

**ADDIS ABABA UNIVERSITY COLLEGE OF HEALTH SCIENCES SCHOOL
OF MEDICINE, DEPARTMENT OF PEDIATRICS AND CHILD HEALTH**



**ASSESSMENT OF CLINICAL PRESENTATIONS, AND OUTCOME OF
PATIENTS ADMITTED TO PEDIATRICS INTENSIVE CARE UNIT,
SAINT PAUL'S HOSPITAL MILLENNIUM MEDICAL COLLEGE: A
TWO-YEAR RETROSPECTIVE CROSS-SECTIONAL STUDY.**

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APPROVED BY BOARD OF EXAMINERS

This thesis by **Gemechu Edae (MD)** is accepted in its presented form by board of examiners in satisfying thesis requirement for the Specialty certificate in Pediatrics and child health.

EXAMINERS

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ABSTRACT:

Introduction: A pediatric intensive care unit is a separate physical facility or unit specifically designated for the treatment of pediatric patients, because of shock, trauma, or other life-threatening conditions, require intensified, comprehensive observation and care. Knowledge of the characteristics and outcomes of critically ill children admitted to PICU in low income countries may help with the identification of priorities and the resources required for improvement of the care of critically ill patients.

Objective: - To assess the clinical presentations, and outcome of children admitted to the pediatric intensive care unit of Saint Paul's Millennium Medical College.

Methods: - Data were collected through chart abstraction of pediatric patients who were admitted to the PICU during the period from January 2017 to December 2018. Data were analyzed using Statistical Package for Social Sciences version 20.0 for windows. Data were summarized by using frequency tables, figures and odds ratio with its 95% confidence interval was determined when it is appropriate. A retrospective cross-sectional study design was used.

Results: From 400 admitted patients, 260 patients were analyzed. Average age at admission was 48.13 ± 53.65 months, with M: F ratio of 1.4:1. Overall (from infectious and non-infectious) the most commonly affected systems were central nervous system (79/260 pts, 33.2%) and respiratory system (55/260 pts, 23.1%). The mean duration of stay was 7.26 ± 6.87 , the median being 6.0 days. Binary logistic regression shows, need for mechanical ventilation ($p = 0.04$), and post cardiopulmonary resuscitation admission ($p=0.001$) were independent predictors of mortality. The major causes of death being septic shock in a total of 24 (43.6%), followed by respiratory failure in 14 (25.5%) secondary to severe chest infection, GBS and various central causes. Cardiogenic shock accounted for 7 (12.7%). The overall mortality rate was (21.1%).

Conclusion: The mortality rate of our PICU was 21.1 %, with the most common cause of admission, and death being infectious causes mostly affecting CNS and respiratory, and septic shock respectively. The mean duration of stay of 7.26 ± 6.87 days. The statistically significant predictor of mortality in this study was need for mechanical ventilation and post cardiopulmonary resuscitation admission.

Key Words: SPHMMC, Pattern, Intensive care unit, outcome

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LIST OF ABBREVIATIONS

AAU: Addis Ababa University

AKI: Acute kidney Injury

AICU: Adult Intensive Care Unit

AOR: Adjusted Odds Ratio

ARDS: Acute Respiratory Distress Syndrome

CI: Confidence Interval

CHF: Congestive Heart Failure

CHS: College of Health Science

CVS: Cardio Vascular System

GUS: Genitourinary System

HIV: Human Immunodeficiency Virus

LONS: Late Onset Neonatal Sepsis

MV: Mechanical ventilation

NICU: Neonatal Intensive Care Unit

OPD: Out Patient Department

PICU: Pediatric Intensive Care Unit

PRISM: Pediatrics Risk of Mortality

RS: Respiratory System

SPHMMC: Saint Paul's Hospital Millennium Medical College

TASH: Tikur Anbessa Specialized Hospital

WHO: World Health Organization

1.INTRODUCTION:

A pediatric intensive care unit (PICU) is a separate physical facility or unit specifically designated for the treatment of pediatric patients, because of shock, trauma, or other life-threatening conditions, require intensified, comprehensive observation and care(1).

Advances in the field of intensive care medicine have greatly improved the prognosis in critically ill children. The concept of dedicating an intensive care unit (ICU) to critically ill infants, children and the teenage groups started in Sweden in the 1950s and in the United States in the 1960s and later spread to other parts of the world (2). Before then, the practice had been to group pediatric patients along with adults. The practice of pediatric critical care has matured dramatically throughout the past 3 decades. In 1985, the American Board of Pediatrics recognized the subspecialty of pediatric critical care medicine and set criteria for subspecialty certification. Over the next 40 years, hundreds of pediatric ICUs would be established in academic institutions, children's hospitals, and many community hospitals throughout North America and Europe. There were 306 general pediatric ICUs identified in the United States in 1995 and 349 in 2001(1).

Though a report by the British Pediatric association in 1993 did not show any difference in the outcome between children managed in a dedicated pediatric intensive care unit (PICU) and those managed in a general ICU, Subsequent studies by other authors have indicated an improved outcome in critically ill children managed in the PICU(3).

There are two types of ICUs, an open and closed. In the former physicians admit, treat and discharge and in the latter, the admission, discharge and referral policies are under the control of intensivists(4). The patient outcome, cost benefit is noted to be better if intensivists have full clinical responsibility. The pediatric intensive care unit (PICU) is a part of the hospital where critically ill pediatric patients who require advanced airway, respiratory, and hemodynamic supports are usually admitted with the aim of achieving an outcome better than if the patients were admitted into other parts of the hospital (2). Complex technology and equipment is often in

use, particularly mechanical ventilators and patient monitoring systems. The outcome depends on the available human and material resources.

The developed-world intensive care community has acquired enormous expertise and expended considerable resources toward the care of critically ill patients. The challenge is to broaden the scope to consider the majority of the world's critically ill patients who lack access to these resources(5), in developed countries, death before discharge from intensive care unit is rare outcome(6).

Moreover, in Africa, deficiencies in children's critical care are related to drugs, oxygen, blood products, and monitoring equipment(7). In least developing countries there are few data on children's critical care, and this makes the provision of aid and improvement of outcome difficult (8).

Disease pattern in PICU particularly in early age group is a sensitive indicator of the availability, utilization and effectiveness of mother and child health services in the community. Globally Eighty-five per cent (5.4 million) of the 6.3 million deaths in 2017 occurred in the first five years of life and about half (47 per cent) of the under-five deaths in 2017 occurred in the first month of life. More than half of these early deaths are due to conditions that could be prevented or treated with access to simple, affordable interventions. Sub-Saharan Africa continues to be the region with the highest under-five mortality rate in the world – 76 deaths per 1,000 live births in 2017. Children in sub-Saharan Africa are more than 14 times more likely to die before the age of five than children in developed region (9). According to the UN Inter-agency Group for Child Mortality Estimation, under-five mortality declined to 60 per 1,000 live-births in 2015 (UNICEF and others, 2015), which is below the MDG target of 63 indicating that Ethiopia has achieved its target of reducing child mortality by two-thirds ahead of time(10).

According to World Health Organization (WHO),the major causes of death in under-five children in developing countries are preventable and curable diseases, if the care is optimized (11). The majority (99%) of childhood deaths occurring in resource limited countries, especially it is highest in sub-Saharan Africa (> tenfold) (12).

