



St. Paul Hospital Millennium Medical College
Graduate Study Program

**Prevalence and Associated Factors of hospital acquired infection in pediatric
intensive care unit St Paul Hospital Millennium Medical College, Addis
Ababa, Ethiopia: A retrospective Study**

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December, 2024 GC

Addis Ababa, Ethiopia



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Graduate Study Program

**Prevalence and Associated Factors for hospital acquired infection in
pediatrics intensive care unit at Saint Paul Hospital Millennium Medical
College: An one year Cross Sectional Study**

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**A research thesis to be submitted to St. Paul Hospital Millennium Medical
College and Department of Emergency and Critical care Medicine as Partial
Fulfillment of Requirements for Specialty in Emergency and Critical Care
Medicine.**

Addis Ababa, Ethiopia

December, 2024

Acknowledgements

First and for most, I would like to thank God, for letting me through all the difficulties. I have experienced your guidance day by day. I will keep on trusting you for my future. I would also like to acknowledge my family for the never ending support during the times of preparation.

Next to this, I would like to express my deepest appreciation and sincere gratitude to my advisors, Dr Tigist Bacha and Dr Yonas Kefelegn for the continuous support, their invaluable comments and constructive guidance in all the time of developing this thesis.

Finally, my special thanks also go to the SPHMMC/EMCC department, for giving me this excellent opportunity to practice research and for financial support that was provided to conduct my thesis.

Acronyms and Abbreviations

CAUTI - catheter-associated urinary tract infections

CLABSI- Central line-associated blood stream infections

HAI- hospital acquired infection

HAP- hospital-acquired pneumonia

ICU- Intensive care unit

LOS- length of stay

PICU- pediatric intensive care unit

SSI- surgical site infection

SPHMMC- St. Paul Millennium Medical College Hospital

UTI- urinary tract infection

VAP- ventilator-associated pneumonia

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Abstract

Introduction: Hospital-acquired infections are usually acquired after hospitalization and manifest 48 hours of admission. HAI is also a significant cause of increased morbidity and mortality amongst hospitalized patients and represents a considerable health and economic burden worldwide. Furthermore, evidence about HAI in pediatric ICU is limited.

Objective: To assess the prevalence and factors associated with hospital-acquired infection in the pediatrics intensive care unit in St Paul Hospital Millennium Medical College, Addis Abeba, from August 2022- July 2023.

Methodology: From a one-year retrospective chart review admitted from August 2022-2023 to the pediatrics intensive care unit, 248 patients were selected by simple random sampling. Data were entered by Excel and exported and analyzed to SPSS version 25.0. Bivariate and multivariate logistic regression was used to analyze the association between dependent and independent variables and P-value <0.05 at 95%CI was used as statistically significant.

Results: From a total of 344 patients 248 patients were selected by simple random sampling after the exclusion of patients aged less than one month and incomplete data records. The mean age per month was 32.84 months. Male patients accounted for 134(54%) of the study. The main source of admission was the emergency department 177(71.4%), followed by the pediatric ward 38(15.3%). More than half of the patients 130(52.4%) admitted come from rural areas. Regarding nutritional status 28.2% Of children have severe malnutrition at the time of their admission. The prevalence of HAI in the PICU is 93(37.5%). The main focus of infection was respiratory, central nervous system, and gastrointestinal systems respectively. Organisms were identified in 27 cases.

Conclusion: The rate of infection in this study was higher compared to some developing countries. Sedation, presence of a central line, previous antibiotics use, and GI prophylaxis had a statistical association with the development of hospital-acquired infection.

Keywords

Hospital-acquired infection, pediatrics, intensive care unit, low resource setting

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1. INTRODUCTION

1.1 Background

Hospital-acquired infections, also known as healthcare-associated infections (HAI), are infections that are typically not present at the time of admission. These infections are usually acquired after hospitalization and manifest after 48 hours of admission.(1)

Hospital-acquired infection (HAI) is a substantial public health problem that occurs during the patient care process.(2,3) The occurrence of HAI in intensive care units (ICU) is much higher in developing than developed countries. The recently reviewed and published data in World Health Organization (WHO) showed that in low and middle-income countries, the incidence of HAI in ICU is 2–3 times higher than in high-income countries.(4) In another review on HAI done in Africa by the WHO, there were significant differences in the prevalence and incidence, though it ranges from 2.5% to 14.8%.(5,6) The average prevalence is significantly higher in high than low-quality studies (15.5% vs 8.5%, respectively). The European Centre for Disease Prevention and Control reports an average prevalence of 7.1% in European countries.(5)

The most frequent nosocomial infections are infections of surgical wounds, urinary tract infections and lower respiratory tract infections. Lots of studies have also shown that the highest prevalence of nosocomial infections occurs in intensive care units and in acute surgical and orthopedic wards. Infection rates are higher among patients with increased susceptibility.(7)

The purpose of this research project is to determine the prevalence and to identify scientifically significant factors associated with infection in pediatric ICU after 48 hours of admission.

1.2 Statement of the problem

Hospital-acquired infections are accountable for substantial morbidity, mortality, prolonged hospital stay, and increased healthcare costs(10). These infections represent an important cause of morbidity and mortality in pediatric population(8).

Patients in intensive care units (ICUs) are at particularly high risk of infection because of the extensive use of invasive devices and procedures. Most current literature pertaining to ICU-acquired infections focuses on adults (8). However, hospital-acquired infections in pediatric ICUs (PICUs) are common; the National Nosocomial Infections Surveillance (NNIS) system reported an incidence of 14.1 infections per 1000 patient- days (11).

