ADDIS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCE

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Assessment of prevalence, risk factors, and outcome of acute kidney injury patients admitted to an adult intensive care unit at St. Paul's hospital millennium medical college, Addis Ababa, Ethiopia, 2019.

BY; EDMIALEM GETAHUN (CN, BSC, ECCN)

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Principal Investigator	Edmialem Getahun (BSC, ECCN)
Advisors	1. Mr. Asmamaw Abebe (Msc in Emccn, Lecturer), AAU 2.Tigist Zewdu MD, Assistant professor of EMCC, AAU
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Address of the investigator	Tel:+251915715784 Email:edmia89@gmail.com

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Approval by the board of examination

This thesis by Edmialem Getahun is accepted in its present form by the board of examiners as satisfying the thesis requirement for the degree of master in emergency medicine and critical care nursing.

External examiner:

_____ _____ _____

Name signature date

Internal examiner:

_____ _____ _____

Name signature date

Research advisors:

1. Mr. Asmamaw Abebe (Msc in Emccn, Lecturer), AAU

_____ _____

Signature date

2. Tigist Zewdu MD, Assistant professor of EMCC, AAU

_____ _____

Signature date

Department head:

_____ _____ _____

Name signature date

Addis Ababa University, College of Health Sciences

Department of Emergency medicine and critical care

Advisor's Approval Sheet

This is to certify that the thesis entitled on "assessment of prevalence, risk factors, and outcomes of acute kidney injury patients admitted to adult intensive care unit at St. paul's hospital millennium medical college, Addis Ababa, Ethiopia, '' is submitted in partial fulfilment of the MSc with specialization in "Emergency medicine and Critical care nursing" to the Graduate Program of the College of Health Sciences of Addis Ababa University and has done by Edmialem Getahun, ID No: GSR/2038/11 under my supervision. Therefore, I recommend that the student has fulfilled the requirements and hence hereby can submit the thesis to the Department.

_____ _____ _____

Name of Major Advisor Signature Date_____

_____ _____

Name of Co advisor Signature Date

Declaration

I hereby declare that this MSc thesis is my original work and has not been presented for a degree in any other university and all sources of material used for this thesis have been duly acknowledged.

Name: _____

Signature: _____

Date: _____

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List of Acronyms and abbreviations

ADQI……Acute Dialysis Quality Initiative
AKI……. Acute Kidney Injury
AKIN……. Acute Kidney Injury Network
CA-AKI……..… Community-Acquired Acute Kidney Injury
CKD……...Chronic Kidney Disease
DM……Diabetes Mellitus
ESRD……End-Stage Renal Disease
GFR……... Glomerular Filtration Rate
HA-AKI……. Hospital-Acquired Acute Kidney Injury
ICU……Intensive Care Unit
IQR…… Interquartile Range
KDIGO……..… Kidney Disease Improving Global Outcomes
MOH.....Minster Of Health
RIFLE……Risk, Injury, Failure, Loss and End-stage Renal Disease
RRT……Renal Replacement Therapy
Scr……. Serum Creatinine
SD……... Standard Deviation
SPHMMC……...…Saint Paul's Hospital Millennium Medical College
SPSS……... Statistical Package for the Social Sciences
UO……. Urine Output

ABSTRACT

Introduction: Acute kidney injury is a syndrome characterized by the rapid loss of the kidney's excretory function and is typically diagnosed by -the accumulation of end products of nitrogen metabolism (urea and creatinine) or decreased urine output, or both. In critically ill patients Acute Kidney Injury (AKI) occurs frequently and it allied with great rates of morbidity and mortality.

Objective: This study aims to assess the prevalence, risk factors and outcome of acute kidney injury in patients admitted in the intensive care unit of Saint Paul's Hospital Millennium Medical College from January 2017 to December 2019**.**

Methods: The study design was a facility-based retrospective; the cross-sectional study was conducted. Medical records of 108 were revised. Data collection checklist was developed and the data were extracted from the patients' medical records. Data entry and analysis were conduct by using the Epi-Data-4.2 and Statistical Package for the Social Sciences (SPSS) software version 25.0 respectively. The logistic regression model was used for analysis.

Result: AKI in critically ill patients covered 16.1% with a mean age of 34 $\pm$ 15 age distribution and female predominance (66.7%). Being female and Anemia were the leading risk factors to develop AKI, 72 (66.7%) and 56 (51.9%) respectively. Sepsis was more likely associated to kill the patients with AKI. Most 81 (75%) AKI critically ill patients were initiated renal replacement therapy. Stage three AKI were account for 66(61.1%). Length of hospital stay ranged from 1 day to 52 days with a mean stay of 10.7 days. Critically ill patients with AKI (48.1%) had died in the study period.

Conclusion: AKI is the most common cause for critically ill patient's morbidity I too observed the higher prevalence of AKI in critically ill patients with younger age groups and female predominance. The mortality rate of AKI in critically ill patients was near to half of all respondents during the study period.

Keywords
Acute kidney injury; critically ill; Prevalence; Risk-factors; Outcomes

1. INTRODUCTION

1.1. Background

Acute kidney injury is a syndrome characterized by the rapid loss of the kidney's excretory function and is typically diagnosed by the accumulation of end products of nitrogen metabolism (urea and creatinine) or decreased urine output, or both (1).

In critically ill patients Acute Kidney Injury (AKI) occurs frequently and it allied with great rates of morbidity and mortality. There was no agreement on a clinical definition or diagnostic criteria for AKI for many years, however in 2012, Kidney Disease Improving Global Outcomes (KDIGO) workgroup were developed a concord definition and staging of AKI (Table 1) using a combination of RIFLE (risk, injury, failure, loss, and end-stage renal disease), and AKIN (acute kidney injury network). Both criteria depend on the glomerular filtration rate (GFR), serum creatinine, and urine output(2,3). The study done by Joaniddis et al gives a clue for KDIGO to coming up with this definition and staging (Table 1). In this study, they directly compared the RIFLE and AKIN criteria. RIFIL criteria cannot able to detect 9% of cases that were distinguished by the AKIN criteria. Conversely, the AKIN criteria lost 26.9% of cases noticed by the RIFLE criteria(4).

Table 1 the KDIGO classification system

Creatinine	**Urine output**
Stage 1 Rise of ≥26 μmol/L within 48 h or 50–99% rise from baseline within 7 days	<0·5 mL/kg per h for more than 6 h
Stage 2 100–199% rise from baseline within 7 days	<0·5 mL/kg per h for more than 12 h
Stage 3 ≥200% rise from baseline within 7 days; or concentration ≥354 μmol/L, with either: rise of ≥26 μmol/L within 48 h or ≥50% rise from baseline within 7 days; or any requirement for renal replacement therapy	<0·3 mL/kg per h for 24 h or anuria for 12 h
KDIGO=Kidney Disease Improving Global Outcomes. *SI units rounded to the nearest integer.	

The RIFLE criteria classify AKI according to a relative increase in the SCr concentration, or decrease in GFR, or a decrease in urine output. Five stages of severity were defined (Table 2). Studies using the RIFLE criteria have shown a stepwise association with the stage of AKI and worse clinical outcomes such as increased mortality, longer intensive care unit stay, and reduced renal recovery (5,6). Even a transient decrease in renal function is associated with increased mortality (7).