Intensive care medicine is a developing discipline in almost all developing countries. Financial restraints due to inadequate insurance and national health systems together with severe logistic

and educational problems account for high morbidity and mortality rates in ICUs of developing countries. More studies on the current state of intensive care medicine in developing countries are needed to provide reasonable aid to improve the care of the most severely ill patients in the poorest countries of the world(13). Intensive care could reduce mortality rates by 15–60%, when it is a well-equipped, and staffed with intensivists (11).

Sepsis and serious infections are major reasons for ICU admission. Mortality attributable to infectious diseases is considerably higher in developing countries (29% in South Asia, 56% in sub-Saharan Africa) than in high income countries (6%)(14).

In sub-Saharan Africa, ICUs have varying qualities and quantities of infrastructure necessary for the provision of proper critical cares services. The reported disease characteristics and mortality rates of patients admitted to ICUs in sub-Saharan Africa vary widely from one population to another. The regional hospitals send their critical patients to these referral hospitals for ICU care(15).

Saint Paul’s Hospital Millennium Medical College PICU was opened in 2016, and one of public hospital with relatively equipped and functional pediatric intensive care unit.

Demographic profile and outcome of PICU patients can vary widely in different studies while there is a scarcity of data in Ethiopia’s critically ill children. The aim of the present study is to describe the admission pattern and the outcome of SPHMMC PICU patients, to evaluate the relationship of the outcome to diagnostic categories and treatment characteristics, and to investigate mortality risk with possible outcome of associated factors.

1.1 Statement of the problem:

Very little is published about the state of pediatric critical care in undeveloped countries, while a modicum of information has been published pertaining to adult and neonatal critical care.

Scientific critique of the problems facing pediatric intensive care units (PICUs) in developing countries is therefore lacking. In a recent review of the critical care literature from 2007, found little research to report on critical care in the resource limited countries (4).

A five-year chart review of deaths in pediatric patients aged 7 days to 13 years presenting to the Tikur Anbessa Specialized Tertiary Hospital (TASTH) from January 2012 to December 2016

was conducted. The proportion of pediatric emergency department (PED) deaths was 4.1% (499 patients) out of 12,240 PED presentations. This translates to a mortality rate of 8.2 deaths per 1000 patients per year. The three top causes of deaths were pneumonia, congestive heart failure (CHF) and sepsis. Thirty two percent of the deaths occurred within 24 h of presentation with 6.5% of the deaths being neonates and the most common co-morbid illness was malnutrition (41.1%)(16).

A recent study conducted to describe admission pattern and outcome with its predictor variable on the mortality of children admitted to pediatric intensive care unit (PICU), Ayder Referral Hospital, Northern Ethiopia, from September 2012 to August 2014, out of 680 admitted patients, 400 patients were analyzed. Average age at admission was 62.99 ± 60.94 months, with F: M ratio of 1:1.2. Overall (from infectious and non-infectious) the most commonly affected systems were respiratory (90/400 patients, 22.5%) and central nervous system (83/400 pts., 20.75%). Most were admitted due to meningitis (44/400 pts., 11%), post-operative (43/400 pts., 10.8%) and acute glomerulonephritis (41/400 pts., 10.3%). The overall mortality rate was 8.5%, with the most common cause of admission and death being infectious causes mostly affecting respiratory(17).

The main purpose of the PICU is to prevent mortality by intensively monitoring and treating critically ill children who are considered at high risk of mortality. This, however, comes at a huge cost to all the parties involved in the hospital, the personnel, and the care givers of patients. Because of its dramatic display of medical intervention at its best, it is viewed as part of medical system that is expected to contribute its share of service for welfare of entire society. Quality assurance and continuous quality improvement is an important aspect of any critical care unit. The constant thrust for improvement of quality can provide significant for all who care for critically ill.

1.2 Rationale of the study

Children require intensive care in different situation. Many children in Ethiopia seek emergency care at district and zonal hospitals. These public institutions are ill equipped to offer to care needed due to lack of required facilities and trained personnel. A great number succumb to their

illness before care can be instituted but others are referred PICU, which is only available in Tikur Anbessa specialized hospital, Saint Paul's Millennium medical college and Yekatit 12 hospital.

There is great demand for PICU in Ethiopia and other developing countries. This is to try and reduce the high mortality rates of very critically ill pediatric patients admitted to hospital. This study aims at determining the general outcome of PICU case, in so doing will enable health providers to focus their attention on more specific clinical areas.

For pediatric emergency care facility to be developed the special need of these age group must be addressed and the current outcome in the existing care unit is one of the major guidelines towards this goal.

2. LITERATURE REVIEW

Examination of published experiences in developing countries is limited by a selection bias in that only the most developed PICUs in these developing countries will have the resources or motivation to publish their experiences, leaving little or no information about the conditions in PICUs in the resource limited countries. Despite these limitations, examination of some of the relevant published information does give some idea of the challenges facing critical care practitioners and some approaches to their solution(11).

In the United States and Europe, by the end of the 1950s approximately 20% of hospitals with over 300 beds had at least one ICU. In Latin America the first ICUs appeared at the end of the 1960s and beginning of the 1970s in Mexico, Colombia, Venezuela, Brazil, Argentina, and Peru (9).

Retrospectively a cohort of consecutive study done in 15 institutions in the United States, between May 1995 and December 2001 reported, there were 20547 pediatric patients admitted to the 15 PICUs on an emergency basis, and 7052 (34.3%) were admitted on weekends. Overall PICU mortality rates were not statistically different for patients admitted on weekends and patients admitted on weekdays (4.71% vs 4.71%). Patients admitted during the evening (n = 12 746, 62%), compared with those admitted during the daytime (n = 7801, 38%), were more likely to be male (57.8% vs 56.4%) and were older (6.1 vs 5.6 years) but were less likely to have experienced a previous PICU admission (3.0% vs 5.2%), received vasoactive medications within 24 hours after admission (15.1% vs 19.5%), or received mechanical ventilation within 24 hours after admission (34.5% vs 38.4%). Patients admitted during the evening demonstrated a lower mean PRISM III score, compared with those admitted in the daytime (mean PRISM III scores of 5.5 vs 6.3) (18).

In England, Wales and Northern Ireland clinical database were extracted to know Characteristics and outcome of children admitted to adult intensive care units on consecutive admissions of children (age less than 16 years) from the Case Mix Programme Database covering a 16-year period (1 January 1996 to 31 December 2011). During the study period, 1,069,477 admissions to 229 adult intensive care units were recorded in the case mix programme database. A total of 13,430 admissions (from 210 AICUs) were of children aged less than 16 years. Overall, 623

children died before discharge from the AICU over the 16-year period (crude mortality 4.6 %). Of the total 12,806 survivors, the majority (57.9 %) were discharged to-wards within the same hospital, although this proportion gradually decreased over the study period, such that in recent years less than half were discharged to-wards within the same hospital (75.3 % in 1996 to 47.9 % in 2011)(19).