The magnitude and point prevalence of hospital acquired infection varies throughout the globe and settings in health institution. The proportion of patients with suspected or proven infection ranged from 43% in Australia to 60% in Asia and the Middle East. The prevalence rates for infection were 58% among patients from countries with low to lower-middle gross national income per capita, 59% among patients from countries with upper-middle gross national income per capita, and 50% among patients from countries with high gross national income per capita(17).

Because PICU patients are a younger population than adult ICU patients, the excess morbidity and mortality attributable to hospital-acquired infections in children has a greater potential effect on productive years of life loss.(14)

The rates of central line-associated bloodstream infection, ventilator-associated pneumonia and urinary catheter-associated infection per 100 devices were 10.2, 18.7 and 1.8, respectively.

1.3 Significance of the study

Prevalence of infection in Intensive and critical care unit and its predictors in terms of sex, age, severity, service capacity varies from place to place in the world but not studied well in Ethiopia.

Insightful knowledge on prevalence and factors associated with hospital acquired infection in PICU will help to improve and minimize mortality related to intensive care. Besides, the knowledge of this information and its application will have significant importance in the economic utilization of mechanical ventilators; shorten ICU stay and decreases ICU mortality and morbidity in the intensive care unit.

Progress in intensive care can only be achieved if good quality of information is generated and utilized appropriately. Search for new knowledge, and identifying existing challenges and predictors are an essential and powerful tool to plan and practice the intervention in health care facility especially in PICU. Understanding and identifying factors helps health services providers to design appropriate solutions for better patient and service outcome. This proposed study will indicate the need to take into account multiple factors that can influence infection in pediatrics ICU.

Furthermore there is no explicit and comprehensive data showing the current situation of hospital acquired infection in the study area. Therefore the purpose of this study aimed to assess the current prevalence of Hospital acquired infection in pediatric ICU.

Finally, recommendations will be forwarded to avert influential factors on health care associated infections. Furthermore, the study will help health professionals and patient care givers particularly nurses, physicians and other care providers in identifying the potential predictors of impaired health and patient outcome in ICU.

2. LITERATURE REVIEW

Patients admitted to intensive care units (ICU) are more likely to acquire nosocomial infection due both to their underlying disease, with resulting impairment of the humoral and cellular immunity, and the invasive procedures that they undergo, causing breakdowns in their natural defense barriers.(32) Health care-associated infections (HAIs) are the primary cause of preventable death and disability among hospitalized patients.(1) Rates of infection within the ICU may be 300-400% higher than the general hospital survival rate of infected patients was over 87% in pediatrics and neonatal ICU, compared with only 55.4% in medical/surgical ICU.(7)

The overall mortality attributable to pediatric nosocomial infections in America has been estimated at 11%. From January 1992 to December 1997, 61 PICUs in 54 hospitals submitted data on 110 709 patients with 427 811 patient-days. Fifty-six (92%) of the units were in teaching hospitals. Fourteen PICUs (23%) were in hospitals exclusively devoted to pediatric patients. Forty-eight units (79%) were in hospitals with high risk nurseries. The mean number of beds in the hospitals was 519 6 238 and the mean number of beds in the PICUs was 10.8 6 5.7. During this 6-year period, the median length of stay fell from 4.8 days in 1992 to 4.3 days in 1997 (P , .05). Data on 6290 nosocomial infections were submitted from this period. The distribution of infections was examined by the major site of infection. Three major infection sites represented 64% of all reported infections; primary bloodstream infections were most frequent, followed by pneumonia and UTIs. The distribution of nosocomial infections by age showed 1145 (18%) infections were reported in children age 2 months or less, 2433 (39%) in children .2 months but ,1 year, 1049 (17%) in children of 1 year up to 5 years, 935 (15%) in children .5 years to 12 years, and 728 (11%) in children 13 years and older. The distribution of major infection sites differed between most age groups. As the distribution of infection sites for infants aged .2 months but ,1 year and children 1 year up to 5 years was not different, these two groups were combined. Differences in distribution of major infection sites were observed between each of

these four new age groups. Primary bloodstream infections and surgical site infections were reported more frequently in infants 2 months or less as compared with older children (386/1145 [33.7%] vs 1352/5145 [26.3%], P , .001, and 116/1145 [10.1%] vs 330/5145 [6.4%], P , .001, respectively). UTIs accounted for a smaller percentage of infections in those children, 5 years compared with older children (626/4627 [13.5%] vs 317/1663 [19.1%], P , .001).(9)

An observational prospective cohort study conducted in the pediatric ICU of “Hospital São Paulo”, Brazil, from April 1996 to October, 1997. During the study, data on about 515 patients, 3,072 patient days, 2,120 central line days, 2,120 ventilator days, 676 urinary catheter days and 139 NI in 94 patients was evaluated. A large number of the patients had surgical conditions, particularly cardiac and neurological. The most common NI sites were the lungs (31.6%), followed by primary bloodstream infection (17.3%) and surgical site infection (17.3%). The mean overall patient NI rate was 27.2 per 100 discharges, with a incidence of 18.3% (patients with NI), and the mean infection rate per 1,000 patient day was 46.1. The rates of central line-associated bloodstream infection, ventilator-associated pneumonia and urinary catheter-associated infection per 1,00 devices were 10.2, 18.7 and 1.8, respectively. Patients with NI were significantly younger (mean age 29.2 months) compared with patients without NI (mean age 43.8 months) ($P=0.006$); the median age in months of the patients with NI was seven and of patients without NI was 17.2. Patients without NI had a mean length of stay of 4.1 days, while patients with NI were hospitalized for 15.7 days ($P=0.0000$). PRISM could be calculated in only 25% of the patients and it was significantly higher in patients with NI (17.1), compared to those without NI (10.0) ($P=0.0002$). Nosocomial-related mortality was 21.3%, the pneumonia-associated mortality rate was 11.4% and the primary bloodstream infection-associated mortality rate was 33.3%. Mortality was significantly higher in patients with NI, compared to patients without NI. Pathogens were identified in blood culture, secretions (except tracheal secretions), spinal fluid, urine and peritoneum. Forty-two pathogens were identified. Gram-negative bacteria's were the most common pathogens identified in the NIs (54.8%), followed by Gram-positive bacteria's (23.8%), and yeasts. The most common species identified were *Acinetobacter baumannii* and *Klebsiella pneumonia*.(32)