Table 2 Risk, Injury, Failure, Loss of kidney function and End-stage kidney disease (RIFLE) classification

Class	GFR	UO
Risk	↑ SCr × 1.5 or ↓ GFR >25%	<0.5 mL/kg/h × 6 h
Injury	↑ SCr × 2 or ↓ GFR >50%	<0.5 mL/kg/h × 12 h
Failure	↑ SCr × 3 or ↓ GFR >75% or if baseline SCr ≥353.6 μmol/L(≥4 mg/dL) ↑ SCr>44.2 μmol/L(>0.5 mg/dL)	<0.3 mL/kg/h × 24 h or anuria × 12 h
Loss of kidney function	Complete loss of kidney function >4 weeks	
End-stage kidney disease	Complete loss of kidney function >3 months	

GFR, glomerular filtration rate; UO, urine output; SCr, serum creatinine

1.2. Statement of the Problem

Acute kidney injury (AKI) is a major public health problem, associated with high mortality, morbidity, decrease functional status in daily living, and progression to chronic kidney disease. It affects over 13 million people per year worldwide and results in 1.7 million deaths. Major differences exist in the prevalence and outcomes of AKI from the developed and developing world. Greater than 85% of the world-wide death of AKI occurred in low-income/middle-income countries(8,9).

In developed countries patients with Acute Kidney Injury are usually older and have various comorbid conditions whereas in poor countries they are younger and in good health(10,11).

Acute kidney injury (AKI) is a frequently encountered condition associated with numerous causes and pathophysiological processes leading to decreased kidney function. Full recovery of kidney function is uncommon, which leaves these patients at risk of long-term morbidity and death. As a result, it makes a significant burden for the society in terms of health resource use during the acute phase and the potential long-term consequences including the development of chronic kidney disease (CKD) and renal failure (12,13).

In different studies; sepsis, chronic liver disease, hypertension, diabetes mellitus, old age, and presence of a background chronic kidney disease, venous thromboembolism, and previous exposure of nephrotoxic drugs were seen as major risk factors to develop AKI. Acute Kidney Injury was accompanying with a prolonged hospital stay, increased mortality rate, and dialysis requirement(14,15).

In 2013, the International Society of Nephrology has called the nephrology and the broader health care community to work collaboratively to develop effective programs to stop the flow of preventable deaths due to untreated AKI in developing countries. The “0 by 25” initiative has been launched with a goal that no patient deaths due to untreated AKI by 2025 (16). Even though the initiative said that still there is a gap between the current prevalence of AKI Sub-Saharan Africa and the International Nephrologists workgroup initiative. A study done in Cameroon showed that the incidence was 22.3% of hospital admission(17). Also in Sudan, there was a 5.7% incidence of AKI in all hospitalized patients(14).

1.3. Significant of the study

Numerous studies have been performed concerning determining prevalence, risk factors, and outcomes of AKI in other countries, particularly in the developed world. However very few studies were carried out in Ethiopia; therefore, this study will estimate the prevalence, determine the outcome, and determine the association of AKI with potential risk factors in critically ill patients. The result of this study, together with those of similar studies will help to provides available information to SPHMMC and other health organizations, so that proper measures can be taken according to the results to improve the outcome of AKI in SPHMMC ICU proper intensive care and patient's satisfaction.

Also, it will help to recommend to the policymakers to design methods for best interventions and also will be used as baseline data for further researches**.** The main reason that elicits the investigators to undertake this study is increasing the incidence of acute kidney injury in ICU.

2. LITERATURE REVIEW

2.1. Epidemiology of Acute Kidney Injury

An international cross-sectional study performed in 97 intensive care units (ICU) on the prevalence of AKI in ICU patients using KDIGO criteria. They found that AKI occurred in greater than half (57.3%) of ICU patients. Increasing AKI severity was associated with increased hospital mortality, and AKI patients had worse renal function during hospital discharge. Adjusted risks for AKI and mortality were similar across the world (10).

World incidence of AKI: A meta-analysis done by P. Susantitaphong Globally 21.6% of adults and 33.7% of children encountered with AKI in the course of hospital admission by use of KDIGO definition. The AKI associated mortality rate decreased over time (18).In the intensive care unit (ICU) setting, the AKI incidence ranges from 3.2% to 78% (19).

AKI is the most common cause of organ dysfunction in the intensive care unit (ICU) patients. The incidence of AKI is increasing. In a study that was done with the use of Kidney Disease Improving Global Outcomes (KDIGO) of AKI definition and AKI diagnosed in up to 20% of patients admitted to the hospital settings and 31.7% of patients in critical care settings (18). In a study done at British tertiary care hospital ICU, AKI was the most frequent cause of organ dysfunction in intensive care units (ICUs) and the existence of even mild AKI is concomitant with more than 50% of mortality rate(20).

In a study done by B. Talabani were determined short-term (3 months) and long-term (3 years) outcomes Mortality at 3 months was 16.5% and was related to the severity of AKI. Over the 3 years of follow-up, 71% of patients with Community-Acquired Acute Kidney Injury (CA-AKI) developed progressive CKD which was more likely following partial or no recovery of renal function and in the context of pre-existing CKD. They conclude that Community-acquired AKI carries a significant risk of progressive kidney disease and long-term patient mortality(21).

A study at Imam Khomeini Hospital in Ardebil, Iran, which is a retrospective cohort done on 900 critical patients admitted to the ICU within a 1-year duration concludes that AKI is related to a greater mortality rate. The overall incidence rate of AKI was 37%. The mortality rate was 58.3% for AKI patients, and 13.4% for non-AKI patients. Patients in RIFLE-R (Risk) had a mortality rate of 37.8% compared with 48.8% for those in RIFLE-I (Injury) and 76.5% for RIFLE-F (Failure) patients (22).

2.2. Risk Factors of Acute Kidney Injury

AKI can cause end-stage renal disease (ESRD) directly, and raise the occurrence risk of chronic kidney disease (CKD) and deteriorating underlying CKD.CKD also an important risk factor for the occurrence of AKI. This two-way relationship among AKI and CKD is confirmed with experimental finding which supports the clinical observations. Also, severity, duration, and frequency of AKI appear to be important predictors of poor patient outcomes (23).

Increasing in the incidence of AKI is because of several factors, including patient characteristics (old age, black African race, proteinuria, diabetes mellitus), complications (hypertension, fluid overload, cardiovascular diseases, pre-existing chronic kidney disease), and therapeutic interventions (major surgery, percutaneous coronary intervention, chemotherapy) (18).

A study was done by Mohammadi K et al. in Iran, conclude that; age more than 60 years, increased length of hospital stay, systolic blood pressure less than 100 mm Hg, a requirement of mechanical ventilation, comorbidities, anemia, thrombocytopenia, increased serum bilirubin and liver enzymes, and serum sodium abnormalities were important risk factors to the development of AKI (22).

