



INCIDENCE OF HOSPITAL ACQUIRED INFECTION AMONG PEDIATRIC PATIENTS
ADMITTED TO ST PAUL'S HOSPITAL MILLENNIUM MEDICAL COLLEGE: PROSPECTIVE
FOLLOW UP STUDY

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Addis Ababa, Ethiopia,

2023



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A Thesis paper Submitted To The Department Of Pediatrics And Child Health In
Partial Fulfillment Of The Requirements Of Specialty Certificate In Pediatrics And
Child Health, St. Paul Hospital Millennium Medical College

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ACRONYMS AND ABBREVIATIONS

BMV Bag and Mask Ventilation

BSI	Blood Stream infection
CA-UTI	Catheter-Associated Urinary Tract Infections
CDC	Center for Disease Control and Prevention
CI	Confidence Interval
CLA-BSI	Central-Line–Associated Bloodstream Infection
CR	Catheter Related
CVC	Central Venous Catheter
HAIs	Health Care-Associated Infections
ICU	Intensive Care Unit
LMIC	Low and Middle Income Countries
MDR	Multi Drug Resistant
MV	Mechanical Ventilation
NIs	Nosocomial Infections
SPHMMC	St. Paul’s Hospital Millennium Medical College
SPSS	Statistical Package for Social Sciences
USA	United States of America
VAP	Ventilator Associated pneumonias
WHO	World Health Organization

Abstract

Introduction: Hospital-acquired infections are usually acquired after hospitalization and manifest 48 hours of admission. HAI are associated with increased morbidity and mortality, prolonged hospital stays, and unnecessary cost. Accurate diagnostics are critical for safe patient care and have additional impacts in our environment of value based payment, public reporting, and quality metrics, treatment overuse.

Objective: To assess Incidence of hospital acquired infection among pediatric patients admitted to SPHMMC Addis Ababa, Ethiopia, 2023.

Methodology: Institution based prospective follow up (cohort) study was conducted on admitted paediatric patients at ward and picu in SPHMMC from Aug 1- January 30, 2024. All patients aged 18 and lower who are admitted to the SPHMMC hospitals and fulfil inclusion criteria will be included in the study. Data was entered in to kobotoolbox and export to SPSS version 25.0 and was checked for missing values. Data was cleaned. Descriptive statistics such as frequency and percentages was done to describe and displayed in tables, graphs and charts. Mean was calculated. Binary logistic regression was done to see the adjusted significant

relation of each independent variable with dependent variables. Significant factors was identified based on To assess incidence, and associated factors and hospital acquired infections among paediatric patients admitted to SPHMMC Addis Ababa, Ethiopia 2023.

multi variety logistics regression in 95% confidence level at P-value less than 0.05.

Results: From a total of 735 patients ,539 pediatric patients had participated in this study after exclusion criteria was applied . Of these participants, 436(80.9%) were from the pediatric ward and the remaining were from PICU. 309(57.3 %) of patients were male in gender. Near half, 256(47.5%) of patients' age were between 1 and 5 years.The mean age per month was 18 months. During the study period, a total 106(19.7%) of patients were developed HAI . Among admitted to pediatric ward 17.7% of patients were developed HAI and 28.1 % of patients were developed HAI from total numbers of patients admitted to PICU. Among those patients, 8(7.5%) developed HAI at least two times. The mean time of diagnosis of HAI was 11.82 days. Sepsis of unknown focus(46.2%) and chest(41.5%) were the most frequently reported focus of HAI.Microorganisms were reported among 29(27.4%) participants with HAI .SAM, the presence underlying diseases, previous antibiotics use, and patient on mechanical ventilation had a statistical significant association with the development of hospital-acquired infection. On the other hand Anemia , patient on steroid , patient on NG tube and HIV positive had association with HAI but it was not statistically significant

Conclusion: SAM, the presence underlying diseases, previous antibiotics use, and patient on mechanical ventilation had a statistical significant association with the development of hospital-acquired infection

Key words: Hospital acquired , Incidence, Factors

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1. INTRODUCTION

1.1. Background

Hospital-acquired infections (HAI) are infections that are acquired after admission to a health care facility for another reason . The infection was not incubating at the time of admission and includes infections noticed after 48 hours of admission, after discharge, and occupational infection among the staff of the institution.(1,2).

World Health Organization has defined Healthcare-associated infections (HAIs) as infections that patients acquire while taking care of medical and surgical pathological situations. These are infections that develop while a patient is hospitalized, persist after discharge, and spread from and to health care providers(2–7).

Different microbial agents such as bacteria, viruses, fungi and parasites have the potential to cause hospital acquired infections. These include Staphylococci, Escherichia coli, Pseudomonas aeruginosa, Enterococci, fungi and to a smaller rate, viruses and parasites are also responsible for the majority of nosocomial infections. in addition, from the patient's own flora (endogenous infection) or from another person in the hospital (cross-infection) or contaminated inanimate sources can also be another sources of hospital acquired infections(5,8,9).

Hospitals acquired infections can affect patients in any settings where they receive care. However, HAIs are more common and serious in tertiary hospitals than other health care levels. Patients who seek care at tertiary hospitals are prone to HAIs because of paediatric patients reduced body defence, sever underlying disease, multiple times exposure to invasive devices and wide range spectrum of drugs(3,4,6).

This makes patients more than 10 folds likely to acquire hospital acquired infections with higher rate. On the other hand, patients tend to stay long in tertiary hospitals as average length of stay and acquired infection have synergic relation(5,8–10).

Hospital Acquired Infections (HAIs) management requires sets of procedures with appropriate prevention, early identification, and effective treatment(11–15).

Prevention practice is the core of HAIs management, with an objective to reduce transmission of infectious agents between patients and health workers through antimicrobial stewardship. Studies explored that significant decrement of HAIs was noticed through hand hygiene, care bundles, and safe antimicrobial use at tertiary care settings(16–18).

