"INCIDENCE OF HOSPITAL ACQUIRED INFECTIONS IN PATIENTS ADMITTED TO PAEDIATRIC EMERGENCY WARD OF A TERTIARY CARE CENTRE: A ONE YEAR LONGITUDINAL STUDY"

By

REG NO: BI0116003

Dissertation

Submitted to the K.L.E. Academy of Higher Education and Research,

Belagavi, Karnataka

In partial fulfillment of the requirements

for the degree of

DOCTOR OF MEDICINE (M.D)

IN

MICROBIOLOGY

DEPARTMENT OF MICROBIOLOGY,

JAWAHARLAL NEHRU MEDICAL COLLEGE,

BELAGAVI, KARNATAKA, INDIA– 590010

APRIL - 2019

KLE Academy of Higher Education and Research,

BELAGAVI

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This is to certify that the dissertation entitled **"INCIDENCE OF HOSPITAL ACQUIRED INFECTIONS INPATIENTS ADMITTED TO PAEDIATRIC EMERGENCY WARD OF A TERTIARY CARE HOSPITAL: A ONE YEAR LONGITUDINAL STUDY"** is a bonafide research work done by **REG NO: BI0116003**.

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LIST OF ABBREVIATIONS

CAUTI	Catheter Associated Urinary Tract Infection
CLABSI	Central Line Associated Blood Stream Infection
CVC	Central Venous catheter
HAI	Hospital Acquired Infection
ICU	Intensive Care Unit
MDRO	Multi Drug Resistant Organism
NABH	National Accreditation Board for Hospitals
NICU	Neonatal Intensive Care Unit
PICU	Paediatric Intensive Care unit
PED	Paediatric Emergency Department
RTIs	Respiratory Tract Infections
Spp.	Species
SPS	Sodium Polyanethole Sulfonate
SSI	Surgical Site Infection
UTI	Urinary Tract infection
VAP	Ventilator Associated Pneumonia
WHO	World Health Organization

ABSTRACT

Introduction:

Healthcare-associated infections (HAIs) are an important cause of morbidity and mortality among critically ill patients of all age groups. This prospective surveillance study was performed to estimate the burden of HAIs in a paediatric emergency department of a tertiary care multispecialty hospital. For developing countries, active surveillance is essential to reduce the burden of HAIs in high risk groups.

Objectives:

1. To know the incidence rate of HAI in patients admitted to Paediatric emergency ward.
2. To isolate and identify bacteria causing HAI with special emphasis on Antibiotic sensitivity.

Materials and Methods:

The prospective study was conducted in a twelve-bedded paediatric emergency ward of a tertiary care hospital for one year. Patients were assessed daily during their stay in emergency ward. Detailed data including the clinical diagnosis, invasive device usage, Length of stay (LOS), antibiotics administered and clinical outcome was taken for children who were admitted in emergency unit for more than 48 hours. All statistical analysis was performed using software (STATA 9.0 Corp. College Station, TX, USA). Clinical outcome variable in the form of length of stay was calculated using Mann Whitney Standard U test.

Results:

Of the 410 patients, 5 patients developed 8 episodes of HAI, which is a crude incidence rate (CIR) of 1.95%. Crude incidence rate of VAP, CLABSI and CAUTI was 33.33%, 16.6% and 0% respectively. Incidence density of site specific HAI was found to be 0% for CAUTI, 8.7% for CLABSI, 24.53% for VAP and 16.4% for SSI. The mean LOS of admitted patients was 7.43 days and 49.8 $\pm$ 30.73 days in patients who developed HAI. Acinetobacter baumanni, Citrobacter freundii and Klebsiella pneumoniae were the most common isolated pathogens in HAI patients. 7 out of 8 pathogens in HAI patients were found to be multi drug resistant.

Conclusion:

The incidence rate HAI in paediatric emergency ward is 1.95%. Gram negative bacilli are the predominant pathogen causing HAI, with VAP being the most common type of HAI. Length of stay is found to be the major risk factor for acquiring HAI, among the factors studied. Multi drug resistance further narrows down the possibility of recovery, though all the patients in this study have recovered.