An HAI point prevalence survey (PPS) was conducted in neonatal and pediatric wards at two district and two regional hospitals in the Western Cape during December 2016, applying National Healthcare Safety Network HAI definitions was done and in showed HAI in hospitalized

neonates and children, bloodstream infections (BSIs), urinary tract infections and hospital-acquired pneumonia are the most prevalent HAI types.(34) The five most common HAIs in order of occurrence are SSI, accounting for 36% of the infections; C. difficile infections (30%); catheter-associated urinary tract infections (CAUTI) (17%); central line-associated blood stream infections (CLABSI) (9%); and ventilator-associated pneumonia (VAP) (7%).(4)

In keeping with international literature, important risk factors for HAI in this population include prematurity, intensive care unit admission, malnutrition and the presence of indwelling devices. HIV infection and HIV exposure have recently been identified as novel risk factors for HAI in SA children. The prevalence of HAI among hospitalized children in Cape Town was 24%. Pediatric HAI surveillance in other low- to middle-income countries reported considerable incidence and prevalence density rates of 13.8 per 100 patients at risk in Cambodia, 29.1 per 1 000 patient days in Indonesia and 14.7 per 1 000 patient days and 21% in Uganda.(32)

Matched-case control study done in teaching hospitals of Amhara regional state, Ethiopia: in October 2016 states that Patients admitted to the hospital wards are susceptible to HAIs. Risk factors for such infections vary between different specific site infections, because hospital environments are complex. Previously conducted researches indicated that, longer hospital stays, gender, intravascular catheter, surgery since admission, intubation, mechanical ventilation, age of the patient, type of hospital, urinary catheter were some of the risk factors for hospital acquired infections. In Ethiopia, though few researches were conducted on specific surgical site infections and hospital-acquired infections, none of those used strong epidemiological analytical method, to determine important risk factors. The availability of hand-washing facilities waste management material in the ward is important to prevent hospital acquired infection. The presence of alcohol-based hand rub material in the ward significantly increases the consumption of alcohol-hand rub material in the ward. Thus availability of hygiene maintenance materials and behaviors of healthcare workers reduced healthcare associated infections.

In Ethiopia researches showed low level of hand hygiene practice and poor condition of medical waste management in health care facilities. The availability of waste management materials is believed to reduce the exposure of waste to patients and health care workers. This study found immune deficiency of patients as a risk factor for hospital acquired infection. This finding was

also supported by another finding, in which patients with high compromised health status were at risk for hospital acquired infection.(29)

3. OBJECTIVES

3.1 General Objective

To assess the prevalence and factors associated with hospital Acquired infection in pediatrics ICU in St. Paul Hospital millennium medical college, Addis Ababa, from August 2022 to July 2023.

3.2 Specific Objectives

To determine, the prevalence of hospital acquired infection in pediatrics ICU, in SPHMMC.

To assess, factors associated with hospital acquired infection in pediatrics ICU, in SPHMMC.

4.METHODS AND MATERIALS

4.1STUDY DESIGN AND PERIOD

Retrospective institution based cross-sectional study over a period of one year was conducted by reviewing the charts of admissions made to SPHMMC pediatric intensive care unit from August, 2022 - July 2023 G.C

4.2STUDY AREA

This study was conducted in pediatric intensive care unit of SPHMMC, which is tertiary teaching hospital located in Addis Ababa which, is a capital city of Ethiopia. The PICU in St SPHMMC is under the Department of pediatrics and child health, one of the major specialties in SPHMMC, it is the largest pediatric intensive care unit in the country with 8 beds, 6 invasive types of mechanical ventilators, and eight functioning monitors. It is staffed with 2 pulmonologists, 2 pediatrics critical care specialists, 22 nurses, and 2 respiratory therapists. In addition, 1 pediatric pulmonology and critical care fellow, two second year pediatric residents, and one senior pediatrician are often attended by additional trainees. Nurse to patient ratio is 1 :1 day covered by consultants and night by pediatric residents .

4.3SOURCE POPULATION

The source population were all pediatric patients admitted to pediatric intensive care units with in the study period.

4.4 STUDY POPULATION

All PICU admitted patients who fulfill inclusion and exclusion criteria in study period.