Currently, it is a growing public health problem which concerns both the medical and the general community, and a rising issue for patient safety and quality of care in every level. Most current efforts to reduce HAIs focus on strategies to prevent infection without addressing unnecessary testing or diagnostic error; however, a false-positive test result that provides

an erroneous diagnosis of an HAI may lead to increased cost and possible harm to the patient. Accurate diagnostics are critical for safe patient care and have additional impacts in our environment of value based payment, public reporting, and quality metrics, treatment overuse. From a patient care perspective, over diagnosis of HAIs could lead to inappropriate antimicrobial use and attendant unnecessary cost and risks antimicrobial resistance and adverse drug effects(50-52).

1.2. Statement of the problem

Hospital acquired infections are highly substantial, principal cause of morbidity and mortality in tertiary healthcare settings throughout the world. Even though there is wide range of approximation agreement, HIA have substantial socioeconomic load worldwide. When it comes to the low and middle income countries the burden rises to worst(19–21). Hospital acquired infection is undesired but leads to increased length of hospital stay, higher economic loss, adverse effect from added antibiotics, additional work burden for staffs, which finally results death to patients and economic load to their families. Medical legal issues might deal with professionals and the hospitals for unintended infection compensations(22,23).

Mortality among patients is associated to the type of infection they acquire, comorbidities, patient's clinical status, and application of invasive procedures, pneumonia, cardiovascular system infection, sepsis, and Multi Drug Resistant (MDR) microorganisms(24). Device Associated Hospital Acquired Infections (DA-HAIs) which arose secondary to invasive devices utilization in tertiary healthcare settings, considered highly prevalent and causes series health consequences(25,26).

Globally each year hundreds of millions of patients are affected by health care-associated infections(11–13). More than 12 million annual deaths of HAIs are recorded every year. Around 2 million healthcare associated infections from all types of microorganisms leads to around 100000 deaths in the USA, while more than 11.9 million deaths occurred in low and middle income countries(27–30).

Infection is the leading cause of death in Tertiary hospital care settings with mortality rates up to 60% and twice as much in those patients with HAIs(31). Study revealed that more than 30% of patients acquire infection in tertiary hospitals of developed countries while the magnitude of hospital acquired infection in low- and middle-income countries is 5% to 90% which is more than 3 fold higher than in high-income countries(11,32). In some developing countries tertiary hospitals contributed, up to 20 times higher than Germany and USA when associated with the use of central lines, ventilators and other invasive devices(19,20).

The incidence of HAI in Sub-Saharan Africa is very alarming ranging from 22 to 36% including at intensive care units. There are only few hospital studies in Ethiopia regarding health care-associated infections, which are not particular to Tertiary hospitals which showed that prevalence of HAI is high ranging from 7%

to 20%. a single study showed that Health care associated infections accounts 207.55per 1000 patient days(33–35).

Little is known about the prevalence and incidence of hospital acquired infections at tertiary hospitals in Ethiopia. To deal with it, you'll need to use proper evidence based diagnosis of HAI. Inappropriate or insufficient data that diagnosis HAI can have major effects for a patient's life, prolonged hospital stay as well as the formation of drug-resistant organisms and an increase in the financial burden. And therefore the main objective of this study is to assess hospital acquired infections at tertiary hospitals providing paediatrics care services in Addis Ababa, using prospective study design.

1.3. Significance of the study

It is described that HAIs are among the most significant primary cause of morbidity and mortality in healthcare settings throughout the world and Tertiary care health settings are the prominent place of acquiring infection. The results of this study will serve as a baseline data for program managers and decision makers working on infection prevention and control to design and implement essential interventions and adds knowledge regarding epidemiology health care acquired infections at tertiary hospitals.

This study provides data that helps to understand the incidence, and risk factors for hospital acquired infections at paediatrics treatment centres of tertiary hospitals.

The data generated in this study will serve as evidence base for future research, decision-making, and to develop and implement training packages and policy-related interventions. The findings of this study will also have paramount importance to leaders in both the health and educational sectors.

2. LITERATURE REVIEW

2.4. Incidence of hospital acquired infection

According to World Health Organization (WHO) global burden report of HAI more than 4 million patients affected every year in Europe, 1.7 million affected patients in USA. Approximately 30% of admitted patients were diagnosed as having at least one episode of HAI(36).

As high as 51% overall infected patients in intensive care units, most of these are health care associated infections approximately 30% of patients in tertiary hospitals found to had at least one episode of health care-associated infection and longer patients stay in an ICU, the more to acquire an infection(37).

From 2017 annual Epidemiological report of European Center for Disease prevention and Control on HCAI it stated that 8.3% of the patients admitted to ICU and with length of stay more than two days were presented with at least one HCAI and specifically 4% reported having BSI, 2% were UTI infected and pneumonia dominated by being 6% of this 97% associated with intubation. 98% of UTI episodes were associated with presence of a urinary catheter, 97% pneumonia episodes were associated with intubation, 37% of BSI episodes were catheter-related as well as 24% Staphylococcus aureus isolates were oxacillin-resistant(38).

According to a study conducted in United States of America (USA) Ohio, on the impact of Catheter-Associated Urinary Tract Infection (CA-UTI) in critically ill children in the paediatric intensive care unit, the mortality in the CA-UTI group was significantly higher (17%) compared with the control group (5%). In addition, PICU LOS, duration of mechanical ventilation, and hospital LOS were also significantly higher in the CA-UTI group. Finally, total hospital charges were also significantly greater in the CA-UTI group compared with the control group (6).

According to a study conducted Ethiopia, Addis Ababa, in total of 199(50.9%) study participants have had at least one healthcare-associated infection, with urinary tract infection 94(47.2%) and hospital-acquired pneumonia 89 (44.7%) among the common infections. Of all healthcare-associated infections, 112(56.3%) were device-associated infections. Among patients admitted to intensive care units for cases of respiratory failure, traumatic brain injury, and acute kidney injury, about 100 (50.2%), 39 (19.6%), and 59(29.6%) of them have developed a healthcare-associated infection respectively (26).