Key words: HAI, VAP, SSI, CLABSI, CAUTI, Paediatric Emergency Ward

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INTRODUCTION

Nosocomial infections, or hospital-acquired infections or healthcare associated infections (HAI), are one the most significant causes of morbidity and mortality in healthcare settings throughout the world.[1,2,3]In developing countries, the magnitude of this problem remains underestimated or even unknown largely because HAI diagnosis is complex and surveillance activities to guide interventions require expertise and resources.[4] Studies on the epidemiology and effectiveness of interventions to reduce HAIs are limited in developing countries, particularly in paediatric care.[5]

Hospitals in general and pediatric wards in particular are suited for transmission of infections through instrumentation, invasive procedures in vulnerable patients. Infants and toddlers frequently harbor infectious organisms and may shed pathogens, even when they are asymptomatic.[6] Young children are also susceptible to many infections because they have not yet developed immunity. Common invasive interventions in paediatric units include insertion of intravascular, urinary and peritoneal dialysis catheters, endotracheal tubes, nasogastric and gastrostomy tubes, as well as endoscopic and surgical procedures. Children become vulnerable to endogenous infections as a result of the breakdown of their normal defenses by these invasive procedures or intravenous therapies.[6,7,8] Behavioral characteristics of young children, such as incontinence, inadequate hygiene, frequent mouthing of hands and objects, drooling and direct contact between children during play, facilitate the spread of infection. The increasing acuity of illness in hospitalized children and invasive therapeutic advances have resulted in a patient population that is increasingly at higher risk for nosocomial infections.[7] Paediatric population has higher rates of catheter-associated bloodstream infections (BSIs), urinary tract infections (UTIs), and certain surgical site infections than adults.[8,9]

Healthcare associated infections (HAIs) in the Paediatric Intensive Care Units (PICUs) are a major clinico-managerial problem resulting in prolonged length of hospital stay, increased medical costs, and increased morbidity and mortality.[10,11] Only a few studies, based on prospective, patient-based surveillance have estimated the burden of HAI in the paediatric age group[13]. Majority of HAIs which occur in intensive care units are associated with the use of invasive devices such as a central line or mechanical ventilator. Central Line Associated Blood Stream Infection (CLABSI) and Ventilator Associated Pneumonia (VAP) are the leading contributors of increased costs of treatment in critical care, however, there is limited information available on costing of HAI in PICU from hospitals in India.[14]

Gram-negative bacilli represent a leading cause of serious HAI. Of particular concern is the capacity of Gram negative bacilli to accumulate co-resistance and cross resistance mechanisms to commonly used antimicrobial drug classes, which has culminated in the circulation of multidrug-resistant strains.[15] Depending on the infection site, Gram negative bacilli are the causative organism in 24% to ≥ 58% of cases reported for PICUs and neonatal intensive care units (NICUs).[16,17] It is not unexpected that the probability of encountering a multidrug-resistant Gram-negative pathogen is far higher in the ICU than in other patient-care areas, and also far higher in ICUs in developing than developed countries.[16,17]

Emergency Units are the busiest department of any hospital and it is invariably the first point of contact for all the inpatients. Emergency healthcare personnel are required to act swiftly under all circumstances and this forms a predisposing factor leading to the breach in protocols for HAI prevention strategies. There is no epidemiological data of HAI in the Paediatric Emergency Units (PEU). The aim of this study is to document the incidence of HAI in the Paediatric Emergency Ward of

a tertiary care hospital and determine epidemiological share of VAP, CLABSI, SSI and CAUTI. Also, in this study antibiotic sensitivity pattern of the isolates from HAI patients has been analyzed.

OBJECTIVES

1. To know the incidence rate of HAI in patients admitted to Paediatric Emergency Ward of a tertiary care centre.
2. To isolate and identify the bacteria causing HAI with special emphasis on Antibiotic sensitivity.

REVIEW OF LITERATURE

2.1 NOSOCOMIAL INFECTIONS OR HOSPITAL ACQUIRED INFECTIONS (HAI)

Patient care is provided in facilities which range from highly equipped clinics and technologically advanced university hospitals to front-line units with only basic facilities. Despite progress in public health and hospital care, infections continue to develop in hospitalized patients, and may also affect hospital staff.