4.5 SAMPLE SIZE DETERMINATION

The proportion of ICU outcome is unknown in the study area. However, the prevalence of hospital acquired infection specifically in ICU was conducted in Ayder PICU, Tigray, Ethiopia and it was 20.2% from a total of 223 patients. Then p value was taken as 0.202. The total number of patients admitted during study period was 344. Single proportion formula was used to calculate sample size. The chosen margin of 5%, considering 10% none response rate, and 95% confidence interval. The required sample size will be determined using a single population formula to calculate the sample size:

$$n = \frac{(Z_{\alpha/2})^2 p (1-p)}{d^2}$$

Where, n- Required Sample

z- Standard normal value at 95% CI which is 1.96

p- 0.202

f- 1-0.202=0.80

$$n = \frac{(1.96)^2 \times 0.202 \times 0.80}{(0.05)^2} = 248$$

4.6 INCLUSION AND EXCLUSION CRITERIA

4.6.1 INCLUSION CRITERIA

All patients admitted to the pediatric intensive care units who were admitted from August 2022- July 2023 who do not fulfill exclusion criteria

4.6.2 EXCLUSION CRITERIA

All patients who already have acquired hospital infection before ICU admission.

All patients age less than 28 days.

All patients who have incomplete data.

4.7 STUDY VARIABLES

▪ INDEPENDENT VARIABLES

- Demographic :-, age, sex, nutritional status,
- Comorbidities:, Cancer, Diabetes mellitus, Heart failure, Chronic renal, HIV infection, congenital anomaly
- Length of stay in the ICU
- Previous history of antibiotics
- Presence of steroid use
- Presence of blood transfusion
- Presence of GI prophylaxis
- Presence of intubation and mechanical ventilation
- Number of days on mechanical ventilator
- Presence of central lines
- Presence of urinary catheter
- Use of nasogastric tube feeding
- Use of maintenance fluid
- Total hospital stay

- **DEPENDENT VARIABLE**

Hospital acquired infection

4.8 DATA COLLECTION TOOL AND PROCEDURES

Structured questionnaires in English version was adopted from different literature developed for similar purposes by different authors; it then reviewed to suit the local condition. Necessary data was extracted by reviewing patient's chart. Then any deviation was rechecked and rephrased or readjusted. To collect the data four physicians were trained about the data collection. Inconsistency and incompleteness was checked during data collection time by supervisors and principal investigator.

4.9 DATA MANAGEMENT AND ANALYSIS PLAN

To ensure the quality of the data, the entire filled questionnaires will be checked for incompleteness and inconsistency. Data was enter using excel and exported to SPSS version 25 for statistical analysis. Descriptive and analytical statistical analysis was used to compute frequency, percentage and mean for independent and dependent variables. Logistic regression was used to identify factors associated to hospital acquired infection. Variables with P-value less than 0.05 in multivariate logistic regression will be declared as independently associated variables. Before running multivariate logistic regression, variables will be selected by their p value less than 0.25 in binary logistic regression.

4.10 DATA QUALITY ASSURANCE

Data quality will be assured by using structured and pre-tested tool. The questionnaire was assessed for clarity. Four data collectors and supper visors were used to collect data and supervision. Data collectors and supervisors were trained for two days before data collection. The training was given on data collection procedure, data handling, maintaining patient confidential issues. Consistency and completeness was checked on daily base during chart reviewing period by supervisors and investigators.

4.11 ETHICAL CONSIDERATION

This study was approved by the Institutional Review board of St. Pauli Millennium Medical College before it began to conduct. Additionally, the objective of the study was explained to the hospital administrators, medical director, and card room staffs. Confidentiality of the patient's information contained within their registration books, cards, and referral papers will be assured by using code numbers than patients' identification names and by keeping questionnaires locked.

5.Results

5.1 Socio-Demographic characteristics

From a total of 344 patients 248 patients were selected after checking exclusion criterias. The mean age in month was 32month. The median age of the children who participated in this study was 10 month. Male patients accounted for 134(54%) of study participants. The main source of admission was emergency department 177(71.4%), followed by pediatric ward 38(15.3%). More than half of patients 130(52.4%) admitted from rural area. Regarding nutritional status 28.2% of children have sever malnutrition at the time of their admission (Table 1).

Table 1. Socio-Demographic and Admission-Related Characteristics of patients admitted in pediatric intensive care units in SPHMMC

Variables (n=248)	Number	Percent

Age in month			
Age	<5yr	198	79.8%
	>5yrs	50	20.2%
sex	Male	134	54.0%
	Female	114	46.0%
Address	Rural	130	52.4%
	Urban	118	47.6%
Source of admission	Emergency	177	71.4%
	Ward	38	15.3%
	OR	29	11.7%
	other hospital	4	1.6%
Nutritional status	Normal	142	57.3%
	moderate malnutrition	36	14.5%
	severe malnutrition	70	28.2%
Organ or system involved	Neurology	112	45.2%
	Respiratory	158	63.7%
	Cardiac	127	51.2%
	GI	15	6%
	Renal	57	23%
	Skin	3	1.2%
	Hemato-onco	11	4.4%
	Others	4	4%

5.2 Clinical features

Fever is the most common 81 (38.2%) of clinical feature seen among patients admitted in pediatric ICU. Cough as clinical feature was seen among 14.6% of patients admitted. More than half 133(53.6%) of patients have comorbidity. Regarding the Glasgow coma score 33(13.3%) of patients had score less than 8. Related to urinary catheter 164(66.1%) were catheterized. See table 2

Table 2: clinical characteristics of pediatric of patients admitted in pediatric intensive care units in set Paul medical millennium college, 2022

variables (n=248)		Number	Percent
Clinical features	fever	81	38.2%
	dysuria	1	0.5%
	vomiting	17	8.0%
	cough	31	14.6%