According prospective matched cohort study conducted at a Tertiary Care Public Hospital in India, from 100 patient followed 35% developed a single organ disease, 40% had double organ system involvement and in 25 % multiple systems. Ventilator associated pneumonia (VAP) was the most common HAI with 62% of total HCAs, followed by Central Line Associated Bloodstream Infection (CLABSI) (20.7%) and the least diagnosed was Catheter Associated Urinary Tract Infection(CAUTI) which was 17.2%, the most common isolated microorganism in the area was *Pseudomonas aeruginosa* 27.6% followed by *Staphylococcus haemolytic* and *E. coli* (39).

According to a study conducted in India, nosocomial infections rate is alarming and is estimated at about 30-50% of all hospital infections, from this study among 84 final analysed patients in Critical care unit 28(33.33%) has developed nosocomial infection majority stayed 3 to 5 days. Urinary tract infection is the commonest followed respiratory tract infection (40)

A retrospective study aimed to assess the epidemiology of infections in hospitals of admitted patients (29.5%), Incidence density rate; 70.3/1000 ICU days and commonest nosocomial infections were pneumonias (15.5%), urinary tract infections (8.9%), blood stream infections (8.2%) and surgical site infections (7%). *Pseudomonas aeruginosa* and *Acinetobacter baumannii* most common isolates microbes (41).

A prospective surveillance, conducted in China showed that 7.57%(8.9 per 1000 days) of an overall prevalence of HAI in respiratory intensive care unit. While, lower respiratory tract, urinary tract and bloodstream accounted the highest prevalence (43.1, 26.5 and 20.6%, respectively. besides majority (85.29) resulted from invasive device. *Pseudomonas aeruginosa* (10.7), *Klebsiella pneumonia* (16.4%) and *Staphylococcus aureus* (20.9%) were the most frequently isolated pathogens in ascending prevalence rate (42). Another study in Zhe-jiang University teaching Hospital in china identified the overall rate of 32.48% from 1,718 care recipients particularly respiratory tract infection (RTI) accounted for 64.75% of total NIs, followed by urinary tract infection (UTI) for 9.4% and bloodstream infection (BSI) for 7.96%. Of the 558 patients with NI (71.4%) were gram-negative aerobic bacilli and followed by gram-positive aerobic bacilli (19.26%).(26) In Brazil, Sao Paulo, prevalence of HAI in ICU was 30.6%. Respiratory infection was most frequently reported (58.5%) and The most frequently isolated bacteria were Enterobacteriaceae (33.8%), *Pseudomonas*

aeruginosa (26.4%), and *Staphylococcus aureus* (16.9%; [100% resistant to methicillin(43).

A Romania's prospective, clinical observational study done by enrolling 125 hospitalized patients stated that incidence of nosocomial infections was 19.1% and the most common HCAI and pathogen were pneumonia and *Acinetobacter baumannii*(44).

An observational case study of hospital associated infections in a critical care unit in Astana Kazakhstan aiming to assess the rate of device-associated infections and causative HAI etiological agents showed that BSI, 24.6% (28) & 18.5% (25), VAP 25.4% (29) & 29.6% (40), UTI 19.3% (22) 18.5% (25) and the last but the commonest HCAI SSI 30.7% (35) & 33.3% (45) with their respective study period. The pre-dominantly isolated microorganisms were gram-negative pathogens, including *P. aeruginosa*, *K. pneumonia*, and *E. coli* (45).

A study conducted in west Africa Nigeria, the prevalence of hospital acquired infections was 12.0% in the Intensive Care Unit of University of Ilorin Teaching Hospital, Ilorin Nigeria and in another prospective cohort study of Nigerian Lagos University Teaching Hospital (LUTH) 71 patients were recruited with a prevalence of 45% healthcare associated infection rate representing an incidence rate of 79/1000 patient-days in the intensive care unit and the most common infections were (BSI) 49.0% (22/71) and urinary tract infections (UTI) 35.6% (16/71) with incidence rates of 162.9/1000 patient-days and 161.6/1000 patient-days respectively. From the isolated microorganisms *Staphylococcus aureus* was the most common cause of BSIs, responsible for 18.2% of cases, while *Candida* spp. was the commonest cause of urinary tract infection(46).

One study in Uganda of analysed result of 111 patients and 32(28.82%) patients got intensive care acquired infection, about 52 pathogens isolated i.e. K. pneumonia, Acinetobacter species, S. aureus, P. aeruginosa and Enterobacter species in descending order of most seen. Antimicrobial susceptibility patterns of the 9 isolated organisms were checked and the lowest susceptibility rates were to cephalosporin, ciprofloxacin and gentamycin and the highest were found to be to the amikacin, vancomycin and imipenem (47).

According to a study conducted in in Jimma, western part of Ethiopia, a longitudinal study of 1069 hospitalized patients was enrolled for the study in the entire tertiary hospital. The overall incidence rate of HAI at Jima university medical college was known to be 28.15 (95% C.I 24.40, 32.30) per 1000 patient days with the prevalence of 19.41% (195/992) (95% C.I: 16.97, 21.85) simultaneously the highest incidence rate was registered in ICU (207.60, 95% C.I:133.40, 309.10) per 1000 patient days of total 22 patients admitted to ICU.UTI and SSI were listed by being the commonest health care associated infections (48).

2.5. Factors associated with incidence of hospital acquired infections among pediatrics patients admitted to tertiary hospitals

WHO report revealed that hospital stay longer than seven days, placement of a central venous catheter, indwelling urinary catheter, or an endotracheal tube, undergoing surgery, trauma-induced immunosuppression, neutropenia and a rapidly or ultimately fatal disease and impaired functional or coma was associated with hospital acquired infections at tertiary level health care areas (37).

