-1	107	97	1	
	Stage-2	21	57	1.44 (0.68-3.01)	0.338
	Stage-3	1	54	15.8 (1.56-159.6)	**0.019**
Hemoglobin at admission to the ICU	> 11.5 mg/dl	111	112	1	
	< 11.5 mg/dl	32	55	0.96 (0.47-1.94)	0.907
Type of AKI	Pre-renal	120	151	1	
	Intrinsic	6	20	1.07 (0.28-4.06)	0.918
	Post-renal	3	8	0.67 (0.10-4.52)	0.683
Cause of AKI					
Septic shock	No	101	99	1	
	Yes	28	80	2.06 (0.972-4.36)	0.059
Hypovolemic shock	No	104	163	1	
	Yes	25	16	0.77 (0.29-1.99)	0.587
Sepsis	No	111	18	1	
	Yes	116	13	0.51 (0.17-1.48)	0.214
Need for RRT	No	125	112	1	
	Yes	4	67	11.6 (3.41-39.6)	**0.000**
Taken ACEIs before admission	No	127	167	1	
	Yes	2	12	1.32 (0.18-9.47)	0.783
Taken diuretics before admission	No	99	118	1	

	Yes	30	61	1.38 (0.62-3.10)	0.433
Taken Antibiotics before admission	No	18	40	1	
	Yes	111	139	0.46 (0.21-1.02)	0.056

Hosmer-Lemeshow goodness of fit test model was fitted with a P-value of 0.417; *P >0.05, **P<0.001.

ACEIs: angiotensin converting enzyme inhibitors, AKI: acute kidney injury, AOR: adjusted odds ratio, CICU: central intensive care unit, COR: crude odds ratio, HFCSUH: Hiwot Fana Compressive Specialized University Hospital, MICU: medical intensive care unit, RRT: renal replacement therapy

5. DISCUSSION

AKI in the ICU is an increasing global burden, contributing to prolonged hospital stays, the need for renal replacement therapy (RRT), progression to CKD, and higher morbidity and mortality (Corte WD et al., 2016; Jiang L et al., 2019; Ponce D et al., 2020; Adhikari S et al., 2024). Despite this, data from Ethiopia on treatment outcomes and factors associated with AKI in ICU patients remain limited.

In this study, the majority of patients were aged 40–65 years (51.9%), with a mean age of 45.6 ± 14.6 years, which is comparable to findings from Tanzania (42.37%, 45.7 ± 17.8 years) (Makanga G et al., 2022) and the United States (48%, 48 ± 15.7 years) (Ishwarya S et al., 2025). However, it contrasts with studies reporting predominantly older populations, mainly over 60 years (Jailza da et al., 2017; Ashraf O. Oweis et al., 2020; Jiang et al., 2021; Adhikari S et al., 2024), possibly due to differences in admission reasons and sample sizes. AKI also occurred more frequently in male patients, consistent with previous studies (Aylward RE et al., 2019; Jiang et al., 2021; Adhikari S et al., 2024; Ishwarya S et al., 2025).

In this study, the most common comorbidities were cardiovascular disease (88, 54.3%), diabetes mellitus (37, 22.8%), and liver disease (24, 14.8%), consistent with findings from China (Jiang et al., 2021), Tanzania (Makanga G et al., 2022), and Nepal (Adhikari S et al., 2024). The primary reasons for ICU admission were infection/sepsis (167, 54.2%), cardiovascular disease (38, 12.3%), and trauma (26, 8.4%). The leading etiologies of AKI were septic shock (109, 35.4%), hypovolemic shock (41, 13.3%), and hemorrhagic shock (32, 10.4%). These results align with multiple studies indicating that sepsis is the most common cause of new-onset AKI and a frequent reason for ICU admission (Salma Mohammed et al., 2020; Jiang et al., 2021; Shashikantha et al., 2021).