	Increased secretion	20	9.4%
	dyspnea	23	10.8%
	discharge	5	2.4%
	Mentation change	25	11.8%
	hypothermia	9	4.2%
Comorbidity	No	115	46.4%
	Yes	133	53.6%
Organs involved	neurology	112	45.2%
	Respiratory	158	63.7%
	Cardiac	127	51.2%
	GI	15	6%
	renal	57	23%
	Skin	3	1.2%
	Hemato-onco	11	4.4%
	Others	4%	4
GCS	>13	138	55.6
	8-13	77	31.0
	<8	33	13.3
Patient on sedation	No	125	50.4
	Yes	124	49.6
Anemia	No	130	52.4
	Yes	118	47.6
Drainage tube inserted	No	215	86.7
	Yes	33	13.3
Urinary catheter	No	84	33.9
	Yes	164	66.1
Central line	No	99	39.9
	Yes	149	60.1
variables (n=248)		Number	Percent
Previous antibiotics use	No	109	44
	Yes	139	56
GI prophylaxis	No	101	40.7
	Yes	147	59.3
Patient on chemotherapy	No	241	97.2
	yes	7	2.8
Patient on steroid	No	113	45.6
	Yes	135	54.4
Pt on mechanical ventilator	No	105	42.3
	yes	143	57.7
Days on mechanical ventilator	<72 hr.	79	55.6
	4-6 days	22	15.5
	>7days	42	29.6
PICU stay	<=72 hr	119	48%
	4-6 days	56	22.6%

	>7days	73	29.4%
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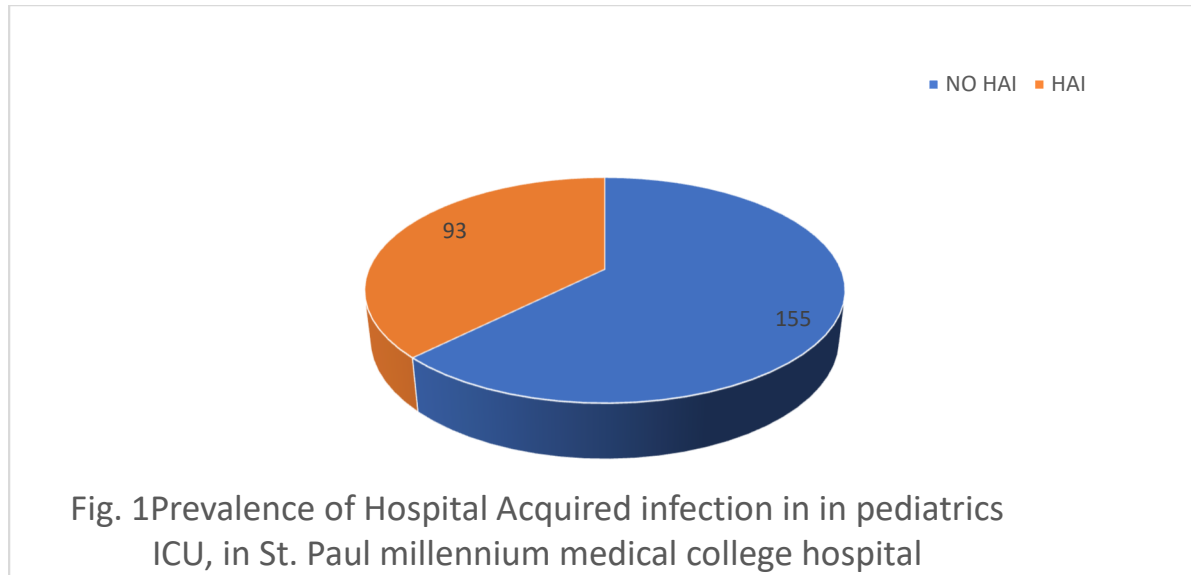
INVESTIGATION Results	FREQUENCY	VALID PERCENT
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WBC	LEUCOCYTOSIS	149	60.1
	LEUKOPENIA	37	14.9
	NORMAL	62	25
	TOTAL	248	100
ANEMIA	PRESENT	118	47.6
	NOT PRESENT	130	52.4
	TOTAL	248	100
THROMBOCYTOPENIA	PRESENT	97	39.1
	NOT PRESENT	151	60.9
	TOTAL	248	100
CRP	POSITIVE	166	66.9
	NEGATIVE	75	30.2
	NOT DONE	7	2.8
	TOTAL	248	100
LP	SUGGESTIVE OF INFECTION	36	14.5
	NOT SUGGESTIVE OF INFECTION	58	23.4
	NOT DONE	154	62.4
	TOTAL	248	100
Culture	NOT SENT	84	33.9
	SENT	164	66.1
	POSITIVE	27	16.5
	NEGATIVE	137	83.5

Table 3: Laboratory Investigation results among PICU admitted patients

Prevalence of hospital acquired infection

The prevalence of hospital acquired infection in pediatric intensive care unit was 93(37.5%). The main focus of infection was chest 47(50.5), followed by CNS 17(18.3%). Other focus of infection involved were gastrointestinal system 12(12.9%). Organism was identified in 27 cases.



FACTORS ASSOCIATED WITH HOSPITAL ACQUIRED INFECTION

According to the bivariate analysis in the binary logistic regression model, the age of the child was related to the development of hospital-acquired infection (HAI). Keeping everything constant, it was found that the odds of developing HAI were 55% less likely in children with an age greater than 5 years compared to those who were under 5 years old at the time of their admission.