Extrinsic risk factors associated with increased incidence of Central-Line–Associated Are Bloodstream Infections (CLABSI), increased length of stay before pvc insertion, multiple pvc, parenteral nutrition while being males associated with

an increased risk of CLABSI, hematologic, oncologic, cardiovascular, and gastrointestinal diseases associated with higher incidence of CLABSI among intrinsic risk factors. Indwelling urinary catheters that are connected to a closed collection system to drain urine considered to be risk factor for CA-UTI in the other hand SSIs are associated with intraoperative blood transfusions, diabetes, and steroid use (49).

A study conducted in northern India showed that pre-admission infection AOR (3.33), diabetes requiring insulin AOR (1.20), endotracheal tube AOR (20.98), tracheostomy tube (AOR)11.32 and TPN AOR (2.98) were significant risk factors of hospital acquired infection (41).

Another study conducted in china revealed development of HCAI was associated with length of stay (≥ 30 d vs. < 30 d; 95% CI=15.842~18.099; $P<0.05$), urinary catheter (used vs. unused; 95% CI=6.815~7.783; $P<0.05$), blood catheter (used vs. unused; 95% CI=7.385~8.371; $P<0.05$) and ventilator (used vs. unused; 95% CI=6.842~7.730; $P<0.05$).

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3. OBJECTIVES

3.4. General objective

- Incidence of hospital acquired infection among pediatric patients admitted to SPHMMC Addis Ababa, Ethiopia, 2023.

3.5. Specific objectives

- To assess incidence of hospital acquired infection on pediatric patients admitted to SPHMMC , Addis Ababa, Ethiopia, 2023.

- Assessment of factors associated with hospital acquired infection incidence pediatric patients admitted to SPHMMC's Addis Ababa, Ethiopia, 2023.

4. METHODS AND MATERAILS

4.1 Study area

This research was take place in the pediatric patients ,admitted at Saint Paul Hospital Millennium Medical College. SPHMMC is based in Addis Ababa, Ethiopia's capital -city. SPHMMC teaching hospitals and provide services to paediatrics and child health care with advanced laboratory and paediatrics care

service units including, intermediate and Intensive care units that can primarily chose as study area advanced laboratory and paediatrics care service units including, intermediate and Intensive care units that can primarily chose as study area.

4.2 Study design

Institutional based prospective cohort study design was conducted .

4.4. 4.3 Study period

The study was conducted from from Aug1- January 30, 2024. (6 month follow up study) and the rest of the activities from proposal development up to analysis

4.5. Populations

4.5.1 Study population

All paediatric patients who were admitted to SPHMMC during the study period but not admitted to other hospital in the past one month prior to their current admission

4.6. Inclusion and exclusion criteria

4.6.1 Inclusion

Padiatric patients who were admitted to SPHMMC during the study period and who were not admitted to any hospital one month prior to their current admission.

4.6.2 Exclusion criteria

Those who were not be willing to provide consent to participate in the study
Enrolled patients who showed signs of infections and/or symptoms of infection within the first 48 hours were excluded from the study.

4.7 Sampling technique and Sampling procedure

All paediatric patients who were admitted to SPHMMC during the study period but not admitted to other hospital in the past one month prior to their current admission.

To select the study participants, all patients aged 18 and below was assessed sociodemographic and clinical data was collected through a structured questionnaire using individual patient chart investigation approach, accordingly, a detailed clinical history of patients was taken and recorded. Patients with no new signs or symptoms of infection after the first 48 hours from admission was included and followed prospectively for the development of HAIs during their stay in the hospitals.

Data was collected from enrolled patients on a daily basis. children were followed by a paediatrician daily, charts was reviewed, and discussions with nurses and physician caring for the patients was held. Hospital acquired infections confirmed by senior paediatrician specialists working in the respective PICU and paediatric wards.

4.8 Variables

4.8.1 Dependent Variable

Hospital acquired infections at SPHMMC hospital

4.8.2 Independent variables

- Prior antibiotic therapy
- Immunosuppression therapy
- Co-morbidity
- Presence of mechanical ventilation

- Presence of blood transfusion
- Presence of urinary catheter
- Presence of central line ,NG tube and driange tube
- Length of hospital stay
- Age
- Sex
- Organism isolation

4.9 Operational definition

- HAI: a localized or systemic condition that results from an adverse reaction in the presence of an infectious agent or its toxin, and occurring 48 hours or longer after hospital admission, which was not incubating at the time of admission (16,26).
- Severe anemia: hemoglobin <50 g/L (for patients older than 28 days) or hemoglobin <90 g/L (for neonates) (16,26).
- Septicaemia (blood stream infection); Fever or rigors and at least at least one positive blood culture and
- Nosocomial pneumonia; recent and progressive radiological opacities of the pulmonary parenchyma, purulent sputum, and recent onset of fever
- Confirmed diagnosis; Diagnosis made by the clinical judgment of practitioner based on evidences (specific criteria's) such as imaging, laboratory findings and clinical manifestations appropriate to specific infected area (16,26).

- Previous antibiotic use defined as received antibiotics within the past 3 months
- Suspected diagnosis; Diagnosis made by the clinical judgment of practitioner without adequate evidences of imaging, laboratory findings and appropriate clinical manifestations appropriate to the site of infection.
- Ventilator Associated Pneumonia; is hospital acquired pneumonia that presents more than 48 hours after exposure to invasive ventilation through endotracheal or tracheostomy opening.

4.10 Methods of data collection

4.10.1 Data collection tool

Data was collected by resident working at ward and picu . In this study, the usage of any antimicrobials and information on the use of different medical devices at the time of hospital admission and before the diagnosis of HAIs was recorded. The data collection tool was adopted from a previous prospective study conducted in south east Ethiopia, Goba hospital(16). The tool contains 52 questions including all the variables considered.