The serum creatinine level (mean ± SD) at admission and during the diagnosis of AKI was 0.87 ± 0.22 mg/dl and 2.52 ± 2.27 mg/dl, respectively. Regarding the severity grading of AKI, 66.2%, 24.4%, and 9.4% of patients had stage 1, stage 2, and stage 3, respectively. This finding is comparable to a study done in Nepal, which showed serum creatinine levels of 0.87 ± 0.25 mg/dl at admission and 1.63 ± 1.19 mg/dl during the diagnosis of AKI, with 74.5%, 19.1%, and 6.4% of patients having stages 1, 2, and 3, respectively (Adhikari S et al., 2024). In Jordan, 59.4%, 22.5%, and 18% of patients had stages 1, 2, and 3, respectively (Ashraf O. Oweis et al., 2020). In

contrast, the study conducted in Tanzania showed that 19.2%, 28.1%, and 52.6% of patients were in stages 1, 2, and 3, respectively (Makanga G et al., 2022). This difference might be explained by the delay in the diagnosis of AKI after admission, as well as the comorbidities and causes of AKI.

In this study, AKI outcomes were classified as **good** for patients who recovered at discharge and **poor** for those who died in the hospital, were referred to other healthcare facilities, or stayed ≥7 days due to AKI. A total of 179 patients 58.1% with (95% 52.4-63.7) experienced poor outcomes, with a mortality rate of 38%. This is comparable to findings from China (34.1%) (Yi-Jia Jiang et al., 2021) and Thailand (37.5%) (Chawika Pisitsak et al., 2016). However, it is lower than reports from South Africa (40%) (M A Khuweldi et al., 2020), Addis Ababa, Ethiopia (56.1%) (MT Tiruneh et al., 2023), Jordan (58%) (Ashraf O. Oweis et al., 2020), Tanzania (94.1%) (Makanga G et al., 2022), and India (68%) (Bhushan D et al., 2025), but higher than studies from Dhaka (24%) (Easnem Khanam et al., 2021) and the United States (8%) (Ishwarya S et al., 2025). These variations may be attributed to differences in patient severity, age, ICU resources, and the types of interventions employed.

In this study, 23.1% of ICU patients with AKI required RRT, comparable to findings from Thailand (22.3%) (Chawika Pisitsak et al., 2016), Jordan (20.4%) (Ashraf O. Oweis et al., 2020), Dhaka (24%) (Easnem Khanam et al., 2021), and Addis Ababa, Ethiopia (17.1%) (MT Tiruneh et al., 2023). The mean ICU stay was 5.6 ± 4.6 days, which is comparable to a study in Sudan (6.7 ± 3.8 days) (Salma Mohammed et al., 2020).

Patients presenting with oliguria (AOR = 3.26; 95% CI: 1.76–6.04) were over three times more likely to experience poor treatment outcomes compared to those without oliguria. Similarly, a study in India reported an association between oliguria and poor prognosis (Shashikantha et al., 2021).

This study found that Patients with stage III AKI were 15.8 times more likely to experience poor treatment outcomes compared to those with stage I (AOR = 15.8; 95% CI: 1.56–159.6). This finding aligns with a study from Jimma, Ethiopia, where stage III AKI patients had a ninefold higher risk of poor outcomes than those with less severe AKI (AHR = 9.60; 95% CI: 1.18–28.52, p = 0.035) (Abinet Abebe et al., 2021). Higher AKI stages are generally associated with increased morbidity and mortality due to greater illness severity (Ostermann, M et al., 2025).

This study found that the patients requiring RRT were 11.6 times more likely to experience poor treatment outcomes compared to those who did not need RRT (AOR = 11.6; 95% CI: 3.41–39.6). This is consistent with a study in Ethiopia, which reported a higher risk of mortality among patients requiring RRT (AHR = 2.15; 95% CI: 1.04–4.76, p = 0.06). RRT is generally indicated for severe AKI, particularly when kidney function is nearly or completely lost, impairing fluid balance and increasing mortality risk (Lixia Liu and Zhenjie Hu, 2024).

Patients who developed AKI in the central ICU were 2.7 times more likely to experience poor treatment outcomes compared to those in the medical ICU (AOR = 2.70; 95% CI: 1.41–5.19). This may be due to greater illness severity, as more critically ill patients are typically admitted to the central ICU.