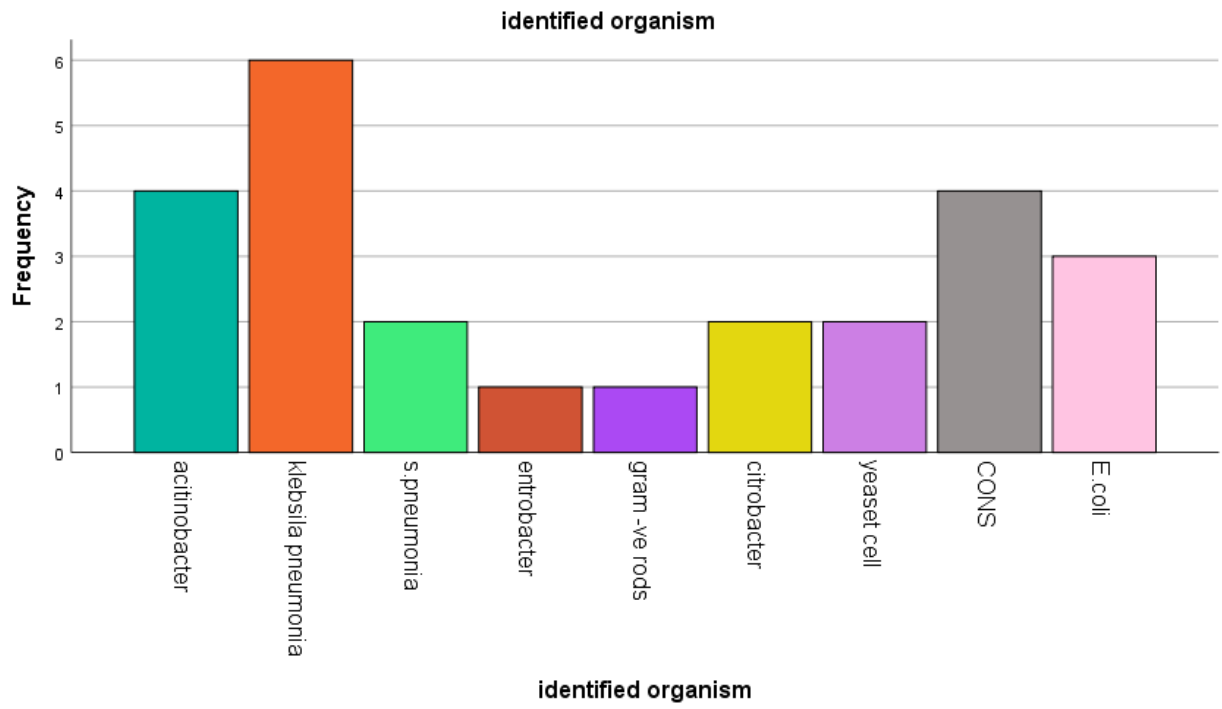
From the demographic features examined, the sex of the child and the place of arrival or residence of the child were not found to be associated with hospital-acquired infection. However, certain clinical factors such as the presence of sedation, anemia, urinary catheterization, and mechanical ventilation were found to be associated with the development of HAI. For example, if all other factors were held constant, the odds of developing HAI were almost 5 times more likely among children with urinary catheterization.

In the multivariate logistic regression model, it was revealed that sedation, the presence of a central line, previous antibiotics use, and gastrointestinal (GI) prophylaxis had a statistical association with the development of hospital-acquired infection. Children admitted in the pediatric ICU who were on sedation medications were almost 2.5 times more likely to develop HAI compared to children who were not on sedation (AOR 2.47, CI 1.289-4.723).

Interestingly, GI prophylaxis was identified as a protective factor against HAI. Children on GI prophylaxis were 59% less likely to develop HAI (AOR 0.406, CI 0.201-0.823).

Table 3: Factors associated with hospital Acquired infection among children admitted to pediatrics ICU in St. Paul medical millennium college, 2022

variables (n=248)		HAI		COR(CI)	AOR(CI)
		No	Yes		
Age	Under 5 years	117	81	1	
	Over 5 years	38	12	0.45 (0.225, 0.926)	
sex	Male	84	50	1	
	Female	71	43	1.02 (0.607, 1.704)	
Address	Rural	78	52	1	
	Urban	77	41	0.78(0.477, 1.34)	
GCS	>13	92	46	1	
	8-13	44	33	1.5(0.45, 2.66)	
	<8	19	14	1.47(0.678, 3.201)	
Patient on sedation	no	97	28	1	1
	yes	58	65	3.88(2.24, 6.73)	2.468(1.289, 4.723)
Anemia	No	90	40	1	
	yes	65	53	1.84(1.091, 3.086)	
Drainage tube inserted	No	136	79	1	
	Yes	19	14	1.268(0.603, 2.67)	
Urinary catheter	No	71	13	1	
	yes	84	80	5.2 (2.673, 10.123)	
Central line	No	84	15	1	1
	Yes	71	78	6.15 (3.225, 11.627)	4.067(1.868, 8.855)
Previous antibiotics use	No	92	17	1	1
	Yes	63	76	6.52(3.527, 12.085)	3.359(1.663, 6.781)
GI prophylaxis	No	65	36	1	1
	Yes	90	57	1.14(0.676, 1.934)	0.406 (0.201, 0.823)
Pt on chemo.	No	152	89	1	
	yes	3	4	2.27(0.498, 10.408)	1
Pt on steroid	No	75	38	1	
	Yes	80	55	1.357(0.805, 2.282)	
Pt on mech. Ventilator	No	81	24	1	
	yes	74	69	3.147(1.795, 5.517)	
Stay in PICU	<=3days	101	18	1	
	4-6days	33	23	3.571(1.700,7.500)	
	>=7days	21	52	14.429(7.087,29.377)	
Total hospital stay	<=14days	131	43	1	
	>14days	24	53	6.347(3.496,11.522)	



6.DISCUSSION

The prevalence of hospital acquired infection in pediatric intensive care unit was 93(37.5%). This finding indicates the presence of significant microorganisms in the intensive care unit, lack of appropriate utilization of universal precautions and or immaturity of children immune system.