A study was done at Alexandria Teaching Hospitals, in Egypt, to evaluate the risk & prognosis of AKI in patients (532) admitted to intensive care units. They concluded that; advanced age, sepsis, a preceding requirement of diuretics & less educated status were related to AKI at ICU admission. The risk of AKI is great in critically ill patients related to unpleasant outcomes. And a total mortality rate of 22.5% (24).

A cross-sectional study done by Phillips, L et al in 3 teaching hospitals of Ethiopia, to assess the AKI risk factor recognition; they were proven that the existence of significant risk factors for the development of AKI frequently goes unknown due to lack of complete evaluation of patients or records. For that reason, this untimely recognizes of AKI risk factor most likely increases patients mortality(25).

2.3. The outcome of Acute Kidney Injury

Five years of prospective observational study that was done in patients admitted at nine ICUs of developed countries and five ICUs in developing countries. Results show that there was hospital mortality was 22.0%, and 13.3% of survivors were required Renal Replacement Therapy (RRT) at discharge. From a total of 6647 critical patients, 19.2% of them developed AKI and worse outcomes in developing countries seen. Patients were less frequently treated with dialysis 15.5% from developed countries whereas 30.2% in developing countries (26).

A multi-cantered, observational-prospective, study in Finnish Intensive Care Units, to evaluate the occurrence, risk factors, and outcome of acute kidney injury (AKI). They discovered that from 2,901 patients the occurrence of AKI was 39.3 % and of the 10.2 % got RRT. Hospital mortality for AKI in critical patients was 25.6 % and the three-month mortality rate for AKI patients was 33.7 %. In this study, the occurrence of AKI related Hospital mortality rates in the critical patient was lesser than in other studies (27).

A study done on prevalence and outcome of AKI in the Indian population among 528 patients, with AKI, Community Acquired-AKI (CA-AKI) accounted for 35% and Hospital Acquired-AKI (HA-AKI) accounted for 65% Sepsis and CKD was seen to be the leading aetiologies. AKI with Diabetes Mellitus (DM), sepsis, or Urinary Tract Infection (UTI) might worsen the prognosis. Fluid replacement shows to improve the prognosis. 64% of them recovered fully however 16% of patients were died (28).

One of the major results of AKI is related to non- recovery of kidney function. A study was done by Kellum, J et al, to evaluate the recovery of the critically ill patient after AKI; in this study, a recovery patterns investigation after AKI disclosed that 41.2% of patients with AKI did not recover their renal function before hospital discharge; on the other hand, full recovery seen in 36.3% of critically ill patients. In non-recovered patients, one-year age-adjusted mortality was approximately 60%, which is more than three times that in patients who did recover fully (29).

Prominent differences in Renal Replacement Therapy (RRT) accessibility, availability, and procedures are apparent when comparing developed and developing countries. Access to RRT is strongly dependent on socio-economic development and health- system organization. The availability of RRT can also vary widely within a country's urban and rural regions. In general, RRT is unavailable to patients in developing country except for exclusive population (30)

A retrospective cohort study was done by Osman M, et al. ; to evaluate the cause and outcome of AKI patients who were admitted at Soba University Hospital of Sudan. They conclude that 5.7% of the study population (6769) had AKI and from them, 35.7% of patients were fully recovered; however 31.2% of them were died(14).

In Ethiopia, the prevalence and outcome of AKI are not well-known. A study that was done at Saint Paul's Hospital Millennium Medical College (SPHMMC) dialysis center to describe the clinical profile and outcome of adult Acute Kidney Injury (AKI) patients treated with intermittent hemodialysis at the of SPHMMC. The leading causes of AKI were hypovolemia (22.5 %), acute glomerulonephritis (AGN) (21.9 %), and pregnancy-related causes (18.5 %). From the list of etiology, AGN and sepsis are the leading reasons for AKI related deaths which accounted for more than half (54.5 %). The main reasons for dialysis requiring AKI were Infections, AGN, obstetric causes, and nephrotoxins. From the finding; 53 % were discharged

improved, 29.1 % died, with the remaining, 10.6 % progressed to end-stage renal disease, and 20.7 days was the average length of hospital stay (31).

3. OBJECTIVES OF THE STUDY:

3.1. General objective

To assess the prevalence, risk factors, and outcome of acute kidney injury in patients admitted in the intensive care unit of SPHMMC from January 2017 to December 2019.

3.2. Specific objective

1. To identify the prevalence of acute kidney injury in patients admitted in the intensive care unit of SPHMMC during the study period.
2. To determine the clinical outcomes of acute kidney injury in patients admitted in the intensive care unit of SPHMMC during the study period.
3. To identify risk factors of acute kidney injury in patients admitted in the intensive care unit of SPHMMC during the study period.

Research question

What are the prevalence, risk factors, and outcome of Acute Kidney Injury in critically ill patients who were admitted to SPHMMC ICU?

4. METHODS AND MATERIALS

4.1. Study area

The study was conducted at SPHMMC, which is found in Addis Ababa and one of the biggest tertiary hospitals in Addis Ababa serving as a referral center for patients from Addis Ababa and most of the western regions of Ethiopia. In addition to being a tertiary referral hospital that provides medical, surgical and obstetrical services on an elective and emergency basis; SPHMMC was specifically selected for this study as it comprises a highly specialized nephrology unit that delivers hemodialysis service for acute kidney injury and kidney transplantation service for chronic kidney disease patients.

It was built by Emperor Haile Selassie I in 1969 with the help of the German Evangelical Church. It is the training center for undergraduate and a wide spectrum of postgraduate. The hospital has 700 beds it sees an average of 1200 emergency and outpatient clients daily. It has a catchment population of more than 5 million. The college has more than 2800 clinical, academic, and administrative and support staff. The adult ICU department has 10 beds, 50 nurses 10 residents, and 1 Intensivist.

4.2. Study period

The study was conducted from February 2020 to March 2020.

4.3. Study design

Institution-based retrospective quantitative cross-sectional study.

4.4. Source Population

All patients admitted at SPMMHC adult ICU from January 2017 to December 2019 were the source of the population.

4.5. Study Population

All patients who had AKI and admitted at SPMMHC adult ICU January 2017 to December 2019

4.6. **Sample size determination** and sample technique

4.6.1. Sample Size

The sample was comprised of all AKI patients admitted at SPHMMC adult ICU during the study period and who meet inclusion criteria.

4.6.2. Sampling methods

A convenience sampling method was used to select the sample.

4.7. Study Variables

4.7.1. Dependent variable

- ICU length of stay,
- Mortality
- Degree of renal recovery
- Initiation of Renal Replacement Therapy
- Development to CKD

4.7.2. Independent variable

- Age
- Sex
- Co-morbidities
- Severity of AKI
- Risk factors

4.8. Inclusion and Exclusion Criteria

4.8.1. Inclusion criteria:

- The patients were included only if they are above 14 years of age and were admitted to the ICU with the diagnosis of AKI or developed AKI during the study period of hospitalization.
- If one patient admitted more than once to the ICU during the study period, the last admission was selected.

4.8.2. Exclusion criteria:

- Patients with chronic kidney disease and undergoing long term renal replacement therapy (RRT) were excluded from the study.
- Six records with incomplete medical data were excluded from the study.