A retrospective study of admissions (from August 2012 to June 2013) was conducted tertiary care center in India, to evaluate the morbidity pattern and outcome of admissions into the PICU of 341 patients. Mean age was reported 40.01 ± 45.79 months; 50.7% were infants and 59.8% were males. The three most common disease categories admitted were cardiovascular disease (41.1%), neurological disorders (12.0%), and respiratory disease (10.0%). The mean duration of stay in PICU was 3.2 ± 4.5 days. The overall mortality rate was 2.1%(20).

A retrospective study done in India which records of admissions (from January 2015 to August 2017) were obtained from the PICU records to evaluate the morbidity pattern and outcome of admissions into the PICU of a tertiary care center in India: - mean age of the studied 1231 patients was 36.8344 ± 28.5419 months; 55.2% were infants and 61.2% were males. The three most common disease categories admitted were Respiratory disease (32.3%), neurological disorders (17.0%), and Infection other than sepsis- (11.7%). The mean duration of stay in PICU was 7.42 ± 7.72 days. The overall mortality rate was 20.9 %(21).

Retrospective audit of children (age from one month to 14 years) admitted in the PICU Aga Khan University Hospital, Pakistan from January to December 2005 and January to December 2007 were reviewed. During the year 2007, all patients care was directed by pediatric intensivist (Cohort-1, n= 314). During the year 2005, patients were managed by general pediatrician with support of adult anesthesiologist (Cohort -2, n= 99). Patients were compared during the two 12-month cohort period: - During the study of 2007, in cohort one, 314 patients were admitted, mean age was 24 months (range, one month -14 year), 37% were less than 1-year old, 66% were male, mean PRISM Score was 13.2(3- 39) while in cohort-2 (2005), 99 patients were admitted; mean age was 29 months and 60% were male. There were similar medical diagnostic categories

in both cohorts. There were significant differences in two cohort for mortality (35% vs. 14%), length of stay (7.5 days vs. 3.2 days) and number of admissions (314 vs. 99)(22).

Retrospective analysis of all patients between the ages of 0 to 16 years admitted to the PICU from July 2009 to July 2010 was done at Patan Hospital, Nepal. In 12 months, 126 children were admitted to the PICU including 43% female patients. Sixty-three percent were under 5 years. Almost half were admitted for shock (45%), particularly septic shock (30%). The second commonest reason for admission was neurologic etiologies (15%). Neonatal admissions were also significant (19%). Mortality was 26% and was significantly associated with septic shock, mechanical ventilation, and multiple organs. Almost one third of patients required mechanical ventilation; median duration was 4 days (interquartile range, 2–8). Mean length of stay in the hospital was 6.2 days ($\pm$ 5.3) and median 4 (interquartile range, 2.5–9.0)(23).

Retrospective study records of patients admitted in the PICU of BP Koirala institute of health sciences, Nepal from April 2011 to March 2012 were reviewed. 230 children were admitted to the PICU with male to female ratio of 1.7:1. Diagnoses included respiratory diseases (n=76, 33%), central nervous system diseases (n=43, 18.6%), infectious diseases (n=26, 11.3%), surgical problems (n=18, 7.8%), gastrointestinal diseases (n=17, 7.4%), cardiovascular diseases (n=15, 6.5%), poisonings (n=11, 4.8%), renal (n=9, 3.9%), hematological (n=3, 1.3%) and others (n=12, 5.4%). Out of 230 admitted children, 29 (12.6%) died, 19 (8.2%) left against medical advice and 5 (2%) were referred to other centers. Forty-one (17.8%) children received mechanical ventilation, among which 23 (56%) improved, 14 (34.1%) died and 4 (9.7%) children were taken away by caretakers against medical (24).

A prospective study of all patients admitted to the PICU for 13 months (from 1 March 2000 to 31 March 2001) in teaching children to Alexandria University hospital were conducted. During the study period (13 months) overall admissions were 406 cases: - the average length of stay was 4.67 ± 5.4 days. The overall death rate was 50.49 percent. The rate was 98.8 percent among cases in whom the length of stay was < 24 h (24).

Descriptive study of all children aged less than 14 years presenting with critical illnesses to the PICU was conducted in a tertiary medical Hospital, in Cairo, from 2011 to 2012. During the year of the study, the total number of patients admitted to this PICU was 532. Children (1-5 years of age) were the largest age group admitted to PICU (n = 238). Mortality rate was 33.1% and half

the patients (53%) stayed an average of 1 week (n = 282). Children representing with pneumonias (n=264) and foreign body (FB) inhalation (n=63) represented the highest cause of admission, followed by encephalopathy (n=61). All patients with stridor were discharged, followed by FB inhalation (95.2%) and Guillain-Barre syndrome (94.4%). All patients who presented with post arrest died, followed by liver cell failure (66.7%) and heart failure with pneumonia (61.5%)(25).

A retrospective audit was conducted in a general ICU in a university hospital in Uganda, in the period of January 2003 to December 2009. Demographic data, admission diagnosis, and ICU length of stay were recorded for the 1,774 patients during the study period. Their mean age was 35.5 years. Males accounted for 56.5% of the study population; 92.8% were indigenous, and 42.9% were referrals from upcountry units. The average mortality rate over the study period was 40.1% (n = 715). The highest mortality rate (44%) was recorded in 2004 and the lowest (33.2%) in 2005. Children accounted for 11.6% of admissions (40.1% mortality). Sepsis, ARDS, traumatic brain injuries and HIV related conditions were the most frequent admission diagnoses(26).

A retrospective study of all pediatric (< 16 years) admissions to Jos University Teaching Hospital, Jos-Nigeria general ICU from January 1994 to December 2007 was conducted. Results: Out of a total of 1364 admissions, 302 (22.1%) were in the pediatric age group. Their age ranged from a few hours old to 15 years with a mean of 4.9 ± 2.5 years. The male: female ratio was 1.5:1. Postoperative admissions made up 51.7% of the admissions while trauma and burn made up 31.6% of admissions. Medical cases on the other hand constituted 11.6% of admissions. Of the 302 children admitted to the ICU, 193 were transferred from the ICU to other wards or in some cases other hospitals while 109 patients died giving a mortality rate of 36.1%. Mortality was significantly high in post-surgical pediatric patients and in patients with burn and tetanus. The length of stay (LOS) in the ICU ranged from less than one day to 56 days with a mean of 5.5 days. The total mortality rate in the ICU within the same period was 35.7% (487 patients died out of 1364 admissions). Causes of death in the postoperative cases included shock, sepsis and

respiratory failure while in the burns patients it was due to shock, sepsis, and multiple organ dysfunctions(2).

Retrospective analysis of ICU patient records, for three years (2009 to 2011) from all tertiary referral hospitals of Tanzania, the total number of patients admitted to the four ICUs was 5627, male to female ratio 1.4:1, median age of 34 years. Overall, Trauma (22.2%) was the main disease category followed by infectious disease (19.7%). Intracranial injury (12.5%) was the leading diagnosis in all age groups, while pneumonia (11.7%) was the leading diagnosis in pediatric patients (<18 years). Patients with tetanus (2.4%) had the longest median length ICU stay: 8 (5, 13) days. The overall in-ICU mortality rate was 41.4%(27).