The finding of our current study is higher than China (32.4%)(Wang et al., 2019). The possible reason behind may be the nature of study participants in the ICU; comorbid diseases, poor nutritional status. The study finding is lower than the finding of North Indian nosocomial infection prevalence (58.86%) (Choudhuri et al., 2017). This could be due to study area setting differences, dissimilar management approaches, the severity of comorbid illness, and participants' diverse nature may predispose a lower acquisition rate.

Even though the prevalence of HAI in Ayder hospital was (20.2%) and it is higher than in studies done in Pakistan (4.7%), Lithuania (13.6%), Egypt (15.6%), American study (11.9%), Rwanda (12.1%) and Peru (20%), but it was lower than studies done in India (27.3–30.5%), Egypt (27.7%), Serbia (32.7%), Nigeria (45%). The prevalence of HAI in developing countries is higher may be due to the disparities in quality of care, weak infection prevention mechanism implementation, and the type of patients where NI was assessed. According to Ayder hospital findings, the main focus of infection was the chest which was consistent with a study done in Lithuania (58.8%) and Egypt, but in other studies, BSI was more prevalent than respiratory infection like in Peru and Nigeria. In our study the prevalence is 37.5% which is higher than ayder hospital study it may be due to the case variety and comorbidities involved. The main focus of infection is chest, which is similar with ayder PICU study. (13)

This current study highlighted the role of sedation in increasing the risk of acquiring infections during a hospital stay. Children on sedation had more than double odds in acquiring nosocomial infection. This might be related to Sedation medication potential compromise a child's natural defense mechanisms such as cough reflex. Factors such as depressed respiratory rate, altered mucociliary clearance, decreased cough reflex, and compromised mobility associated with sedation are some of more likely features associated to sedative medication in relation to this increased risk. This study was in line to prospective study conducted in French (Nseir et al., 2009).

Based on this finding, it is crucial to closely monitor patients on sedation medications for signs of infection and implement appropriate preventive strategies. This may include regular assessment of vital signs, prompt detection of changes in clinical condition, and adherence to infection control protocols. Developing targeted interventions and guidelines specifically for children on sedation can help mitigate the risk of HAI and improve patient outcomes.

Our study finding revealed and strengthened the evidence that central line route cannulations are associated with increasing the risk of nosocomial infection. Children on central line were four times more likely to develop infection in hospital. This might be related to the nature of central lines. As the pathophysiology is concerned central line associated bloodstream infection involves colonization of the catheter, microbes gain access to the patient's bloodstream through two routes: either by the external surface of the catheter (extra luminal) from the skin or by the internal surface (intraluminal) through hubs or ports. Patients' own skin bacteria or exogenous microbes from health care personnel are the most common routes of infection and these organism get the chance to enter to the patient through the central line (Bennett et al., 2018; Lutufyo et al., 2022)(Lutufyo et al., 2022)

7.Strengths and limitations of the study

7.1 Strengths

- The research conducted on a topic which was never publish in our hospital previously.
- So can be used as a tool for evidence for improvement of the quality of the health system as well as a reference for further research conduction and comparison of outcomes and assessment of measures taken to improve the health system after its publication.
- The sample size is near to the total number of patients in the study duration
- It used both descriptive analysis and logistic regression analysis

7.2Limitations

- Being retrospective made it difficult to assess the challenges in managing patients on issues not documented on charts
- Being a single center
- Non-computerized data collection methods like manual HSMIS revision and chart revision
- Culture results are not collected on patients charts.

8.CONCLUSIONS AND RECOMMENDATIONS

8.1 Conclusion

A one year cross-sectional retrospective study was conducted on a tertiary hospital found in Addis Ababa, Ethiopia. The prevalence of hospital acquired infection was 37.5%. Upon multivariate regression analysis HAI was found to be significantly associated with Sedation, presence of a central line, previous antibiotics use, and GI prophylaxis. We need other studies be done on how to implement and evaluate adequate infection prevention plans. Furthermore, priority should be given to implementing an effective infection control team. Hospital management and the Ministry of Health should give precedence to this high rate of nosocomial infection and implement infection prevention control programs.

8.2 Recommendation

For health care providers

- To practice a habit of proper documentation on management processes and responses to each treatment patterns with specified time.
- Proper documentation on reasons not to implement necessary or indicated management protocols.

To hospital administrators and MOH

To consider initiation of advanced management options like thrombolysis, PCI.

- For further expansion of the hospital ED, ICU and other departments for proper and timely disposition of ED patients.
- To implement computerized information and data entry system at the hospital for medical record purpose.

For Researchers

- If feasible to conduct a prospective study in order to identify the challenges and obstacles to manage patients properly and to analyze their level of significance with the outcomes.