In this study, living urban area (AOR=2.22; 95% CI: 1.16-4.25) was 2.22 times more likely to experience poor treatment outcomes compared to those living in a rural area. Urban residence is associated with poor AKI outcomes due to a higher comorbidity burden, delayed recognition in complex healthcare settings, increased exposure to nephrotoxins, environmental and lifestyle factors, and socioeconomic disparities. Urban populations have higher rates of chronic diseases such as hypertension, diabetes, and cardiovascular disease, which increase susceptibility to kidney injury and complicate recovery in critically ill patients (Barnett et al., 2012; Rabanal et al., 2019).

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6. CONCLUSION AND RECOMMENDATION

6.1. Conclusion

This study found that over half of ICU patients with acute kidney injury experienced poor outcomes. Infection was the leading cause of ICU admission among these patients. Factors significantly associated with increased mortality, morbidity, and prolonged hospitalization included admission to the central ICU, urban residence, oliguria, stage III AKI, and the need for renal replacement therapy.

6.2. Recommendation

Acute kidney injury (AKI) in ICU patients arises from multiple risk factors, often leading to poor outcomes such as increased morbidity, mortality, and prolonged ICU stay. Early detection and prompt correction of abnormal hemodynamic conditions can improve renal recovery and reduce these risks. Based on these findings, the study recommends the following:

1. **For the Ethiopian Ministry of Health:** Develop updated treatment guidelines specifically for critical care patients.
2. **For HFCSUH:** Enhance awareness among healthcare workers through continuous medical education and training programs.
3. **For healthcare providers:** Focus attention on patients in the central ICU, those with oliguria, septic shock, stage III AKI, or requiring renal replacement therapy.
4. **For researchers:** Conduct multicenter ICU studies with prospective follow-up to prevent progression to CKD and to evaluate treatment outcomes comparing AKI and non-AKI

7. REFERENCES

Abd ElHafeez, G. Tripepi, R. Quinn, Y. Naga, S. Abdelmonem, M. AbdelHady, et al. (2017). "Risk, predictors, and outcomes of acute kidney injury in patients admitted to intensive care units in Egypt." Scientific Reports 7(1): 17163.

Abinet Abebe, Kabaye Kumela, Maek Belelay and Bezie Kebede (2021). "Clinical outcome and predictors of acute kidney injury in adult patients admitted to the medical ward of Jimma Medical Center, South West Ethiopia: A prospective observational study."

Abinet Abebe, Kabaye Kumela, Maekel Belay, Bezie Kebede, and Yohannes Wobie (2021). "Mortality and predictors of acute kidney injury in adults: A hospital-based prospective observational study." Scientific Reports 11(1): 1-8.

Batwie Raghad, Organji Rahaf, Alaklouk Reham, Alotaibi Afrah, Alharbi Nada, S. Gari, et al. (2022). "The outcome of acute kidney injury in patients admitted to the intensive care unit at King Abdulaziz University Hospital in Jeddah, Saudi Arabia: A retrospective cohort study." International Journal of Medicine in Developing Countries 6(10): 1207-1214.

Barnett K, Mercer SW, Norbury M, Watt G, Wyke S, Guthrie B. Epidemiology of multimorbidity and implications for health care, research, and medical education: a cross-sectional study. Lancet. 2012 Jul 7;380(9836):37-43. doi: 10.1016/S0140-6736(12)60240-2. Epub 2012 May 10. PMID: 22579043.

Bayrakci Nergiz, Ersan Sibel, Celik Ali, C. cavdar, T. camsari, Bodur Hakan Alp, et al. (2022). "The role of rifle, akin, and kdigo criteria in determining the relationship between acute kidney injury and mortality in intensive care patients."

Bhavana Tipparapu, Thota Srikanth and K. Venkatesh (2022). "A study of acute kidney injury in medical wards of tertiary care hospital of south india." European Journal of Molecular & Clinical Medicine 9(6): 1154-1160.