4.9. Data collection tools and procedures

A checklist was developed based on study objectives and available literature for the data collection tool. The data was collected by trained critical nurses through a structured checklist. Before data collection, permission from hospital authority was obtained and the study subjects were selected according to selection criteria. Then data were taken out from the patients' medical records.

The structured checklist is consists of three parts.

Part -1 consist of demographic data

Part -2 consists of data related to risk factors of AKI and other co-morbidities

Part -3 consists of data regarding outcomes of AKI

4.10. Data quality assurance

The data collection instrument was a checklist. The quality of data was assured through wise and careful design of the checklist and close supervision of the data collecting procedures.

Proper categorization and coding of the data as part of the data quality control. The supervisor & principal investigator was checked closely the data for its accuracy consistency and completeness each checklist daily basis. Anything unclear, missing, and ambiguous was corrected on the next day. Also, data cleaning and checking were done before analysis.

4.11. Data management and analysis procedures

Data entry and analysis were conduct by using EpiData version 4.2 and the Statistical Package for the Social Sciences (SPSS) software version 25.0 respectively. Normal distribution was represented by the mean and standard deviation (SD), whereas skewed distribution was expressed by the median and interquartile range (IQR). Descriptive analysis was used to determine the basic features which provided simple summaries of AKI patients in SPHMMC ICU. The logistic regression model was used, to identify the association of risk factors with the outcomes (CKD and death). The summarized information was presented in the form of tables and charts. To assess the level of association and statistical significance, the adjusted Odds ratio with 95% confidence interval was computed. P-value <0.05 was considered significant.

4.12. Ethical clearance

The study was carried out after getting permission and approval from the ethical clearance committee of Addis Ababa University College of Health Science Medical Faculty through the Department of Emergency medicine. Then, data was collected after getting permission to access the patient’s folder from the Institutional Review Board (IRB) Committee of SPHMMC. The

patient's names were omitted from the checklist. Confidentiality of all the documents reviewed was highly secured throughout the data collection of the research process.

4.13. Dissemination of the Result

The findings of the study would be submitted to the Department of Emergency Medicine Addis Ababa University, to SPHMMC Adult ICU and for SPHMMC institutional review board (IRB). Subsequently, attempts will be made to present it on scientific conferences and publish it on scientific journals.

4.14. Operational Definitions& Terms

Prevalence: - percentage or number of events (AKI) in a given population (individual who have been critically ill) and developed AKI at the designated time.
Risk factors- are conditions that increase the risk of developing Acute Kidney Injury.
The severity of AKI: based on KDIGO criteria (Table 1) (32)
Outcomes are defined as follows
Recovery; each of them is defined according to the Acute Dialysis Quality Initiative (ADQI) definition as below;
Full recovery of renal function as defined by the return of creatinine to within 50% of baseline serum creatinine.
Partial recovery of renal function as defined by a failure to return to within 50% of baseline serum creatinine.
Non-recovery as defined by no change in serum creatinine since admission.
Chronic Kidney Disease (CKD) is defined as any patient with either a known history of kidney disease for at least 3 months or with laboratory finding of normocytic normochromic anemia, hypocalcemia, and hyperphosphatemia or proteinuria or with a renal ultrasound showing small, shrunken, hyperechoic kidneys.

5. Result

5.1 Socio-demographic characteristics of the respondents

A total of 122 respondent charts were taken who were admitted to SPHMMC ICU from January 2017 to December 2019. Out of the total 122, ICU admitted AKI patients six of them were excluded because of the second admission, and eight charts were missed, 108 of them were included in the study giving a response rate of 93.1%. The mean age of respondents was 34.3±15.4 with a minimum age in the year of 15 to a maximum of 82 (Figure 1). The age category below was taken from different kinds of literature. Regarding the sex of participants more than two-thirds (66.7%) were females, and around one-third (33.3%) of patients were male. The marital status of the study participants was greater than two-thirds (69.4%) was married, while 25(23.1%) of them were single. The predominant part of participants' residence area was urban which accounts for 56(51.9%) and most of them were from Addis Ababa and Oromia (Table 3).

Table 3*: Socio-demographic characteristics of AKI patients admitted in the intensive care unit of Saint Paul's Hospital Millennium Medical College from January 2017 to December 2019 (n=108)*

Variables		**Frequency**	**Percent**
Sex	Male	36	33.3
	Female	72	66.7
	Total	108	100.0
Age in years	15-25	38	35.2
	26-35	38	35.2
	36-45	12	11.1
	46-55	5	4.6
	56-65	9	8.3
	>65	6	5.6
	Total	108	100.0
Religion	Orthodox	61	56.5
	Protestant	24	22.2

	Muslim	22	20.4
	Others	1	0.9
	Total	108	100.0
Marital status	Married	75	69.4
	Single	25	23.1
	Divorced	3	2.8
	Widowed	2	1.9
	Unknown	3	2.8
	Total	108	100.0
Residence area	Urban	56	51.9
	Rural	52	48.1
	Total	108	100.0

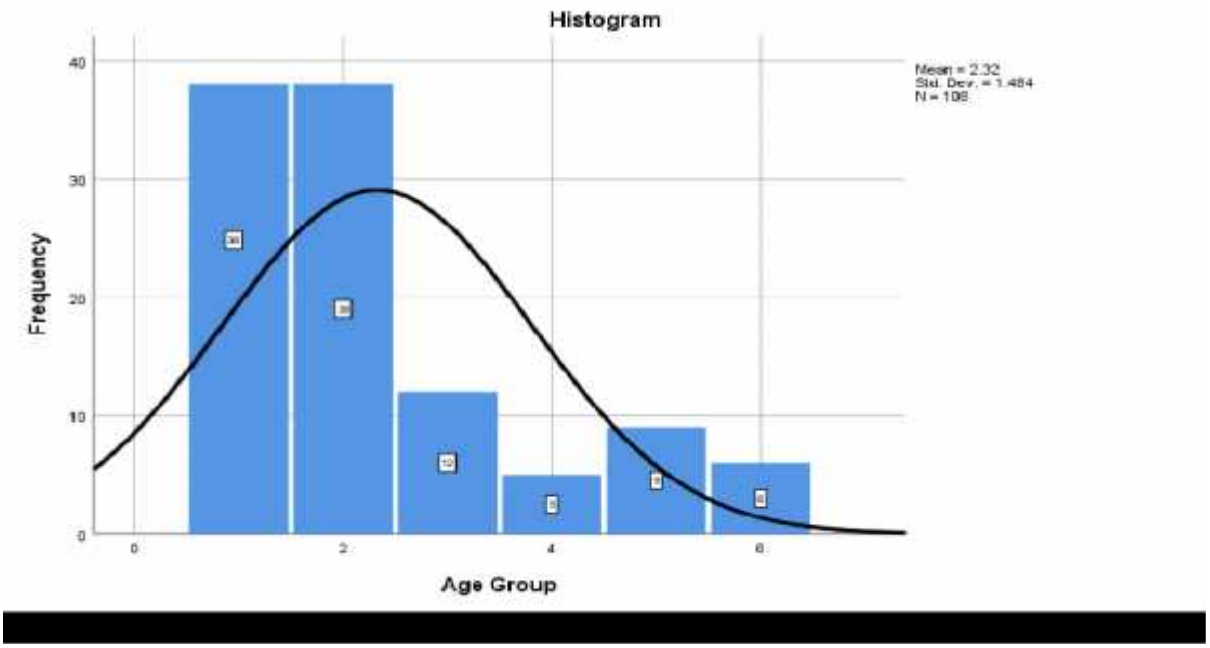

Figure 2 Age distribution of critically ill AKI patients admitted in the intensive care unit of Saint Paul's Hospital Millennium Medical College from January 2017 to December 2019

The normal distribution of age deviate to the left side, most of our respondent was age group between 15 and 35 ages in a year it accounts for 70% of all respondents. In contrast, the age greater than 65 was account for only 6.5 %.