4.11 Data analysis

Data was entered in to kobotoolbox and export to SPSS version 25.0 and was checked for missing values. Data was cleaned.

Descriptive statistics was done to describe frequency and percentages and displayed in tables, graphs and charts. Measure of central tendency (mean) was calculated. Binary logistic regression was done to see the crude significant

relation of each independent variable with dependent variables. Then independent variables found significant was entered in to multivariate logistic regressions to control the effect of confounding variables. Significant factors was identified based on AOR, include in 95% confidence level at P-value less than 0.05.

4.12 Ethical consideration

Ethical clearance was obtained from institutional review board of SPHMMC, department of paediatrics and child health department research committee. . Informed written consent was obtained from all study participants parents. Participants was informed about the objective of the study.

After information is provided to patient's families about purpose of the study, non-invasiveness of the data collection procedure, confidentiality of the information and respondents were reassured that they would be anonymous (unnamed). Then respondents was given a chance to ask anything about the study and free to refused or stop at any moment they want if they didn't want to continue.

4.14 Dissemination and utilization of result

Since the primary objective of this paper is for partial fulfillment in the requirements to specialty certificate in paediatrics and child health: it will be presented and submitted to St. Paul hospital millennium medical college SPHMMC department of Department of paediatrics and child health. . Presentations at professional, local, national and international meetings and publication in peer reviewed national or international journals will be attempted.

5. RESULTS

5.1 Socio-demographic characteristics of study participants

From a total of 735 patients ,539 pediatric patients had participated in this study after exclusion criteria was applied. Of these participants, 436(80.9%) were from the pediatric ward and the remaining were from PICU. More than half, 309(57.3 %) of patients were male in gender(fig 1).

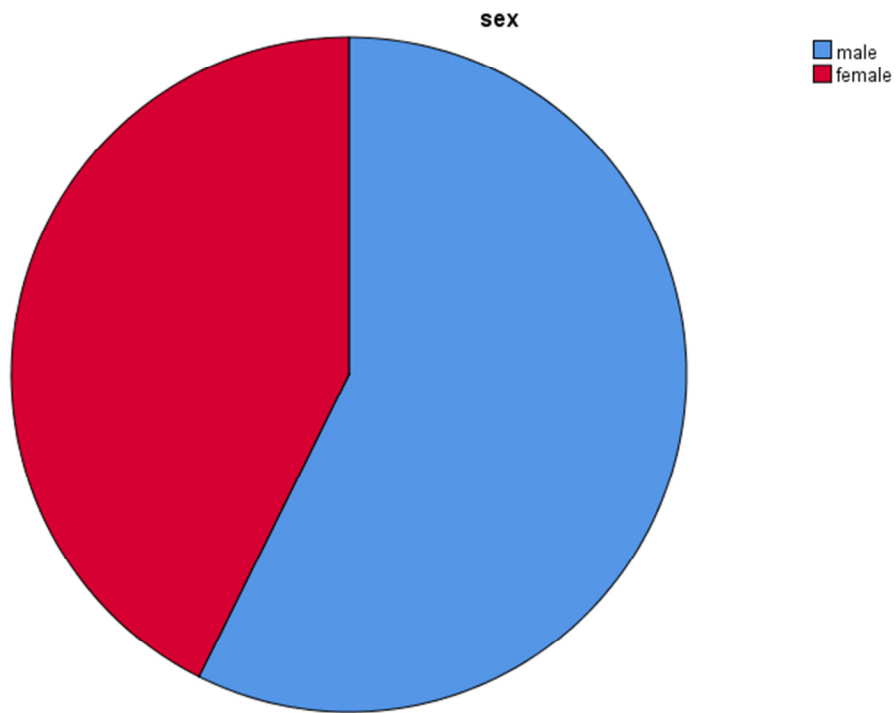
Median age was 1 year and 6 months (varied from 1 month to 14 years). Near half, 256(47.5%) of patients' age were between 1 and 5 years(table 1).