Cheng Yichun, N. Zhang, R. Luo, M. Zhang, Z. Wang, L. Dong, et al. (2021). "Risk factors and outcomes of acute kidney injury in critically ill patients with coronavirus disease 2019." Kidney Diseases 7(2): 111.

Ethiopian Public Health Institute - EPHI, Federal Ministry of Health - FMoH and ICF (2021). Ethiopia mini demographic and health survey 2019. Addis Ababa, Ethiopia, EPHI/FMoH/ICF.

Haredasht Fateme Nateghi, L. Vanhoutte, C. Vens, H. Pottel, L. Viaene and W. De Corte (2023). "Validated risk prediction models for outcomes of acute kidney injury: A systematic review." BMC Nephrology 24(1): 133.

Jiang Li, Y. Zhu, X. Luo, Y. Wen, B. Du, M. Wang, et al. (2019). "Epidemiology of acute kidney injury in intensive care units in beijing: The multi-center bakit study." BMC Nephrology 20(1): 468.

Kahindo Charles Kangitsi, Mukuku Olivier, Wembonyama Stanis Okitotsho and Tsongo Zacharie Kibendelwa (2022). "Prevalence and factors associated with acute kidney injury in sub-saharan african adults: A review of the current literature." International Journal of Nephrology 2022: 5621665.

Kellum John A, Romagnani Paola, Ashuntantang Gloria, Ronco Claudio, Zarbock Alexander and Anders Hans-Joachim (2021). "Acute kidney injury." Nature Reviews Disease Primers 7(1): 52.

Lixia Liu and Zhenjie Hu. (2024). When to start renal replacement therapy in acute kidney injury: What are we waiting for?. Journal of Intensive Medicine. Volume 4, Issue 3, July 2024, Pages 341-346

Lydia, A. (2023). "Raising awareness of acute kidney injury: Unfolding the truth." Acta Medica Indonesiana 54(4): 513.

Magboul Salma Mohammed, Osman Bashier and Elnour Asim Ahmed (2020). "The incidence, risk factors, and outcomes of acute kidney injury in the intensive care unit in Sudan." International Journal of Clinical Pharmacy 42(6): 1447-1455.

Matuszkiewicz-Rowińska and J. Małyszko (2020). "Acute kidney injury, its definition, and treatment in adults: Guidelines and reality." Pol Arch Intern Med 130(12): 1074-1080.

Melo Fernando deassis, Macedo E, Fonseca Bezerra, Melo Waledya, R. L. Mehta, Burdmann E, et al. (2020). "A systematic review and meta-analysis of acute kidney injury in the

intensive care units of developed and developing countries." PLoS One 15(1): e0226325.

Melo Fernando deassis, Macedo E, Fonseca Bezerra, Melo Waledya, R. L. Mehta, Burdmann E, et al. (2020). "A systematic review and meta-analysis of acute kidney injury in the intensive care units of developed and developing countries." PLoS One 15(1): e0226325.

Oweis Ashraf O, Alshelleh Sameeha A, S. M. Momany, S. M. Samrah, Khassawneh Basheer, and Al Ali Musa (2020). "Incidence, risk factors, and outcome of acute kidney injury in the intensive care unit: A single-center study from Jordan." Critical Care Research and Practice 2020: 8753764.

Ostermann, M., Lumlertgul, N., Jeong, R., See, E., Joannidis, M. and James, M., 2025. Acute kidney injury. *The Lancet*, *405*(10474), pp.241-256.

Pickers Peter, Murray Patrick T, and M. Ostermann (2022). "New drugs for acute kidney injury." Intensive Care Medicine 48(12): 1796-1798.

Rabanal KS, et al. *Global prevalence of hypertension and diabetes in urban vs rural populations.* Int J Epidemiol. 2019;48(3):887-902.

Sang Ling, S. Chen, X. Zheng, W. Guan, Z. Zhang, W. Liang, et al. (2020). "The incidence, risk factors and prognosis of acute kidney injury in severe and critically ill patients with COVID-19 in mainland China: A retrospective study." BMC Pulmonary Medicine 20(1): 290.