5.2. Prevalence and Risk Factors of Acute Kidney Injury in adult patients admitted to ICU of SPHMMC

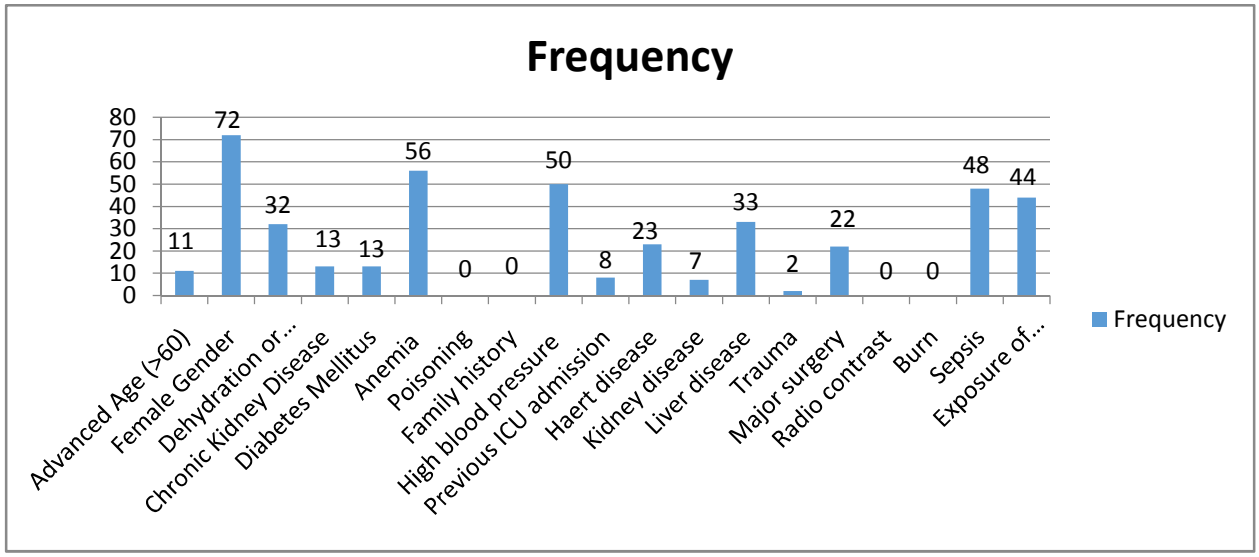

Figure 3 Risk factor characteristics of AKI patients admitted in the intensive care unit of Saint Paul's Hospital Millennium Medical College from January 2017 to December 2019

The prevalence of AKI was 16.1% from a total of 719 critically ill patients of three years of adult ICU admission. From them who developed AKI from January 2017 to December 2019 admitted at SPHMMC adult ICU, being female and Anemia was the leading risk factors to develop AKI, 72 (66.7%) and 56 (51.9%) respectively. The second leading risk factors are high blood pressure 50(46.3), sepsis 48 (44.4%), and exposure of nephrotoxic drug 44 (40.7%). From nephrotoxic drugs, vancomycin 25.9%, and proton pump inhibitor (24.1%) are major exposure drugs, figure (4). The other risk factors were liver disease 30.6%, dehydration or Volume depletion 29.6%, and major surgery 20.4 %.

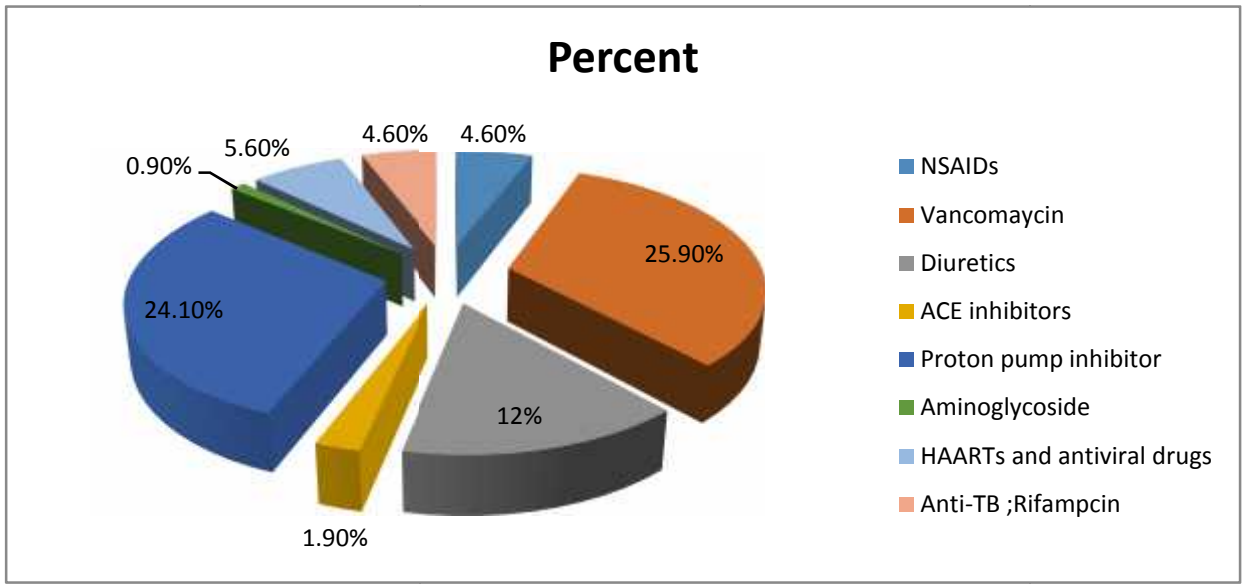

Figure 4 Exposures of nephrotoxic drug characteristics of patient's Risk factor characteristics of AKI patients admitted in the intensive care unit of Saint Paul's Hospital Millennium Medical College from January 2017 to December 2019

Nephrotoxic drug exposure has a significant association for AKI critically ill patients to develop Chronic Kidney Disease. From those common nephrotoxic drugs, vancomycin and proton pump inhibitors were mostly exposed to drugs. Then, the least exposed common nephrotoxic drugs in the study area were aminoglycoside and ACE inhibitors.

5.3. Outcome AKI patients in critically ill patients

Most 81 (75%) AKI critically ill patients were initiated renal replacement therapy. The cause of AKI was 69 (63.9%) pre-renal, 37 (34.3%) renal and the rest 2 (1.9%) were post-renal. From the total three years ICU critically ill AKI patients 25(23.1%) were stage one, 17(15.7%) were stage two and 66 (61.1%) were stage three. When we see the degree of renal recovery of AKI patients most of them had no renal recovery. There was a significant rate (48.1%) of mortality in ICU admitted AKI patients. Regarding the length of ICU stay the mean day was 10.7± 11.2 SD and a minimum of one and maximum was fifty-two days of stay.