Analysis of admissions to the pediatric emergency ward of Tikur Anbessa done a decade ago (from September 2002- august 2003), out of 2522 patients, 76.5% of them were under the age of five. Severe pneumonia which accounted for 38.6% of the total admissions was the most common cause of admission to the emergency ward. Sixty percent of all admissions were due to severe pneumonia (38.6%), meningitis (7.25%), sepsis (5.6%), heart diseases (4.6%) and tuberculosis (4.3%). Outcome of admissions was recorded for 2149 patients (85.2%) and 70.9% of them were discharged improved, 14.8% had unknown outcome and 14.3% that is 360 patients died. Out of the 360 deaths, severe pneumonia was responsible for 41.9% of total deaths and 75.2% of all deaths were due to severe pneumonia, meningitis, sepsis, severe malnutrition and gastroenteritis. The mean and maximum hospital stays for both sexes were 5 days and 33 days(28).

A recent study of analysis of a five-year chart review of deaths in pediatric patients aged 7 days to 13 years presenting to the Emergency department of Tikur Anbessa Specialized Tertiary Hospital (TASH) from January 2012 to December 2016. The proportion of pediatric emergency department deaths was 4.1% (499 patients) out of 12,240 PED presentations. This translates to a mortality rate of 8.2 deaths per 1000 patients per year. The three top causes of deaths were pneumonia, congestive heart failure (CHF) and sepsis. Thirty-two percent of the deaths occurred within 24 h of presentation with 6.5% of the deaths being neonates and the most common co-morbid illness was malnutrition (41.1%). Multivariate analysis revealed that shortness of breath,

late onset of signs and symptoms, fever, and diarrhea had significant association with early mortality(16).

A cross-sectional study was conducted on children from birth to 14 years of age who were admitted to the general ICU of the hospital from 2009–2013 were included in Jimma, Ethiopia. A total of 170 children were admitted to the general ICU of JUSH over the study period. The greater share was taken by males (54.7%), with a male-to-female ratio of 1.2:1. The overall mortality rate was 40%. With the most common cause of admission and death being trauma (4).

A recent study conducted to describe admission pattern and outcome with its predictor variable on the mortality of children admitted to pediatric intensive care unit (PICU), Ayder Referral Hospital, Northern Ethiopia, from September 2012 to August 2014, out of 680 admitted patients, 400 patients were analyzed. Average age at admission was 62.99 ± 60.94 months, with F: M ratio of 1:1.2. Overall (from infectious and non-infectious) the most commonly affected systems were respiratory (90/400 patients, 22.5%) and central nervous system (83/400 pts., 20.75%). Most were admitted due to meningitis (44/400 pts., 11%), post-operative (43/400 pts., 10.8%) and acute glomerulonephritis (41/400 pts., 10.3%). The overall mortality rate was 8.5%, with the most common cause of admission and death being infectious causes mostly affecting respiratory and CNS(17)

3. OBJECTIVES

3.1. General:

- ✓ To assess clinical presentations, and outcome of children admitted to the pediatric intensive care unit of Saint Paul's Millennium Medical College over 2-year period.

3.2. Specific:

- ✓ To describe major diagnosis of admissions
- ✓ To determine the duration of stay
- ✓ To identify major causes of death.
- ✓ To identify associated factors for the death

4. MATERIALS AND METHOD.

4.1. Study area:

The study was conducted at St. Paul's Hospital Millennium Medical College.

Location: Addis Ababa, Ethiopia

Site Description: The hospital is located in Addis Ababa, the capital city of Ethiopia, and is a tertiary care teaching hospital that serves a catchment population of more than five million. In 2007 it became a Medical College, its core services including the provision of medical care, teaching and research.

The hospital provides extensive outpatient and in-patient treatment service with 60 pediatrics beds. The hospital PICU was opened in 2016 G.C. The PICU has four-beds, three mechanical

ventilations, the unit is run by general pediatrician, no pediatric intensive care trained physician but during the year of this study they hired per-time PICU physician for consultation.

4.2 Study Design and period

The study design was hospital based retrospective cross-sectional study.

Data collection was done for 1 month (August 2019).

4.3 Source population:

All paediatrics patients admitted to PICU at Saint Paul's Hospital during study period.

Study Population: All paediatrics patients ≤ 18 years of age admitted to the PICU of SPHMMC January 2017 to December 2018 were constitute the study population of this retrospective study.

Data Source: All available patient Charts and Health Management Information System(HMIS) documentation log of PICU in the study period.

4.4 Sampling Technique and sample size:

All consecutively admitted patients to PICU from January 2017 to December 2018 were included, based on the criteria below:

4.5.1. Inclusion criteria:

All patients admitted to PICU whose age ≤ 18 years were included in the study.

4.5.2. Exclusion criteria:

Patients with incomplete or missed data were excluded from the study. Other patients exclude from the study were those who died on arrival (within 2 hours of admission); due to this is not

sufficient time to give optimal care in the ICU, and the outcome of these patients is related to the emergency or other ward care.

4.6 Study Variables

Dependent variable: Out-come

Independent Variable: Age, sex, address, diagnosis at admission, need for a mechanical ventilator, and duration of mechanical ventilator use, vasopressin use, nutritional status, post cardiopulmonary resuscitation admission, day of admission (weekends vs weekdays), disease character (medical vs surgical), admission sources (emergency, operation theater, ward, from other hospitals), and presence of hospital acquired infection.

4.7. Data Collection Methods:

Data collection was done at SPHMMC, PICU by the investigator and clinical year-II students using a data collection sheet which includes information on, gender, age, address, admission diagnosis, admission sources, need for mechanical ventilation, length of stay, and outcome. Data collectors, clinical year-II students were given 1-hour training about the data collection method.

4.8. Data entry and analysis

Collected data was entered and then analyzed using statistical package for social sciences (SPSS) version 20.0. Characteristics of study participants were analyzed using descriptive statistics. Statistical significance was considered at a p value of < 0.05 . Odds ratio with 95% confidence

interval was used to show the strength of association between independent and dependent variables. Descriptive statistics and logistic regression were used as applicable.

4.9. Operational definitions

Acute respiratory distress syndrome: Acute onset of respiratory failure, bilateral infiltrates on chest radiograph, hypoxemia as defined by $\text{PaO}_2/\text{FiO}_2$ ratio $\leq 200\text{mmHg}$, and no evidence of left arterial hypertension.

Mechanical ventilation: Technique through which gas is moved toward and from the lungs through an external device connected directly to the patient.

4.10. Ethical Considerations

Ethical clearance was obtained from the pediatrics and child Health Department's Research and Publication committee of the School of Medicine, College of Health Science, and Addis Ababa University and IRB of SPHMMC.

This study no risks to the patients as data were drawn from the patients file.

Confidentiality was maintained at all stages of study. No name was included in the final document.

4.11. Dissemination of the result

The result of the study will be presented on the research defense day and a formal report will be submitted to the TASH and SPHMMC, department of pediatrics and child health. The research output will also be published on scientific journals.

5. RESULT

5.1 Sociodemographic characteristics

Among 290 consecutive patients admitted in the study period, of which 260 patients were analyzed, 30 charts were excluded due to in-completeness based on exclusion criteria.

From the total of analyzed patients, male was 153 (58.8%) and mean age of 48.13 ± 53.65 months. Out of all admissions more than a half, 140 (53.8%) of the admissions, are from Oromia region followed by Addis Ababa from where the next majority, 91 (35.0%) came (Table 1).