A nosocomial infection — also called "hospital acquired infection" or "healthcare associated infection" can be defined as: An infection acquired in hospital by a patient who was admitted for a reason other than that infection[18]. An infection occurring in a patient in a hospital or other health care facility in whom the infection was not present or incubating at the time of admission, this includes infections acquired in the hospital which can even appear after discharge[19]. Conventionally, a cut-off time of 48 hours after admission is used to differentiate between hospital and community acquired infections.[19] Three types of infections in Intensive Care Units including the primary and the secondary endogenous as well as exogenous infections are defined by the carrier status. Only, the secondary endogenous and exogenous infections are the real infections acquired in ICUs.[12]

2.2 NOSOCOMIAL INFECTION SITES

2.2.1 Urinary infections

This is one of the most common nosocomial infections; and constitute eighty percent of nosocomial infections.[20] Majority of infections are associated with the use of an indwelling urinary catheter and the associated risk is approximately three times higher in catheterized patients than in noncatheterized patients [20]. Urinary infections are associated with less morbidity than other nosocomial infections, but can lead to

bacteraemia and death. The prognosis of catheter-associated urinary tract infection is complicated due to occurrence of recurrent and complicated UTI. If left untreated, these infections can lead to severe damage like abscess formation, renal obstructions, and scarring and eventually leading to bacteremia, sepsis, and death.[20]

Infections are usually defined by microbiological criteria as per the Kass concept in which semi quantitative urine culture ($\geq 10^5$ Colony forming units/ml, with a maximum of 2 isolated microbial species) is done[21]. The bacteria responsible arise from the gut flora, either normal (for example : Escherichia coli) or acquired in hospital like drugresistant Klebsiella species and other gram negative non fermenters[21]. Also, other colonic gram negative bacteria are gaining prominence over the last two decades.[22]

2.2.2 Surgical site infections

Surgical site infections are also frequent: the incidence varies from 0.5 to 15% depending on the type of operation and underlying patient status and following factors play a role in the rate of infection like length of preoperative stay, preparation of the patient before surgery, surgical technique, extent of contamination during the procedure (clean, clean contaminated, contaminated, dirty), choice of procedure, exposure to certain specific medical devices and duration of surgery.[23,24,25,26] These are a significant problem which limit the potential benefits of surgical interventions. The impact on hospital costs and postoperative length of stay (between 3 and 20 additional days) is considerable.[25,26,27,28,29]

Surgical site infections occur only when the pathogens invade the tissues in sufficient numbers such that they overcome host's defence mechanisms. The source of infection can be exogenous or endogenous. No infections can occur in a dry and

closed wound unless the microorganisms are deposited in it during the surgical procedure.[30]

2.2.3 Nosocomial pneumonia

Nosocomial pneumonia occurs in several different patient groups. The most important are patients on ventilators in intensive care units, where the rate of pneumonia is 3% per day. There is a high case fatality rate associated with ventilator-associated pneumonia, although the attributable risks are difficult to determine because patient comorbidity is so high. Microorganisms colonize the stomach, upper airway and bronchi, and cause infection in the lungs (pneumonia): they are often endogenous (digestive system or nose and throat), but may be exogenous, often from contaminated respiratory equipment.

The definition of pneumonia may be based on clinical and radiological criteria which are readily available but non-specific: recent and progressive radiological opacities of the pulmonary parenchyma, purulent sputum, and recent onset of fever. Diagnosis is more specific when quantitative microbiological samples are obtained using specialized protected bronchoscopy methods. Known risk factors for infection include the type and duration of ventilation, the quality of respiratory care, severity of the patient's condition (organ failure), and previous use of antibiotics. Apart from ventilator-associated pneumonia, patients with seizures or decreased level of consciousness are at risk for nosocomial infection, even if not intubated. Viral bronchiolitis (respiratory syncytial virus, RSV) is common in children's units, and influenza and secondary bacterial pneumonia may occur in institutions for the elderly. With highly immunocompromised patients, Legionella spp. and Aspergillus pneumonia may occur. In countries with a high prevalence of tuberculosis,

particularly multiresistant strains, transmission in health care settings may be an important problem.

2.2.4 Nosocomial bacteraemia

These infections represent a small proportion of nosocomial infections (approximately 5%) but case fatality rates are high — more than 50% for some microorganisms. The incidence is increasing, particularly for certain organisms such as multi resistant coagulase-negative Staphylococcus and Candida spp. Infection may occur at the skin entry site of the intravascular device, or in the subcutaneous path of the catheter (tunnel infection). Organisms colonizing the catheter within the vessel may produce bacteraemia without visible external infection. The resident or transient cutaneous flora is the source of infection. The main risk factors are the length of catheterization, level of asepsis at insertion, and continuing catheter care.