5.4. Bivariate and multivariable analysis for associated risk factors of AKI patient with diagnosed as developed CKD

A patient with exposure to the nephrotoxic drug were five times more likely to develop CKD than a patient who was no exposure to the nephrotoxic drug (AOR=4.528, 95% CI 1.086-17.879), P=0.0.38).

Others variable, dehydration or volume depletion (AOR=3.129, 95% CI 0.361-27.142), P=0.149), high blood pressure (AOR=0.392, 95% CI 0.97-1.583), P=0.232), liver disease (AOR=5.009, 95% CI 0.575-43.678), P=0.137) and previous ICU admission (AOR=0.267, 95% CI 0.039-1.824), P=0.189) had a significant association with diagnosed as developed CKD in the bivariate analysis but they do not have any association during multivariable analysis.

Table 4: Bivariate and multivariable analysis for associated risk factors of AKI patient with diagnosed as developed CKD admitted at intensive care unit of Saint Paul's Hospital Millennium Medical College in Addis Ababa, Ethiopia, from January 2017 to December 2019

Variables	Categories	AKI Yes	AKI No	COR with 95%CI	P-value
Advanced Age (>60)	Yes	2	9	2.173	0.365
	No	9	88		
Being Female	Yes	6	66	0.564	0.373
	No	5	31		
Dehydration or Volume depletion	Yes	1	31	0.213	0.149*
	No	10	66		
Chronic Kidney Disease	Yes	2	11	1.737	0.513
	No	9	86		
Diabetes Mellitus	Yes	2	11	1.737	0.513
	No	9	86		
Anemia	Yes	4	52	0.495	0.285
	No	7	45		

Poisoning	Yes	-	-		
	No	11	97		
Family history	Yes	-	-		
	No	11	97		
High blood pressure	Yes	7	43	2.198	0.232*
	No	4	54		
Previous ICU admission	Yes	2	6	3.370	0.171*
	No	9	91		
Heart disease	Yes	2	21	0.804	0.790
	No	9	76		
Kidney disease	Yes	0	7	0.000	0.999
	No	11	90		
Liver disease	Yes	1	32	0.203	0.137*
	No	10	65		
Trauma	Yes	0	2	0.000	0.999
	No	11	95		
Major surgery	Yes	3	19	1.539	0.551
	No	8	78		
Radio contrast	Yes	-	-		
	No	11	97		
Burn	Yes	-	-		
	No	11	97		
Sepsis	Yes	6	42	1.571	0.480
	No	5	55		

Exposure of nephrotoxic drug	Yes	8	36	4.519	0.033*
	No	3	31		

NB: *variables having a (P <0.25) in bivariable analysis.

Table 5: Multivariable analysis for associated risk factors of AKI patient with diagnosed as developed CKD admitted at intensive care unit of Saint Paul's Hospital Millennium Medical College in Addis Ababa, Ethiopia, from January 2017 to December 2019

Variables	Categories	AKI yes	AKI no	COR with 95%CI	AOR with 95% CI	P-value
Dehydration or Volume depletion	Yes	1	31	0.213	3.129(0.361-27.142)	0.149
	No	10	66			
High blood pressure	Yes	7	43	2.198	0.392(0.97-1.583)	0.232
	No	4	54			
Previous ICU admission	Yes	2	6	3.370	0.267(0.039-1.824)	0.189
	No	9	91			
Liver disease	Yes	1	32	0.203	5.009(0.575-43.678)	0.137
	No	10	65			
Exposure of nephrotoxic drug	Yes	8	36	4.519	4.528(1.086-17.879)	0.038**
	No	3	31			

NB: **variables having a (P <0.05) in multivariable analysis.

5.5. Bivariate and multivariable analysis for associated risk factors of AKI patient with the initiation of RRT and Mortality

There were no risk factors which was significantly associated with the initiation of renal replacement therapy. But when we see risk factors associated with mortality, sepsis was two times more likely associated to kill the patients than those who had no sepsis (AOR=2.267, 95%CI (1.028-5)P=0.043). Risk factors other than sepsis had no significant relationship with mortality during multivariable analysis but they do have significant association during bivariate analysis, like anemia, high blood pressure, volume depletion or dehydration, and exposure of the nephrotoxic drug. the rest risk factors were not had association during both analyses.

Table 6: Bivariate and multivariable analysis for associated risk factors of AKI patient with mortality admitted at intensive care unit of Saint Paul's Hospital Millennium Medical College in Addis Ababa, Ethiopia, from January 2017 to December 2019

Variables	Categories	Mortality		COR with 95%CI	P-value
		Died	Alive		
Advanced Age (>60)	Yes	7	4	2.022	0.285
	No	45	52		
Being Female	Yes	32	40	0.640	0.277
	No	20	16		
Dehydration or Volume depletion	Yes	12	20	0.540	0.153*
	No	40	36		
Chronic Kidney Disease	Yes	7	6	1.296	0.662
	No	45	50		
Diabetes Mellitus	Yes	8	5	1.855	0.308
	No	44	51		
Anemia	Yes	23	33	0.553	0.128*
	No	29	23		
High blood pressure	Yes	21	29	0.631	0.236*

	No	31	27		
Previous ICU admission	Yes	3	5	0.624	0.534
	No	49	51		
Heart disease	Yes	13	10	.367	1.533
	No	39	46		
Kidney disease	Yes	3	4	0.772	0.796
	No	49	52		
Liver disease	Yes	15	18	0.856	0.710
	No	37	38		
Trauma	Yes	1	1	1.078	0.958
	No	51	55		
Major surgery	Yes	9	13	0.448	0.692
	No	43	43		
Sepsis	Yes	28	20	2.100	0.060*
	No	24	36		
Exposure of nephrotoxic drug	Yes	25	19	1.803	0.136*
	No	27	37		

NB: *variables having a (P <0.25) in bivariable analysis.

Table 7Table 4: Multivariable analysis for associated risk factors of AKI patient with mortality admitted at intensive care unit of Saint Paul's Hospital Millennium Medical College in Addis Ababa, Ethiopia, from January 2017 to December 2019

Variables	Categories	Mortality		COR with 95%CI	AOR with 95% CI	P-value
		Died	Alive			

Dehydration or Volume depletion	Yes	7	4	0.540	1.539(0.595-3.978)	0.374
	No	45	52			
Anemia	Yes	23	33	0.553	1.724(0.759-3.917)	0.194
	No	29	23			
High blood pressure	Yes	21	29	0.631	1.431 (0.611-3.351)	0.409
	No	31	27			
Sepsis	Yes	28	20	2.100	2.267 (1.028-5)	0.043**
	No	24	36			
Exposure of nephrothoxic drug	Yes	25	19	1.803	0.674(0.298-1.525)	0.344
	No	27	37			

NB: **variables having a (P <0.05) in multivariable analysis.