The most common source of the PICU admissions is Emergency Room accounting for 136 (52.3%) of the total while admission from Pediatric ward accounted for nearly a quarter 71 (27.3%) of the admissions the rest 50 (19.2%) and 3 (1.2%) being directly from OPD/home and NICU. Almost all, 255 (98.1%) were admitted for the first time while the remaining 2% had one previous admission. One third, 164 (63.1%) of the patients are transferred from other public hospitals while 75 (28.8%) are from different unit of the same hospital and 21 (8.1%) came from private health facilities (Table 1).

Table 1: Sociodemographic characteristic of the patients admitted to SPHMMC PICU (Sep 2017 to Dec 2018 GC)

Variable	Category	Frequency (n = 260)	(%)
Age (year)	≤1	101	38.7
	1 - 2	31	11.9
	2 – 5	39	15.0
	5 – 12	51	19.6
	12 – 18	33	12.9
Sex	Male	153	58.8
	Female	107	41.2
Region	Oromia	140	53.8
	Addis Ababa	91	35.0
	Amhara	12	4.6
	SNNPR#	11	4.2
	Tigray	4	1.5
	Others*	2	0.8
Source	Emergency Room	136	52.3
	Pediatric Ward	71	27.3
	Home/OPD	50	19.2
	NICU	3	1.2
Transfer from other hospital	Governmental	164	63.1
	Private facility	21	8.1
	Not transferred	75	28.8

*Gambella, Somale, Benishangul, Dire Dawa, Afar

Southern, Nations, Nationalities, and Peoples' Region

5.2 Clinical presentation

Among the total of 260 patients, majority 226 (86.9%) were admitted for medical diseases and 29 (11.2%) had surgical cases the rest 5 (2%) had both medical and surgical cases on admission. The top most common presenting symptoms are cough 38 (14.6%), gastrointestinal complaints 38 (14.6%), fast breathing 33 (12.7%), generalized body swelling 28 (10.8%), loss of consciousness 26 (10.0%) and followed by others. The median duration of the presenting chief complaint is 4 and mean is 10 hours with standard deviation of 25.56.

Overall the commonest primary diagnoses include Acute Kidney Injury 37 (14.2%), Meningitis 32 (12.3%), Pneumonia 30 (11.5%), CHF 27 (10.4%), and others were only 22 (8.4%) had non-infectious primary causes of admissions (Figure 1) (Table 2).

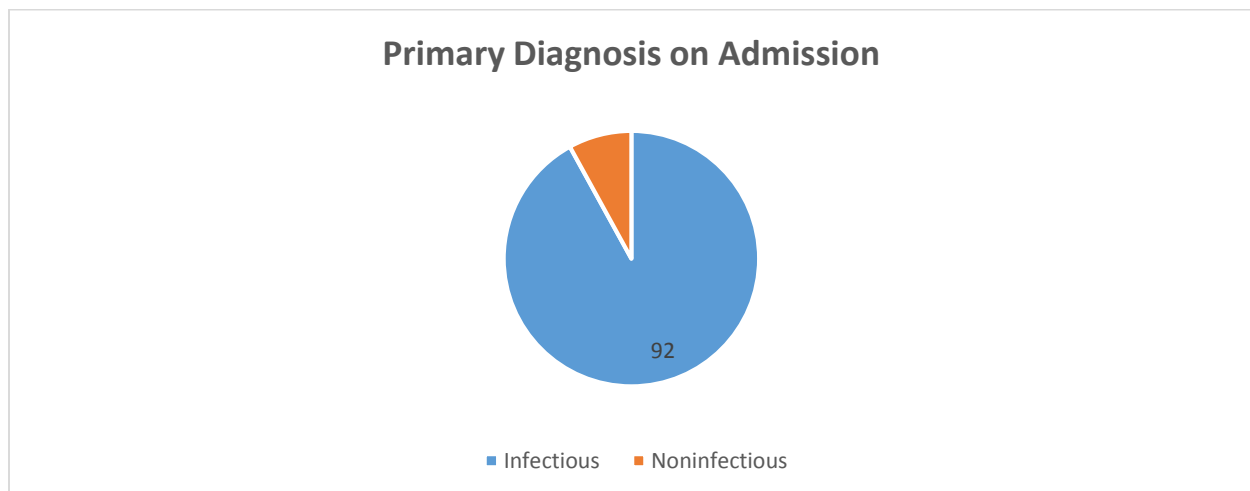


Figure 1: Classification of the primary diagnoses of patients admitted to SPHMMC PICU (Sep 2017 to Dec 2018 GC)

Table 2: Primary diagnosis upon admission among patients admitted to SPHMMC PICU (Sep 2017 to Dec 2018 GC)

Primary diagnosis	Frequency (n = 260)	Percent (%)
Acute Kidney Injury	37	14.2
Meningitis	32	12.3
Sever community acquired pneumonia	30	11.5
Congestive Heart Failure	27	10.4
Septic Shock	19	7.3
Late Onset Neonatal Sepsis	14	5.4
Guillain Barre Syndrome	12	4.6
Complicated TB	11	4.2
Acute on Chronic Kidney Disease	10	3.8
Coma secondary to Poisoning	9	3.5
AGE with severe dehydration	8	3.1
Diabetic Ketoacidosis	7	2.7
Status Epilepticus	7	2.7
Airway obstruction	5	1.9
Acute Abdomen	4	1.6
Disseminated Staph infection (lung, liver)	3	1.2
Primary Tetanus	3	1.2
Obstructive Sleep Apnea	3	1.2
Severe anemia	3	1.5
Cardiogenic shock	2	0.8
Anaphylactic shock	2	0.8
Perinatal Asphyxia	2	0.8
Acute Asthma Exacerbation	2	0.8
Others *	8	3.2

* Fulminant hepatitis, complicated measles, hypertensive emergency, and TORCH each accounted for 0.8%.

System wise, among the infectious primary diagnoses, the most common affected systems are Neurologic 79 (33.2%), Respiratory 55 (23.1%), Genitourinary 31 (13%) Gastrointestinal 30 (12.6%), Cardiovascular 29 (12.2%) along with other systems. On the other hand, the systems affected in non-infectious causes are Cardiovascular in 7/24 (29.2%), Neurologic in 6/24 (25.0%), Renal in 4/24 (16.7%), Respiratory in 2/24 (8.3%), trauma in 2/24 (8.3%) and others (Figure 2).

Over all one third, 83 (31.9%) had various comorbid illnesses. The frequently identified underlying diseases were congenital heart disease in 10 (3.8%), Down syndrome in 9 (3.5%), chronic renal diseases in 9 (3.5%) and other illnesses. When nutritional status of the patients is assessed 36 (13.8%) had severe acute malnutrition while 55 (21.2%) had moderate acute malnutrition. Among 223 patients tested for human immunodeficiency virus, 10 (3.8%) were identified to be reactive while 113 were pronounced to be non-reactive (Table 3).