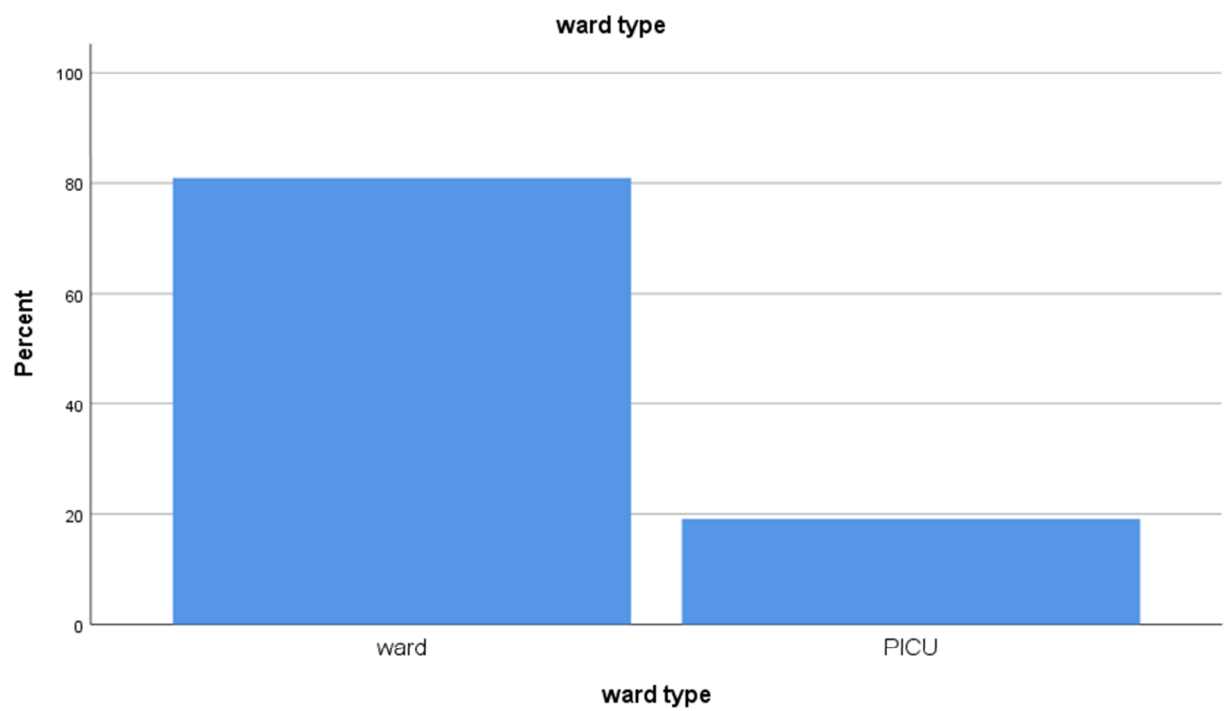
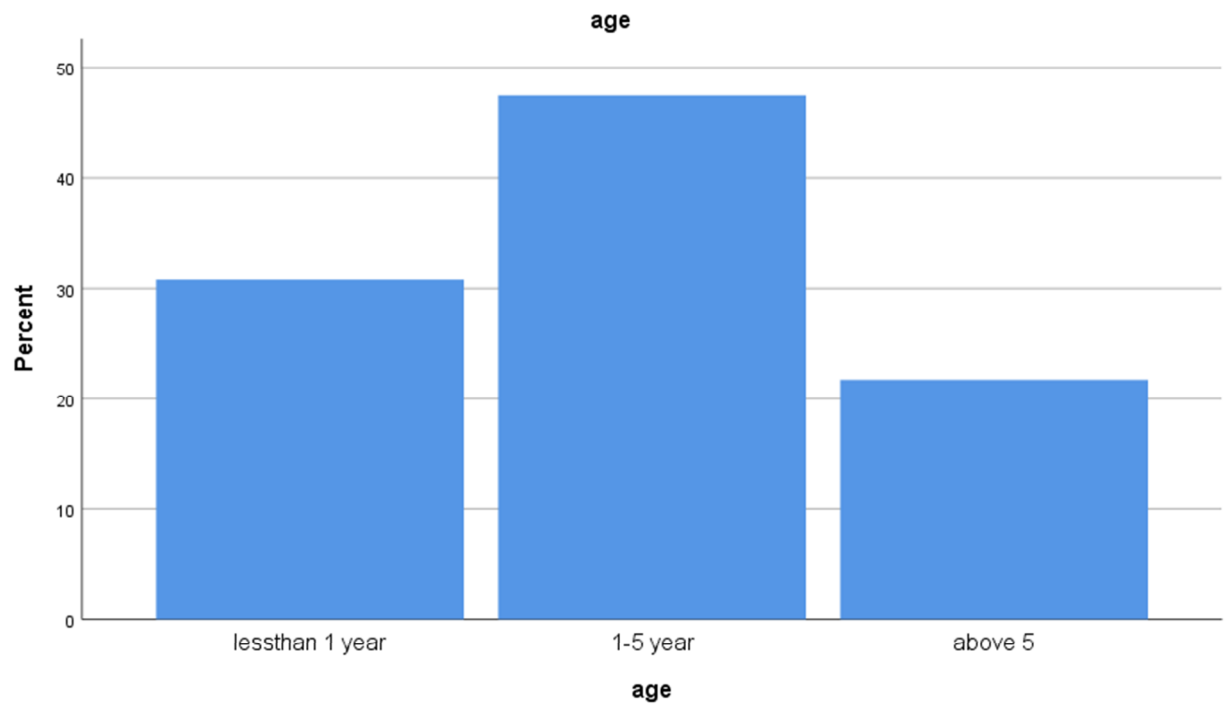
The median hospital stayed of the patients was

Table 1: Sociodemographic characteristics of study participants

Variables	Category	Frequency	Percentage
Sex	Male	309	57.4%
	Female	230	42.7%
Age	Less than 1 year	166	30.8%
	1-5 year	256	47.5%
	Above 5	117	21.7%
ward	Ward	436	80.9%

	PICU	103	19.1%
Hospital stay	Less than 7 days	256	47.5%%
	7-14 days	161	29.9%%
	Above 14	122	22.6%%





5.2 Clinical characteristics of the study participants

In this study, 32.1% of patients had underlying diseases and 28.0% of patients were received antibiotics within the past 3 months. SAM was diagnosed in 91(16.9%) of patients at the time of diagnosis and 32(5.9%) of patients had severe anemia(table 2).

Table 2 : Clinical characteristics of the study participants

Variables	Category	Number of patients
Previous antibiotic use	Yes	151(28.0%)
	No	388(72.0%)
SAM	Yes	91(16.9%)
	No	448(83.1%)
Severe anemia	Yes	32(5.9%)
	No	507(94.1%)
MV	Yes	87(16.1%)
	No	452(83.9%)
Urinary catheter	Yes	24(4.5%)
	No	515(95.5%)
Central IV line	Yes	23(4.3%)
	No	516(95.7%)

Drainage tube	Yes	23(4.3%)
	No	516(95.7%)
NG tube	Yes	169(31.4%)
	No	370(68.6%)
HIV status	Yes	13(2.4%)
	No	526(97.6%)
Underlying disease	Yes	173(32.1%)
	No	366(67.9%)
Patient on Steroid	Yes	26(4.8%)
	No	513(95.2%)
Patient on chemotherapy	Yes	9(1.7%)
	No	530(98.3%)

5.3 Incidence and HAI types

During the study period, a total 106(19.7%) of patients were developed HAI and majority 77(72.6%) of patients were from pediatric ward. Among admitted to pediatric ward 17.7% of patients were developed HAI and 28.1 % of patients were developed HAI from total numbers of patients admitted to PICU. Among those patients, 8(7.5%) developed HAI at least two times. The mean time of diagnosis of

HAI was 11.82 days which ranges from 2 days up to 34 days and the mean length of stay after diagnosis of HAI was 31.4 days ranges from 8 to 90 days.