6. Discussion

Regarding of AKI prevalence, risk factors, and outcomes of critically ill patients, its occurrences, are found throughout the globe. In order to minimize AKI prevalence and improve the outcomes of each patient after sustaining the incident, a holistic approach is essential. Therefore; this study aimed to assess the prevalence, risk factor, and clinical outcome of AKI in critically ill patients.

In this study, the prevalence of AKI in critically ill patients 16.1% from the three-year total intensive care unit of SPHMMC admission was nearly similar to a worldwide meta-analysis done by P. Susantitaphong (18) which was 21.6%. This study was supported by the study conducted at Imam Khomeini Hospital in Ardebil, Iran, the overall incidence rate of AKI in the critical patient was 37%(22).

Concerning the degree of renal recovery in our study, most of our patients had no renal recovery 48.1% whereas 36.1% had fully recovered, in line with, a retrospective study was done by Osman M, et al. ; at Soba University Hospital of Sudan revealed that 35.7% of patients were fully recovered; (14).

In this study, a higher incidence of risk factors such as hypertension, heart disease, pre-existing chronic kidney disease, major surgery, and old age was found and it was supported by the study conducted globally in 2013(17).

In this current study, sepsis was two times more likely associated to kill the patients than those who had no sepsis (AOR=2.267, 95%CI (1.028-5) P=0.043). In agreement with this, a study that was done at Saint Paul's Hospital Millennium Medical College (SPHMMC) (31) revealed that sepsis was the leading reason for AKI related death. This may be related to the severity of sepsis by itself leads to a higher mortality rate.

This study showed that a significant number of mortality (48 %) was found. Similarly, a study conducted at Imam Khomeini Hospital in Ardebil, Iran (22) was the mortality rate was 58.3%, whereas a study done by Ibrahim J at SPHMMC (31) was 29.1 % death rate. A study was done by Osman M, et al. ; in Sudan(14) also showed a 31.2% mortality rate.

In this study, the average length of ICU stay was 11 days. But the longest average length of hospital stay 20.7 days was seen in a study done by Ibrahim J at SPHMMC (31). This discrepancy might be due to because in their study they were included the total number of hospital stay, while this study only includes the length of stay at the intensive care unit.

For our study; 75% of critically ill AKI patients initiated renal replacement therapy. This was inconsistent with the observational-prospective, study in Finnish Intensive Care Units, were discovered that 10.2 % got renal replacement therapy. The probable reason for this finding might be SPHMMC has a dialysis center from the few governmental dialysis centers in the country in Ethiopia could be the reason for the higher prevalence of initiation of RRT.

7. Strength and Limitation of the study

7.1.Strength of the study

This study gives information on prevalence, risk factors, and outcome of AKI in a critically ill patient in SPHMMC ICU and it generates valid information for the institution to establish or strengthen the health service.

This finding is an original study in this particular study area that paves away and expected to generate valid baseline information for the one who needs to conduct another assessment. So that, the finding of this study, will contribute to the epidemiology of AKI in critically ill patients in the country by generating valid information in its part, to help planning and to generate information for the respective institution, in specific.

7.2.Limitation of the study

- Using secondary data have incomplete data
- As the study design is cross-sectional it might not determine the causal relationship between the dependent and independent variable in the analysis
- Since this study was limited by a single centered facility-based study it make difficult to generalize the result

8. Conclusion

AKI is the most common cause of critically ill patient's morbidity and it was prevalent in my study area. This study has identified a considerable burden of AKI ICU because it has a high mortality rate, and need to increase the quality of care and treatment in ICU.

I too observed the higher prevalence of AKI in the critically ill patients with younger age groups and female predominance.

The mortality rate of AKI in critically ill patients was very high

Sepsis was the associated factors that increase mortality rate on AKI critically ill patients.

9. Recommendation

Based on the findings, the following recommendations are forwarded:

- **For SPHMMC:** even though SPHMMC has dialysis center the mortality rate of AKI was very high, therefore they should focus on preventive measure and give much attention to AKI patients
- **For Government policymakers and MOH:** Policymakers and the ministry of health need to consider and plan for the implications of increased numbers of AKI and should work on the prevention of these more comprehensively.
- **For health facility:** All health facilities to give health education and health promotion to improve, the awareness about preventable risk factors of AKI
- **Professional associations:** Professional associations should give a different workshop for health professionals and to work on awareness creation on the prevention of AKI by using different communication media.
- **For Researcher:** This study was institutionally based, so researchers should conduct further community based and multi-centered study on AKI prevalence, risk factors and outcomes should be considered

10. References

1. Duga AL. Acute kidney Injury : Prevalence , Diagnosis , Causes and treatment Article by AlermayehuLelisaDuga Pathophysiology of AKI Classifications of AKI. 2016;3(2):1–15.
2. Hoste EAJ, Schurgers M. Epidemiology of acute kidney injury: How big is the problem? Crit Care Med. 2008;36(SUPPL. 4).
3. Kellum JA, Lameire N, Aspelin P, Barsoum RS, Burdmann EA, Goldstein SL, et al. Kidney disease: Improving global outcomes (KDIGO) acute kidney injury work group. KDIGO clinical practice guideline for acute kidney injury. Kidney Int Suppl. 2012;2(1):1–138.
4. Joannidis M, Metnitz B, Bauer P, Schusterschitz N, Moreno R, Druml W, et al. Acute kidney injury in critically ill patients classified by AKIN versus RIFLE using the SAPS 3 database. Intensive Care Med. 2009;
5. Kuitunen A, Vento A, Suojaranta-Ylinen R, Pettilä V. Acute renal failure after cardiac surgery: Evaluation of the RIFLE classification. Ann Thorac Surg. 2006;
6. Hoste EAJ, Clermont G, Kersten A, Venkataraman R, Angus DC, De Bacquer D, et al. RIFLE criteria for acute kidney injury are associated with hospital mortality in critically ill patients: A cohort analysis. Crit Care. 2006;
7. Uchino S, Bellomo R, Bagshaw SM, Goldsmith D. Transient azotaemia is associated with a high risk of death in hospitalized patients. Nephrol Dial Transplant. 2010;
8. Ponce D, Balbi A. Acute kidney injury: Risk factors and management challenges in developing countries. Int J NephrolRenovasc Dis. 2016;9:193–200.
9. Singbartl K, Kellum JA. AKI in the ICU: Definition, epidemiology, risk stratification, and outcomes. Kidney Int. 2012;
10. Hoste EAJ, Bagshaw SM, Bellomo R, Cely CM, Colman R, Cruz DN, et al. Epidemiology of acute kidney injury in critically ill patients: the multinational AKI-EPI study. Intensive Care Med. 2015;
11. Raimann JG, Riella MC, Levin NW. International Society of Nephrology's 0by25 initiative (zero preventable deaths from acute kidney injury by 2025): Focus on diagnosis of acute kidney injury in low-income countries. Clin Kidney J. 2018;
12. Chalkias A, Xanthos T. Acute kidney injury. Lancet [Internet]. 2012;380(9857):1904. Available from: http://dx.doi.org/10.1016/S0140-6736(12)62104-7
13. Chawla LS, Eggers PW, Star RA, Kimmel PL. Acute kidney injury and chronic kidney disease as interconnected syndromes. N Engl J Med. 2014;371(1):58–66.
14. Osman M, Shigidi M, Ahmed H, Abdelrahman I, Karrar W, Elhassan E, et al. Pattern and outcome of acute kidney injury among sudanese adults admitted to a tertiary level hospital: A retrospective cohort study. Pan Afr Med J. 2017;28:1–7.
15. Cely JE, Mendoza EJ, Olivares CR, Sepúlveda OJ, Acosta JS, Barón RA, et al. Incidence and Risk Factors for Early Acute Kidney Injury in Nonsurgical Patients: A Cohort Study. Int J Nephrol. 2017;2017.