Sengthavisouk Noot, N. Lumlertgul, C. Keomany, P. Banouvong, P. Senavong, S. Sayyaphet, et al. (2020). "Epidemiology and short-term outcomes of acute kidney injury among patients in the intensive care unit in Laos: A nationwide multicenter, prospective, and observational study." BMC Medicine 18(1): 180.

Srisawat Nattachai, W. Kulvichit, N. Mahamitra, C. Hurst, K. Praditpornsilpa, N. Lumlertgul, et al. (2019). "The epidemiology and characteristics of acute kidney injury in the Southeast Asia intensive care unit: A prospective multicentre study." Nephrology Dialysis Transplantation 35(10): 1729-1738.

Xiao Z, Q. Huang, Y. Yang, M. Liu, Q. Chen, J. Huang, et al. (2022). "Emerging early diagnostic methods for acute kidney injury." Theranostics 12(6): 2963-2986.

ANNEX A: DATA ABSTRACTION CHECKLIST

Part-1 Socio-demographic and admission-related questions:

S. No	Question		Response	
1	Sex		Male Female	
2	Age in a year			
3	Residence		1. Urban 2. Rural	
4	Type of ICU unit		1. Medical ICU 2. Central ICU	
5	**Reason for ICU admission**		**If yes specify**	
	Pulmonary diseases	1. Yes 2. No		
	Gastrointestinal disease	1. Yes 2. No		
	Cerebrovascular disease	1. Yes 2. No		

	Malignancies	1. Yes 2. No		
	Infection	1. Yes 2. No		
	Neurologic disorder	1. Yes 2. No		
	Trauma	1.Yes 2. No		
	Obstetric/gynecological disorders	1.Yes 2. No		
	Others (specify)			

Part 2: Treatment outcome-related questions

	Question	**Response**	
1.	**Serum creatinine status**		
	Serum creatinine at ICU admission (mg/dl)		
	Serum creatinine at diagnosis of AKI (mg/dl)		
	Serum Creatinine at discharge (mg/dl)		
2	**Urine output**		
	≤400ml/day (<0.5 mL/kg/h for 6 hours)	Yes No	
	>401ml/dl (>0.5 mL/kg/h for 6 hour)	Yes	

		No	
3	Co- morbidities condition	Diabetics Cancer Liver disease Cardio vascular disease Pre-existing CKD COPD Other _____	
4	BMI (Kg/m2)	under wight normal over wight obese	
5	Length of ICU stay in days		
6	Length of hospital stay in days		
7	Stage of AKI	stage -1 stage -2 stage -3	
8	Duration of AKI		
9	Glomerular filtration rate (GFR)		
	GFR at admission		
	GFR at discharge		
10	Hemoglobin level		
	Hemoglobin at admission		
	Hemoglobin at discharge		
11	Blood urine Nitrogen (BUN) level		
	BUN at admission		

	BUN at discharge			
12	Types of AKI		pre – renal intrinsic post- renal	
13	Cause of AKI (specify)			
14	Need for Renal Replacement Therapy		yes No	
15	Drugs taken before ICU admission		If yes Specify the drug	
	Angiotensin converting enzyme inhibitors	1.Yes 2.No		
	Angiotensin II receptor blockers	1.Yes 2.No		
	Nonsteroidal anti-inflammatory drugs	1.Yes 2.No		
	Diuretics	1.Yes 2.No		
	Antibiotics	1.Yes 2.No		
	Calcium channel blocker	1.Yes 2.No		
	Chemotherapy	1.Yes 2.No		
	Other medication (specify)			
	The medication history is unknown		1.Yes 2.No	
16	Drug taken at ICU admission (specify)			
17	Number of drugs taken per patient during			

	admission (specify)			
18	The drug administered during admission are appropriate	1.Yes 2.No	If no specify	