Table 3: Underlying diseases among patients admitted to SPHMMC PICU (Sep 2017 to Dec 2018 GC)

Underlying disease	Frequency	%
Severe acute malnutrition	36	13.8
Congenital heart disease	10	3.8
Down syndrome	9	3.5
Chronic Renal failure	10	3.8
HIV	10	3.8
Hypertension	3	1.2
Others	6	2.4
None	177	68.1

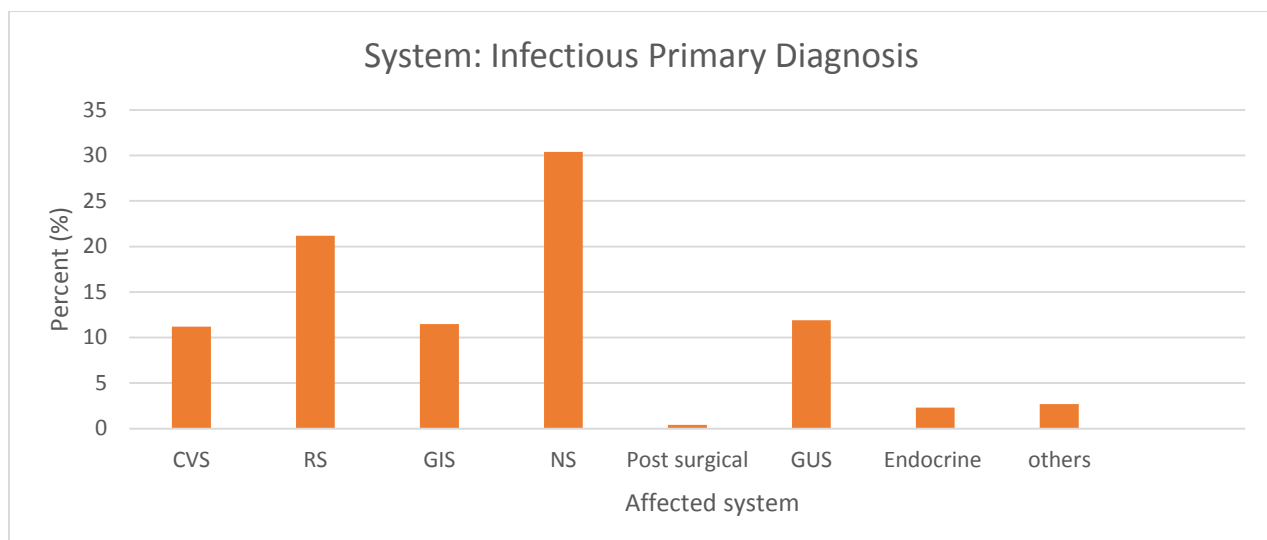


Figure 2: Primary diagnosis by system among patients admitted to SPHMMC PICU (Sep 2017 to Dec 2018 GC)

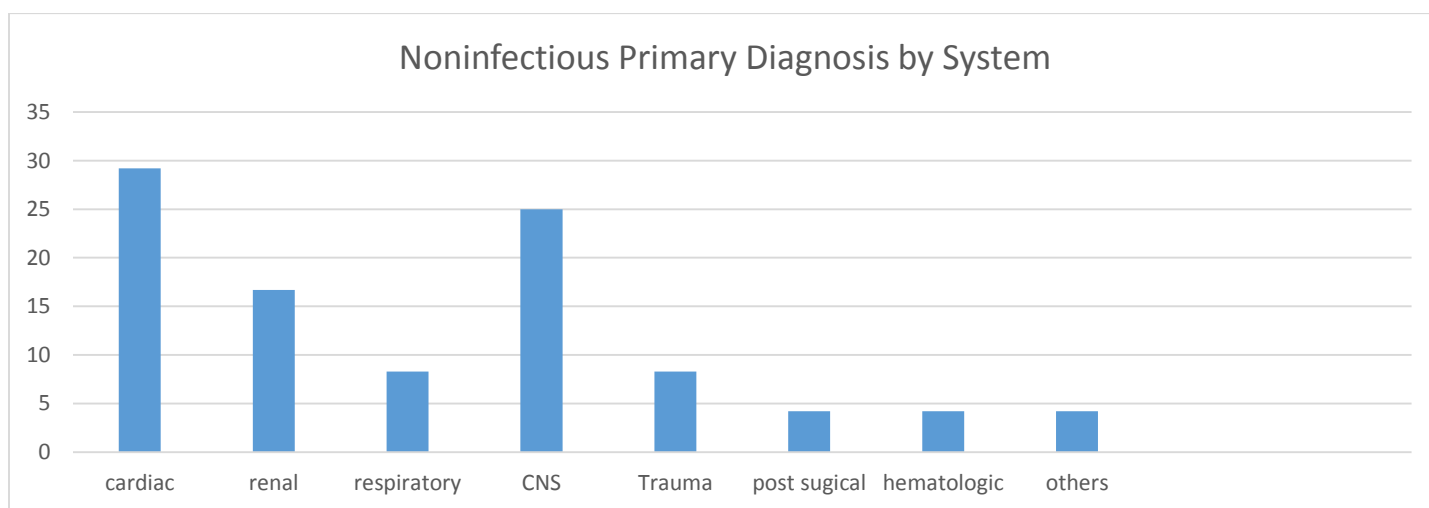


Figure 3: Primary diagnosis by system among patients of SPHMMC PICU (Sep 2017 to Dec 2018 GC)

The overall PICU stay ranged from half a day to 60 days with mean of 7.26 ± 6.87 , the median being 6.0 days. Majority of the patients 164 (63.1%) stayed for 2 – 7 days, the other significant proportion 61 (23.5%) staying for 8 to 14 days (Table 3).

Twenty-nine (11.2%) patients were used mechanical ventilator, 10 /29 (34.5%) patients were died. The mean duration of support lasting for 6.4 ± 8.1 days. Among intubated patients, the most frequently used weaning modes were PS with CPAP in 17 (6.5%) followed by CPAP only which was employed in 13 (5%). Out of intubated patients, 12 (4.7%) had mechanical ventilation associated complications including 3 (37.5%) ventilator associated pneumonia, 2 (25.0%) barotrauma, 1 (12.5%) atelectasis along with other complications.

Vasopressin agents were used in 34 (13.1%) of the admitted patients while the rest did not require any vasopressor.

Table 4: Duration of stay in SPHMMC PICU (Sep 2017 to Dec 2018 GC)

Duration in the Unit	Frequency(n)	Percent (%)
Less than a day	16	6.2
2 to 7	164	63.1
8 to 14	61	23.5
More than 14	19	7.3

5.3 Outcome

Majority of the patients were discharged to pediatric ward while 21 (8.1%) were discharged directly to home and 2 (0.8%) left against medical advice. Out of all admissions, 55 (21.1%) patients died among which 21 (38.2%) were female. The major causes of death being septic shock in a total of 24 (43.6%), followed by respiratory failure in 14 (25.5%) secondary to severe chest infection, GBS and various central causes. Cardiogenic shock accounted for 7 (12.7%) (Figure 4, Table 5).