Sepsis of unknown focus(46.2%) and chest(41.5%) were the most frequently reported focus of HAI.among the diagnosis of chest focus 25% had chest x ray suggested (illustrated table 3).

During diagnosis, commonest clinical symptoms were fever (87.7%) , increase work of breathing(40.6%) and neurological symptoms(3.8%). Majority of patients(48.1%) had normal WBC count and 43.4% of patients had leukocytosis.

Microorganisms were reported among 29(27.4%) participants with HAI and the pattern of of pathogens were commonly identified from blood (22.6%) and tracheal secretions(7.5%) which, 2 cases were positive from both blood and tracheal secretion sample. The three commonest reported microorganisms were acinetobacter(12.3%), klebsiaella(6.6%) ,E.coli(4.7%) and CONS 4.7%

The most commonest responsible microorganism for chest was acinetobacter followed by klebsiaella. For patients treated as unknown focus culture was positive in 4 cases among 49 cases.

Table 3 HAI types

Percentage of HAI by infection types			
HAI types		Number	Percentage
Focus	of	49	46.2%
unknown			

Chest	44	41.5%
LONS	4	3.8%
Neurology	4	3.8%
Urinary	2	1.9%
Skin	2	1.9%
GI	1	0.9%

Table 4 clinical characteristics of patients diagnosed with HAI

Variables	Unknown focus(49)	Chest(44)	Neurology(4)	LONS(4)
Fever	43	40	2	4
Increase work of breathing	15	25	2	1
Neurologic symptoms	0	0	4	0
Leukocytosis	10	30	4	-
leukopenia	4	5	-	-

CXR	abnormal	-	11	-	-
	Normal	-	33	-	-
Culture	+ve	6	21	0	0
	-ve	37	19	3	4
acinetobacter		1	11	0	0
klebsiella		0	6	0	0
pseudomonas		0	2	0	0
E.coli		0	4	0	0
CONS		1	3	0	0
enterococcus		2	0	0	0

Factors associated with HAI

Table 5 showed the risk factors of HAI among pediatric patients admitted to SPHMMC at PICU and pediatric ward.

Multivariate and binary logistic regression model was used, and it was revealed that SAM, the presence underlying diseases, previous antibiotics use, and patient on mechanical ventilation had a statistical significant association with the development of hospital-acquired infection. On the other hand Anemia , patient on steroid , patient on NG tube and HIV positive had association with HAI but it was not statistically significant.

variables (n=539)	Category	HAI		AOR	P value
		No	Yes		
Age	Less than 1 year	129	37	0.835(0.305-2.282)	0.933
	1-5 years	218	38	0.616(0.326-1.166)	0.137
	Above 5 years	86	31	0	
sex	Male	239	70	0.274(0.094-0.797)	0.018

	Female	194	36			
Ward type	Ward	359	77	1.301(0.416-4.605)		0.651
	PICU	74	29			
Hospital stay	Less than 7 days	256		0.007(0.03-0.19)		0.000
	7-14 days	161				
	Above 14 days	122				
Anemia	No	408	99	3.486(0.259-46.851)		0.346
	yes	25	7			
Drainage tube inserted	No	412	104	0.984(0.070-13.836)		0.990
	Yes	21	2			
Urinary catheter	No	419	96	0.476(0.103-2.207)		0.343
	yes	14	10			
Central line	No	412	95	0.419(0.055-3.198)		0.401
	Yes	11	12			
Previous antibiotics use	No	376	4	420.016(109.192-1615.631)		0.000
	Yes	57	102			
NG tube	No	323	47	2.269(0.862-5.969)		0.097
	Yes	110	59			
Pt on	No	427	103	2.235 (0.541-9.237)		0.267

chemo.	yes	6	3		
Pt on steroid	No	412	101	1.116(2.259-30.662)	0.881
	Yes	21	5		
Pt on mech. Ventilator	No	382	86	3.588(1.029-12.506)	0.045
	yes	51	20		
Underlying disease	No	325	41	8.483(3.185-22.590)	0.000
	Yes	108	65		
HIV status	No	427	99	1.002(0.094-10.663)	0.999
	Yes	6	7		
SAM	No	370	78	2.347(1.370-4.022)	0.002
	Yes	63	28		
Received blood transfusion	No	347	91	1.117 (0.282-4.421)	0.874
	Yes	86	15		

DISCUSSION

HAIs are current global challenges that increase morbidity, mortality and massive economic cost. Yet, there remain limited data on the occurrences of HAIs in hospitalised paediatric patients in Ethiopia. This study was designed to determine the incidence and factors associated with hospital acquired infection incidence pediatric patients admitted to SPHMMC's at ward and picu . Among admitted to pediatric ward 17.7% of patients were developed HAI and 28.1 % of patients were

developed HAI from total numbers of patients admitted to PICU. The overall incidence rate of HAI was 19.7% during 6 month follow up. Children who stayed longer than the median day (8 days) in the hospital, and children with underlying disease conditions, previous antibiotics use, and patient on mechanical ventilation had higher risks of developing HAIs

In this study, the overall incidence rate of HAIs was 19.7%. This finding is higher than a related prospective study in southeast Ethiopia (12.7%), west Africa Nigeria (12.0%). The possible reason behind may be the nature of study participants in the ICU; comorbid diseases, poor nutritional status. Also lower than in India, (30-50%) of all hospital infections, Critical care unit 33.33%, Nigeria (45%), Egypt (27.7%), Serbia (32.7%) may be due to the disparities in quality of care, weak infection prevention mechanism implementation, and the type of patients where NI was assessed. This is comparable to those reported from a study in Romania's prospective, clinical observational study incidence of nosocomial infections (19.1%) and in Jima university medical college (19.41%).