ANNEX B: CURRICULUM VITAE

I. Personal Identification

Name	MENBERE DEBELE HEYE
Age	35
Sex	Male
Place of birth	Oromia Region, Arsi Zone, Robe Woreda, Robe city.
Date of birth	April, 19 /1988 G.C
Marital status	Single
Nationality	Ethiopian
Address	Mobile- +251 910781860 Email – menbiidebele2@gmail.com

II. Educational Background

No.	Level of education	Grade	Place of teaching/Educational institution	Year in Ethiopian Calendar
1	Elementary/Primary School	Grade 1 to 8	Robe number 2 primary school	1988-1995

2	High School	9 & 10	Robe didia senior secondary school Awarded Ethiopian General Secondary Education Certificate (EGSEC)	1996-1997
3	Higher Education	Diploma (Level IV)	Rift Valley University faculty of heath, department of Nursing, Adamaa **Awarded Diploma in Clinical Nursing**	1999-2001
		B.Sc. Degree	Rift Valley University faculty of heath, department of Nursing, Harar **Awarded B.Sc. degree in Nursing**	2003-2006
		B.Sc. Degree	Harar Health Science College, faculty of heath, department of Pharmacy, Harar **Awarded B.Sc. degree in B.PHARM**	2005-2009
		MSc candidate	Haramaya University, CHMS	2014-2016
		MPH candidate	Rift Valley University department of public health	2014-2016

III. Work Experience

Since December, 2003 E.C I am working in Rift Valley University, program of Nursing as Instructor (Demonstration instructor), From September 2007 E.C as BSc. Instructor And From May, 2008 E.C 2009 E.C I am working in Harar Health Science College program of Nursing as Instructor and since September 2009 until know (July 2015 E.C) I am working in Harar Health Science College Pharmacy department as Instructor.

IV. Qualification

- ✓ Diploma (Level IV) in clinical nursing
- ✓ BSc. Degree in clinical nursing, Graduated with Very Great Distinction CGPA of 3.94
- ✓ BSc. Degree in pharmacy, Graduated with Very Great Distinction CGPA of 3.88
- ✓ MSc. Candidate in clinical pharmacy

- ✓ MPH. Candidate in public health

V. Language Proficiency

Language Type	Potentials		
	Listening	**Speaking**	**Writing**
English	Excellent	Excellent	Excellent
Afaan Oromo	Excellent	Excellent	Excellent
Amharic	Excellent	Excellent	Excellent

VI. Computer skill

- ✓ Basic Computer Skill of Power Point, Word and Excel.
- ✓ Good skill of SPSS

VII. Personal Quality

- ✓ Good interpersonal communication, sociable and cooperative
- ✓ Believe in Team work
- ✓ Ready to face challenges, work in extra time and in dynamic environment
- ✓ Good in time management
- ✓ Energetic and Hard working

VIII. Hobbies

- ✓ Reading academic related books
- ✓ Watching movies, TV and accessing different website

IX. Legalities

- ✓ I have never been convicted of any crime**.**

X. References

❖ **Rift Valley University**

- ➢ Telephone: +251116814771/+251116815440.
- ➢ E-mail: rvuc@ethionet.et.
- ➢ Fax: +251251129878.
- ➢ P.O.BOX:1686, Harar, Ethiopia.

❖ **Harar Health Science College**

- Telephone: (251)025-666-02-55/ 666-63-22.
- Fax: (251)025-666-06-50
- P.O.BOX:228, Harar, Ethiopia.

❖ **Mohammed Yusuf (RN, B.sc)**

- Mobile: +251911043994
- E-mail: omarmohammed@gmail.com
- Fax: +251251129878.
- P.O.BOX:1686, Dire Dawa, Ethiopia.
- Position: Harar Health Science College C/Nursing department head

❖ **Abebaw Demise (RN, BSc, MPH)**

- Mobile:- +251913084907
- E-Mail: miteabe@yahoo.com
- Position: Harar Health Science College Anesthesia department head

❖ **Zenebe keno (BSc, MSc in C/Pha.)**

- Mobile:- +251912812388
- E-Mail:

  Position: Hiwot Fana Comprehensive Specialized Hospital staff