Table 5: Outcome of the patients admitted to SPHMMC PICU (Sep 2017 to Dec 2018 GC)

Out come	Frequency	Percent
Death	55	21.2
Transfer/discharged to ward	170	65.4
Transferred to other hospital	12	4.6
Left against medical advice	2	0.8
Discharged to home	21	8.1

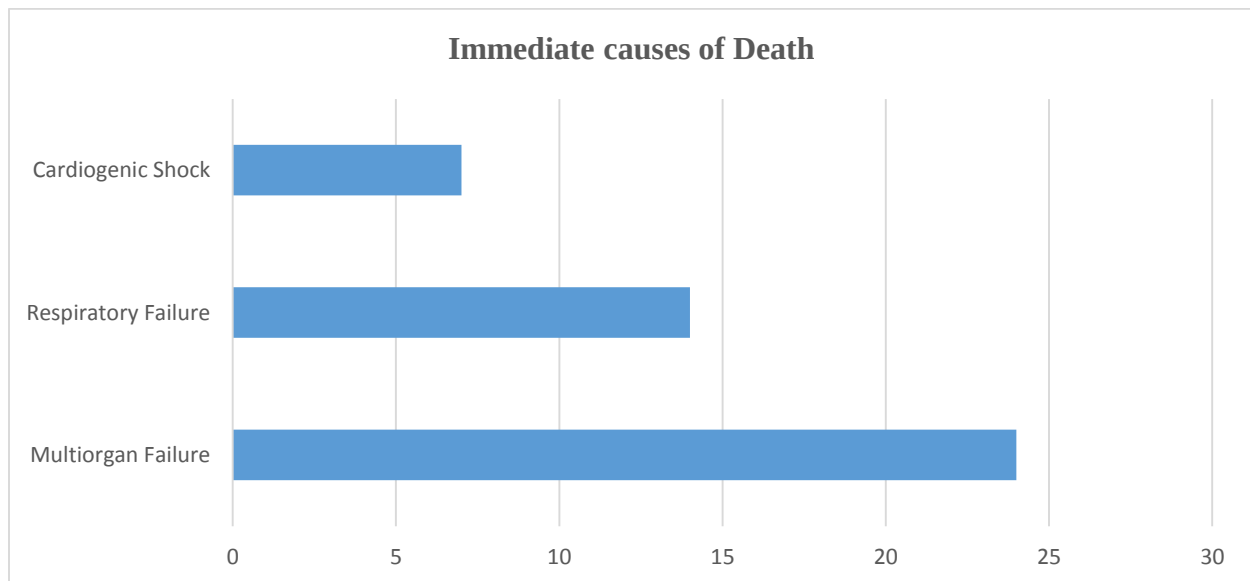


Figure 4: Immediate causes of death among patients admitted to SPHMMC PICU (Sep 2017 to Dec 2018 GC)

5.3.1 Factors associated with outcome

When mortality is tested on binary logistic regression for association with age, infants had 1.3-fold higher rate of death even though statistically not significant with p value of 0.07.

[AOR=1.31 (1.02, 1.69)] (Table 6).

Gender wise, males had slightly (1.17 fold) higher mortality which is statistically insignificant. On the same binary logistic regression, the shorter duration of stay is associated with higher risk of death with consistent strength of association as patients who stayed for less than a day had 1.78 times higher death rate with p value of 0.50 and CI [0.33, 948].

The two statistically significant risk factors on AOR were the need for mechanical ventilation and admission after cardiopulmonary resuscitation, from which post cardiopulmonary resuscitation admission become significant with [AOR = 16.78 (3.85, 73.13), CI = 95%].

Out of the 260 patients 26 (10%) of them had hospital acquired infection and 7 out of the 55 deaths had hospitals acquired infection. Presence of hospital acquired infection was associated with 1.43 higher risk of mortality even though it is statistically significant as p value is 0.45 and [0.57, 3.59]. Most of the deaths 30 /55 in 2 days of weekend compared to 25 on the working 5 days with crude odd ratio of 1.06, p value of 0.86 and CI [0.58, 1.92]

Vasopressors were used in 34 patients among which 10 (29.4%) succumbed to their illnesses as this factor carried 1.37 higher possibility of death with p value of 0.5 and CI [0.75, 3.75], see table 6 below.

Regarding primary diagnosis on admission CHF was associated with 1.93 higher risk of mortality even though it statistically insignificant p=0.33, see table 6 below.

Table 6: Factors associated with outcome among patients admitted to SPHMMC PICU (Sep 2017 to Dec 2018 GC

Variable	Category	Death		Crude odds ratio (95% CI)	p value	Adjusted odd ratio 95% CI	P value
		Yes	No				
Age (yr.)	<1	27	78	3.12 (0.68,14.32)	0.15	1.01(1.02, 1.69)	0.07
	1 to 2	7	24	2.63 (0.49, 14.17)	0.26	0.38	0.06
	2 to 5	10	36	2.50 (0.50, 12.64)	0.27	0.63	0.30
	5 to 12	9	49	1.62 (0.33, 8.40)	0.54	0.52	0.22
	12 to 18	2	18	1			
Sex	Male	34	119	1.17 (0.33, 948)	0.61		
	Female	21	86	1			
Stay (days)	<1	4	12	1.78 (0.33, 9.48)	0.50		
	2 to 7	38	126	1.61 (0.45, 5.82)	0.47		
	8 to 14	10	51	1.05 (0.26, 4.27)	0.95		
	>14	3	16	1			
Mechanical ventilation	Yes	10	19	2.03 (1.07, 3.86)	0.03	2.15(0.88, 5.26)	0.04
	No	45	186	1			
Hospital acquired infection	Yes	7	19	1.76 (0.57, 3.59)	0.45		
	No	48	186	1			
Day of admission	Working day	30	109	1			
	Weekend	25	96	1.06 (0.58, 1.92)	0.86		
Comorbidity	Yes	18	65	1.05 (0.56, 1.98)	0.89		
	No	37	140	1			
Vasopressor used	Yes	10	24	1.68 (0.75, 3.75)	0.21	1.37	0.50
	No	45	181	1			
Cardiopulmonary resuscitation on admission	Yes	8	3	11.46(2.93, 44.85)	0.001	16.78 (3.85, 73.13)	0.001
	No	47	202	1			
Primary diagnosis	Septic shock	8	11	0.36 (0.13, 1.03)	0.06	0.29	0.02
	Meningitis	6	26	1.26 (0.46, 3.44)	0.65	1.03	0.96
	AKI	5	32	1.86 (0.65, 5.33)	0.25	1.23	0.72
	CHF	3	24	2.33 (0.64, 8.44)	0.20	1.93	0.33
	Pneumonia	6	24	0.78 (0.21, 2.54)	0.77	1.72	0.35
	LONS	4	14		0.62	0.71	0.62
	Others*	23	102	1			

*Guillain Barre Syndrome, AGE with severe dehydration, Diabetic Ketoacidosis, Airway obstruction, Primary Tetanus, Cardiogenic shock, Status Epilepticus

6. DISCUSSION

The purpose of this study was to assess pattern and treatment outcome, and its predictors of children admitted to PICU, in SPMMC.

Of the total number of patients admitted, 65.6% of them were under 5 years, and M: F ratio was 1.4:1. The mean ages of admitted patients were higher in our ICU than studies done in Greece (54.26 ± 49.93 months) and India (40.01 ± 45.79 months) (31, 20).

The Mean age of the admitted patient was lower in our ICU than study done in Ayder referral hospital (62.99 ± 60.94) month, with 62.5% of them under 5 years and M: F ratio was 1.2:1 (17). This may be due to the majority of PICU admission were under 5 year of age. The age distribution of ICU admission of which, the majority were under five (62.5%), was comparable. The preponderance of male sex (58.8%) was similar to study done in India – 59.8% (20), and Ethiopia, Ayder referral hospital– 53.8.% (17) and Gondar university hospital- 59.7% (29).