Sepsis of unknown focus (46.2%), and chest (41.5%) were the most frequently reported focus of HAI. Among the diagnosis of chest focus 25% had chest x ray suggested, this may be over diagnosis of hospital acquired hospital

Microorganisms were reported among 29 (27.4%) participants with HAI. The three commonest reported microorganisms were acinetobacter (12.3%), klebsiella (6.6%) and E. coli (4.7%)

In our findings, SAM, the presence underlying diseases, previous antibiotics use, and patient on mechanical ventilation had a statistically significant association with

the development of hospital-acquired infection This was consistent with the finding from another study in Ethiopia.

Limitations of the study

- we did not assess the healthcare workers' infection prevention practices that would have been associated with the prevalence of HAIs.
- the researchers did not examine the number of HAIs after the patients were discharged.
- we focused on a small number of risk factors for HAIs and some important variables were not included.
- Being a single center

CONCLUSIONS

The present study revealed that the cumulative incidence the overall incidence rate of HAIs was 19.7% . Length of stay in the hospital children with underlying disease conditions , previous antibiotics use, and patient on mechanical ventilation had higher risks of developing HAIs

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1.ANNEXES

1.1. ANEX I. Information sheet and consent form

I. Information sheet

Hello dear?

Dear respondent my name is _____ I am here to collect data for a study

entitled, “Hospital acquired infections among paediatric patients admitted to SPHMMC in Addis Ababa, Ethiopia, 2023 prospective follow up study.” The study is being conducted by Dr. Bamlaku Dagnaw who is paediatrics Graduating Resident at SPHMMC. For this study you are selected as a participant and before

getting your consent or permission of your participation, you need to know all necessary information related to the study.

Thus, this information will be detailed as the objective of this study is to assess Incidence of Hospital acquired infections among paediatric patients who admitted to SPHMMC prospective follow up study. You are being asked to take part in this study and to respond sincerely. This questionnaire focuses on assessing Incidence of Hospital acquired infections among paediatric patients admitted to SPHMMC in Addis Ababa, Ethiopia, 2023 prospective follow up study, your cooperation and willingness is greatly helpful in identifying problems in the mentioned area.

There is no possible risk with participating in this study. Your name will not be written in this form and for all the information you give us will be kept confidentially. Your participation is voluntary and if you feel discomfort with any of the questions it is your right to drop or stop filling the questionnaire. If you have questions regarding this study or if you wish to know the result after its completion, its pleasure to give you our phone number. Please contact the principal investigator

Dr. Bmalaku Dagneu

Tell no:

Are you willing to participate in this study? If yes, please proceed to consent form.

Thank you

II. Consent form

In signing this document, I am giving my consent to participate in the study entitled, “Hospital acquired infections among paediatric patients admitted to SPHMMC in Addis Ababa, Ethiopia, 2023 prospective follow up study” I have

been informed that the objective of this study is to assess Incidence of Hospital acquired infections among paediatric patients admitted to SPHMMC.

I have understood that participation in this study is completely voluntarily. I have been told that my answers to the questions will not be given to anyone else and no reports of this study ever identify me in any by any means. I understood that participation in this study doesn't involve risks except the time spent for completing the questionnaire.

I understand that Dr. Bamlaku Dagnew is the contact person and if I have questions about the study or about my rights as a study participant the following is the contact address.

Address of principal investigator: Dr. Bamlaku Dagnew

Mobile no:

Email:

Participants signature: _____ date: _____

Thank you for your willingness to participate!!

1.2. Questionnaire (cohort checklist)

1. Patient ID/CODE

2. Ward_____ Bed number

_____MRN_____

3. Age _____

4. Sex _____

5. Reason for admission/Dx. at the time of admission

6 If she/he develop HAI? A. Yes_____ B. No_____

If yes

A After how many day of hospital admission _____

B How HAI made_____

If microbiological confirmation ,which organism_____

Sensitivity and resistance antibiotics _____

C which antibiotic prescribed

_____ and total duration of antibiotics _____

D Hospital stayed and outcome _____

7 . Previous antibiotic use for the current illness A. Yes _____ B.

No _____

If yes for question ,
specify _____

for how many days? _____ days

8 Being on mechanical ventilator? A. Yes _____ B. No _____

If yes for how many days _____

9. Presence of intravenous line? A. Yes _____ B. No _____

If yes central line or peripheral line _____

10 Presence of urinary catheters? A. Yes _____ B. No _____

If yes, for how long _____

Indication for catheterization _____

11. Drainage inserted? A. Yes_____ B. No_____

If yes, for how long _____

Indication for drainage _____

12 NGT A. Yes_____ B. No_____

If yes for how long _____

13 . Underlying diseases? A. Yes_____ B. No_____

14 . If yes, underlying diseases (more than one answer is possible)

i. Diabetes mellitus vi. Cardiac disorders

ii. Chronic renal failure vii. Severe malnutrition (SAM)

iii. Hypertension viii. TB

iv. Chronic liver disease ix. Cancer

v. HIV/AIDS x. Others (specify)

15 . Severe anaemia [haemoglobin <50 g/L (for patients older than 28 days) or
haemoglobin

<90 g/L (for neonates)]

A. Yes_____ B. No_____ C. Unknown/not
tested_____

16. Immune deficiency(ANC ,and others) A. Yes_____ B. No_____ C.
Unknown/not tested_____

17. Nutritional status _____

18 Received blood transfusion A yes _____ B No _____

19 steroid use A Yes _____ B No _____

If yes how many days _____

20 HIV status A. Reactive B. Non-reactive C. Unknown

21 Chemotherapy A Yes _____ B No _____

22 Duration of Hospital stayed _____

Name of data collectors: _____ Signature _____ date

Name of supervisor _____ Signature _____ date