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10. Annex

1. Mrn
2. Age in month
3. Sex
 - A. Male
 - B. Female

4. Address

a. Rural

b. Urban

5. Nutritional status

a. Normal

c. Severe malnutrition

b. Moderate malnutrition

d. Not recorded

anthropometric measurement

Weight

Height

Muac

6. Source of admission

a. Emergency

c. Or

b. Ward

d. Other hospital

7.reason for admission\dx at time of admission to icu

Primery diagnois

Secondery diagnosis

I.	Rf	XIX.	Hyperkalemia	XXXVII.	Upper airway
II.	Bronchiolities	XX.	Aki		obstruction
III.	Scap	XXI.	Ckd	XXXVIII.	Coanal atresia
IV.	Croup	XXII.	Uremia	XXXIX.	Lons
V.	Hypovolemic shock	XXIII.	Hus	XL.	Multiorgan failure
VI.	Septic shock	XXIV.	Disminated staph	XLI.	Ards
VII.	Cardiogenic shock	XXV.	Cld	XLII.	Acute rheumatic
VIII.	Ugib	XXVI.	Acute asthma		fever
IX.	Post cpr	XXVII.	Ischemic stroke	XLIII.	Hypokalemia
X.	Complicated	XXVIII.	Afib	XLIV.	Rheumatic heart
	meningities	XXIX.	Svt		disease
XI.	Hepatic	XXX.	Biliary atresia	XLV.	Dka
	encephalopathy	XXXI.	Hypertensive	XLVI.	Hyponatremia
XII.	Coma		emergency	XLVII.	Sam
XIII.	Post op	XXXII.	Adhf	XLVIII.	Ovarian tumor
XIV.	Hematologic	XXXIII.	Chd	XLIX.	Diaphragmatic hernia
	malignancy	XXXIV.	Gbs	L.	Ards
XV.	Disminated tb	XXXV.	Raised icp	LI.	Cp
XVI.	Cardiac tamponade	XXXVI.	Forgien body	LII.	Rvi exposed
XVII.	Seizure disorder		aspiration		
XVIII.	Sjs				

8. Developed hai

- I. Yes
- II. No

9. Clinical features of hai

- a. Fever
- b. Dysuria
- c. Vomiting
- d. Cough
- e. Increased secretion
- f. Dyspnea
- g. Wound site discharge
- h. Change in mentation
- i. Hypothermia
- j. Hospital days before icu admission

11. Comorbidity

- I. Yes
- II. No

12. If yes what is the comorbidity

- I. Rvi
- II. Htn
- III. C. Dm
- IV. D. Renal disease
- V. E. Malignancy
- VI. F. Sam
- VII. G. Liver failure
- VIII. H. Congenital anomaly ...what is that
 - i. Cardiac disease
 - ii. Prematurity
 - iii. Others

13. Duration of icu stay_____

14. After how many days' patient develops hai_____

15. Gcs of patient during admission

- a. Gcs>13
- b. Gcs= 8-13
- c. Gcs<8

16. Was the patient on sedation in icu

17. Which sedation used

- a. Ketamine
- b. Fentanyl
- c. Propofol
- d. Morphine
- e. Diazepam

18. For how many days on sedation

- A. < 2day
- C. >7days

B. 2day- 7 days

19. Organ or system involved

- a. Neurology

b. Respiratory

f. Skin

c. Cardiac

g. Hemato oncology

d. Renal

h. Other

e. Gi

20. Mechanical ventilator

a. Yes

b. No

21. For how many days on mv

22. Need for reintubation

a. Yes

b. No

23. Need tracheostomy

a. Yes

b. No

24. Was the patient on steroid

A. Yes

B. No

25. Was the patient on chemotherapy

A. Yes

B. No

26. Was the patient on gi prophylaxis

A. Yes

B. No

27. Feeding type

A. Maintenance fluid

B. Oral feeding

C. Ngt feeding

28. For how many day patient was on maintenance fluid

A. <2days

B. 2day- 7days

C. >7days

29. Focus of infection

a. Chest

c. Tracitis

e. Skin

g. Gi

b. Cauti

d. Cns

f. Wound focus

h. Genitourinary

30. Previous antibiotic use

a. Yes

b. No

31. Presence of central line

a. Yes

b. No

32. Presence of urinary catheter

a. Yes

b. No

33. Drainage inserted

a. Yes

b. No

34. Drainage type

A. Chest tube

C. Cardiac windowing

B. Chest tap

D. Post op drainage

35. Presence of anemia

A. Yes

B. No

C. Not collected

36. Need for blood transfusion

A. Yes

B. No

38. Crp

A. Positive

B. Negative

C. Not done

39. Wbc count

a. Leukocytosis

c. Normal

b. Leukopenia

d. Not collected

40. Thrombocytopenia

A. Present

B. Not present

C. Not collected

41. Lp

A. Suggestive of infection

B. Not suggestive

C. Not done

42. Culture sent

a. Yes

b. No

43. Culture sent from

a. Blood

c. Csf

e. Wound culture

b. Urine

d. Tracheal aspirate

f. Chest tap⁷

Others site

45. Organism identified

a. Yes

b. No

44. If yes which organism identified

A. Acitinobacter

D. Entrobacter

G. Yeast cell

B. Klebsila pneumonia

E. Gram -ve rods

H.cons

C. S. Pneumonia

F. Citrobacter

9. gram +ve cocci

10. pseudomonas spp.

11. e.coli

45. Reinfection in icu stay

46. Sensitivity for indentified organism

47. Resistance for indentified organism

48. Which antibiotics prescribed during admission to icu

49. What antibiotics initiated after considering hai

For question 46- 49 use this

1. Ceftriaxone

2. Ampicilline

3. Cefotaxime

4. Vancomycine

5. Meropenem

6. Cefepime

7. Ceftazidime

8. Amikacine

9. Metronidazole

10. Cloxacilline

11. Fluconazole

12. Acyclovir

13. Azithromycin

ne

14. Gentamycin

15. Ciprofloxacin
line

16. Cotrimoxazole

17. Clindamycin
e

50. discharge from icu

a. Transfer to ward

b. Transfer to other hospital

c. Death

d. Left against medical advice

51. Duration of hospital stay

52. Readmission to icu