The majority of admitted patients were medical (86.9%) with the commonly affected system, CNS (33.2%), respiratory (23.1%). The demographic profile of our patients were similar to studies done in India, of which major cause of admission was due to CNS (41.1%) and respiratory system (10%) involvement (20), studies done in Ethiopia, Ayder referral hospital, respiratory system(22.5%) and CNS (20.75%), and at Gondar university hospital, CNS (31.5%) and respiratory system (10%) (29). This was unlike to studies done in Tanzania, and Jimma where surgical and trauma patients represent a large proportion of PICU patients (27,30). This difference may be due to, Tanzania and Jima have general ICU for all cases and all age groups.

Of the total number of patients admitted, the proportion of patients mechanically ventilated was (11.2%) which is comparable to the findings of other studies, in Nepal and Gondar university hospital (24, 29) but unlike study done in Jimma, 37% (30). This can be explained by highest percentage of admitted patients were head injury in Jimma. Among mechanical ventilated patients (34.5%) patients were died which was similar to study done in Nepal (34.1%) (24).

In this study, the mean duration of PICU stay was 7.26 ± 6.87 , the median being 6.0 days, which is comparable to the study done in Nepal, mean length of stay in the hospital was 6.2 days (± 5.3) and median 4 (23) but in contrast to study done in India, a mean duration of 3.2 ± 4.5 days (20),

and in Ayder referral hospital, the mean duration of stay 4.9 ± 5.8 days (17), and median duration of 3 days was reported in Gonder university hospital (29). This is because of the complexity of the disease variety each hospital's receive.

However, the common cause of ICU admission was infectious (92%) with the most common being meningitis, pneumonia and sepsis which was similar to studies done in Ethiopia, Gonder university hospital and Jimma, and Tanzania (4,27,29,30).

The overall in-PICU mortality rate of 21.1%, is comparable to other studies in Africa. The reported mortality rate varies from 2.1 to 41% (20,24,27,29,30). With the highest mortality in developing countries due to lack of resources (27,30). Even though mortality in our patients was within the reference range, it's relatively high compared to recent studies done in India (20), China (14) and Ayder referral hospital, Ethiopia (17) that was 2.1%, 6.5% and 8.5% respectively. This is related to inadequate resource resulting in lower mortality similar to other developing countries.

Patients with post cardiopulmonary resuscitation admission were at higher risk of mortality ($p = 0.001$) than those without (16.78 times more likely to die), which is similar to studies done in Nepal, (23) and Ethiopia, Ayder referral hospital (17).

An upgrading of the PICU services through equipment, trained personnel and staffing will improve the outcome of children admitted to the Unit.

7. CONCLUSION

- Based on the result of the study
 - ✓ The mortality rate of our PICU was 21.1 %, with the most common cause of admission, and death being infectious causes mostly affecting CNS and respiratory, and septic shock respectively.
 - ✓ The mean duration of stay of 7.26 ± 6.87 days.
 - ✓ The statistically significant predictor of mortality in this study was need for mechanical ventilation and post cardiopulmonary resuscitation admission.

8. RECOMMENDATION

- Based on the study the following recommendations are forwarded
 - ✓ Educating the population about the disease so that they will get treatment in the early stages of a disease.
 - ✓ The Federal Ministry of Health must also consider expanding PICU in the region to address critically ill patients.
 - ✓ Saint Paul's hospital millennium medical college has also to work more on PICU providing a high-quality intensive care to critically ill patients focusing on increase ICU capacity.
 - ✓ Saint Paul's hospital millennium medical college should, improve patient record keeping through computerization using a specific database that has been developed and provided.

9. LIMITATION OF THE STUDY

- ✓ The limitations of this study include the retrospective design and a significant number of patients were not analyzed because their data was incomplete.
- ✓ As this is a facility based study the population can be unique findings may not be generalizable.
- ✓ Single center study

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11. ANNEX 1: QUESTIONNAIRE:

ASSESSMENT OF PATTERN AND OUTCOME OF PATIENTS ADMITTED TO PEDIATRICS INTENSIVE CARE UNIT, FROM JANUARY 2017 TO DECEMBER 2018 AT SHPMHC. ADDIS ABABA, ETHIOPIA.

Instruction-Please take your time, and carefully complete the information below.

1. Code.....
2. Medical number.....
3. Sex: Male ☐ Female ☐
4. Age (in months)
5. Address/Region
 - a. Addis Ababa ☐ b. Oromia ☐ c. Tigray ☐
 - d. Amhara ☐ e. SSNPR ☐ f. Somale ☐
 - g. Afar ☐ h. Gambella ☐ i. Diredawa ☐
6. Source of admission: **(tick the rectangle/box where appropriate)**
 - a. Pediatric ward ☐ b. NICU ☐
 - c. Transfer from other hospital: Private ☐ Governmental ☐
 - d. Home/OPD ☐ e. Emergency ward ☐ f. Operation room/Theatre ☐
7. 1st PICU admission Yes ☐ No ☐
8. If the question for number 7 is no, specify diagnosis and date of previous admission.....
9. Previous hospital admission yes ☐ No ☐
10. Emergency admission ☐ Elective ☐
11. Medical case yes ☐ No ☐
12. Surgical case yes ☐ No ☐
13. Others (specify)
14. Duration of stay in unit.....in hours/days
15. Presenting symptom/ chief complaint.....
16. Duration of chief complaint..... (hrs, day, week, year)

17. Primary diagnosis/Disease

☐ Cardiovascular system

Specify.....

☐ Respiratory system

Specify.....

☐ Gastrointestinal system

Specify.....

☐ Nervous system (non-traumatic)

Specify.....

☐ Nervous system (traumatic)

Specify.....

GCS.....

☐ Post-surgical

Specify.....

☐ Genitourinary

Specify.....

☐ Endocrine

(specify).....

☐ Others (specify).....

18. Number of system affected (Above).....

19. Respiratory support: Yes ☐ No ☐

20. If question number 19 is yes, which one of the following used: -

a. Mechanical ventilator

b. CPAP/BIPAP c. Non rebreather face mask c. Nasal cannula

21. If the question for number 20 mechanical ventilator, duration of use indays

22. Any mechanical ventilation related complication: Yes ☐ No ☐

23. If the question for number 22 is yes
(specify).....

24. Presence of hospital acquired infection: Yes ☐ No ☐

25. If the question for number 24 is yes
(specify).....

26. Vasopressin agents' use: Yes ☐ No ☐

27. Nutritional status on admission: SAM ☐ MAM ☐

28. HIV status Non-reactive ☐ Reactive ☐

29. Post cardiopulmonary resuscitation/CPR admission: Yes ☐ No ☐

30. If the question for number 29 is yes,

a) For how long CPR was done..... b) how many times.....

31. Time of admission: Day ☐ Night ☐

32. Day of admission: Weekends ☐ weekdays ☐

33. Out-come

a. Death: Yes ☐ No ☐

b. If the outcome is death specify Cause of death.....

c. Transfer/Discharged to ward ☐

d. Transfer to other hospital ☐

e. Went against medical advice ☐

f. Discharged to home ☐