16. Mehta RL, Cerdá J, Burdmann EA, Tonelli M, García-García G, Jha V, et al. International Society of Nephrology's 0by25 initiative for acute kidney injury (zero preventable deaths by 2025): A human rights case for nephrology. The Lancet. 2015.
17. Halle MPE, Chipekam NM, Beyiha G, Fouda H, Coulibaly A, Hentchoya R, et al. Incidence, characteristics and prognosis of acute kidney injury in Cameroon: a prospective study at the Douala General Hospital. Ren Fail [Internet]. 2018;40(1):30–7. Available from: https://doi.org/10.1080/0886022X.2017.1419970
18. Susantitaphong P, Cruz DN, Cerda J, Abulfaraj M, Alqahtani F, Koulouridis I, et al. World incidence of AKI: A meta-analysis. Clin J Am SocNephrol. 2013;8(9):1482–93.
19. Case J, Khan S, Khalid R, Khan A. Epidemiology of acute kidney injury in the intensive care unit. Critical Care Research and Practice. 2013.
20. Linder A, Fjell C, Levin A, Walley KR, Russell JA, Boyd JH. Small acute increases in serum creatinine are associated with decreased long-term survival in the critically ill. Am J RespirCrit Care Med. 2014;189(9):1075–81.
21. Talabani B, Zouwail S, Pyart RD, Meran S, Riley SG, Phillips AO. Epidemiology and outcome of community-acquired acute kidney injury. Nephrology. 2014;
22. MohammadiKebar S, Hosseini Nia S, Maleki N, Sharghi A, Sheshgelani A. The incidence rate, risk factors and clinical outcome of acute kidney injury in critical patients. Iran J Public Health. 2018;47(11):1717–24.
23. Chawla LS, Kimmel PL. Acute kidney injury and chronic kidney disease: an integrated clinical syndrome. Kidney Int [Internet]. 2012 Sep;82(5):516–24. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0085253815555993
24. AbdElhafeez S, Tripepi G, Quinn R, Naga Y, Abdelmonem S, Abdelhady M, et al. Risk, predictors, and outcomes of acute kidney injury in patients admitted to intensive care Units in Egypt. Sci Rep [Internet]. 2017;7(1):1–8. Available from: http://dx.doi.org/10.1038/s41598-017-17264-7
25. Phillips L, Allen N, Phillips B, Abera A, Diro E, Riley S, et al. Acute kidney injury risk factor recognition in three teaching hospitals in Ethiopia. South African Med J. 2013;103(6):413–8.
26. Bouchard J, Acharya A, Cerda J, Maccariello ER, Madarasu RC, Tolwani AJ, et al. A prospective international multicenter study of AKI in the intensive care unit. Clin J Am SocNephrol. 2015;10(8):1324–31.
27. Nisula S, Kaukonen KM, Vaara ST, Korhonen AM, Poukkanen M, Karlsson S, et al. Incidence, risk factors and 90-day mortality of patients with acute kidney injury in Finnish intensive care units: The FINNAKI study. Intensive Care Med. 2013;
28. Mohammed ZA, Suresh AA, Kumar P, Attur RP. Acute kidney injury: Prevalence and outcomes in southern Indian population. J Clin Diagnostic Res. 2018;12(5):LC05-LC10.
29. Kellum JA, Sileanu FE, Bihorac A, Hoste EAJ, Chawla LS. Recovery after acute kidney injury. Am J RespirCrit Care Med. 2017;
30. Ponce D, Berbel MN, de Goes CR, Almeida CTP, Balbi AL. High-volume peritoneal

dialysis in acute kidney injury: Indications and limitations. Clin J Am SocNephrol. 2012;7(6):887–94.

31. Ibrahim A, Ahmed MM, Kedir S, Bekele D. Clinical profile and outcome of patients with acute kidney injury requiring dialysis - An experience from a haemodialysis unit in a developing country. BMC Nephrol [Internet]. 2016;17(1):1–5. Available from: http://dx.doi.org/10.1186/s12882-016-0313-8
32. Kellum J a, Lameire N, Aspelin P, Barsoum RS, Burdmann E a, Goldstein SL et al. KDIGO Clinical Practice Guideline for Acute Kidney Injury. Kidney Int Suppl. KDIGO ClinPractGuidel Acute Kidney Inj. 2012;

Annex

Data collection checklist

Table 8 Part -1 Socio-Demographic data of AKI patients admitted in ICU

Code no				
Identification number				
Variables			If yes(√)	Remarks
1	Sex	Male		
		Female		
2	Age	15-24		
		25-34		
		35-44		
		45-54		
		55-64		
		Above 65		
3	Region	Addis Ababa		
		Dire Dawa		
		Tigray Region		
		Oromia Region		
		Amhara Region		
		Afar Region		
		Benishangul Region		
		Gambela Region		
		Harari Region		
		Southern Nations, Nationalities, & peoples Region		
		Somali Region		
4	Religion	Orthodox Christian		
		Protestant Christian		
		Muslim		
		Others		
5	Address	Urban		
		Rural		
6	Marital status	Married		
		Single		
		Divorce		
		Widowed		

		Unknown		

Table 9 Part-2 Risk Factors of Acute Kidney Injury

	Risk factors	If yes(√)	Remarks
1	Advanced age over 60		
2	Female gender		
3	Dehydration or volume depletion		
4	CKD		
5	Diabetes mellitus		
6	Anemia		
7	Poisoning		
8	Family history		
9	High blood pressure		
10	Previous ICU admission		
11	Heart failure		
12	Kidney disease		
13	Liver disease		
14	Trauma		
15	major surgery		
16	Nephrotoxic drug……..		
17	Radio contrast		
18	Burn		
19	Sepsis		

Table 10 Part -3 Outcomes of Acute Kidney Injury

		If yes(√)	If no(X)	Remarks
ICU length of stay in days				
Mortality	Died			
	Alive			
Diagnosed as developed CKD				
Initiation of RRT				
Degree of renal recovery	Fully recovered			
	Partial recovery			
	No renal recovery			
	Unknown Renal recovery			
Serum creatinine in mg/dl	Baseline or at admission			
	Day-1			
	Day -7			
	Worst value			
	At discharge or death			

Table 11 Part-4 Cause and staging of AKI

	Cause of AKI	If yes(√)	Remarks
1	Prerenal		
2	Renal		
3	Post renal		
	The severity of AKI as per KDIGO Staging		
1	AKI stage I		
2	AKI stage 2		
3	AKI stage 3		