2.2.5 Other nosocomial infections

Apart from these four most frequent and important nosocomial infections, there are other potential sites of infection. For example:

● Skin and soft tissue infections: open sores (ulcers, burns and bedsores) encourage bacterial colonization and may lead to systemic infection.

● Gastroenteritis is the most common nosocomial infection in children, where rotavirus is a chief pathogen: Clostridium difficile is the major cause of nosocomial gastroenteritis in adults in developed countries.

● Sinusitis and other enteric infections, infections of the eye and conjunctiva.

● Endometritis and other infections of the reproductive organs following childbirth.

2.3 CLINICAL OR LABORATORY DIAGNOSIS OF HAI

Nosocomial infections, also called “hospital-acquired infections”, are infections acquired during hospital care which are not present or incubating at

admission. Infections occurring more than 48 hours after admission are usually considered nosocomial. Definitions to identify nosocomial infections have been developed for specific infection sites (e.g. urinary, pulmonary). These are derived from those published by the Centers for Diseases Control and Prevention (CDC) in the United States of America[31,32] or during international conferences[33] and are used for surveillance of nosocomial infections. They are based on clinical and biological criteria, and include approximately 50 potential infection sites. Nosocomial infections may also be considered either endemic or epidemic. Endemic infections are most common. Epidemic infections occur during outbreaks, defined as an unusual increase above the baseline of a specific infection or infecting organism.

Changes in health care delivery have resulted in shorter hospital stays and increased outpatient care. It has been suggested the term nosocomial infections should encompass infections occurring in patients receiving treatment in any health care setting. Infections acquired by staff or visitors to the hospital or other health care setting may also be considered nosocomial infections. Following simplified definitions (Table 1) may be helpful for some facilities without access to full diagnostic techniques.[34]

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Type of nosocomial infection	Simplified criteria
Surgical site infection	Any purulent discharge, abscess, or spreading cellulitis at the surgical site during the month after the operation
Urinary infection	Positive urine culture (1 or 2 species) with at least 10^5 bacteria/ml, with or without clinical symptoms
Respiratory infection	Respiratory symptoms with at least two of the following signs appearing during hospitalization: — cough — purulent sputum — new infiltrate on chest radiograph consistent with infection
Vascular catheter infection	Inflammation, lymphangitis or purulent discharge at the insertion site of the catheter
Septicaemia	Fever or rigours and at least one positive blood culture

Table 1: Simplified criteria for surveillance of Hospital acquired infections. Adopted from CHAPTER I Epidemiology of nosocomial infections of WHO Prevention of hospital-acquired infections A PRACTICAL GUIDE 2nd edition

2.4 PAEDIATRIC UNITS: HOW THEY ARE DIFFERENT FROM OTHER MEDICAL UNITS

Pediatric units are different from adult units in many ways apart from age of patients. Firstly, these are usually multidisciplinary as there are fewer patients to justify separate medical and surgical units.[35,37]

Second, they generally lack physical barriers between patients who are commonly present in adult ICUs.

Thirdly, fewer children as compared to adults in ICUs have chronic or degenerative organ system disorders.[36]

Few studies also suggested that viruses are less frequently found to be nosocomial pathogens in the PICUs than in other areas of pediatric hospitals .[38]

Nosocomial infections represent an important cause of morbidity and mortality in this population.[39]

2.5 INCIDENCE: ABROAD, INDIA AND KARNATAKA

HAI in PICU varies between hospitals and countries according to incidence, common systems involved and organisms. The incidence of nosocomial infection varies between 6.1% to 26%.[40] Variations are seen according to age (upto 12% in less than 1 year of age vs upto 4% after ten years of age), and the nature of the unit (upto 26% in intensive care units vs upto 4% in general pediatrics) .[41]

The prevalence of HAIs in developed countries varies between 3.5% and 12% whereas in developing countries it is around 5.7% to 19.1%.[42]

According to an European study, 30% of patients admitted in ICU's are affected by HAIs, as the use of invasive devices is more in the ICUs. Although limited information is available from developing countries, but HAIs are found to be more frequent in these low resource settings as compared to the developed countries.[42] International data related to the prevalence, risk factors, causative microorganisms, and outcomes of infection are necessary to increase and maintain awareness of the impact of infection, to help in the development of local and international guidelines for diagnosis and treatment, to facilitate adequate and appropriate resource allocation, and to assist in the design of multicenter interventional studies.[43] The risk of nosocomial infections depends on the host characteristics, the number of interventions, invasive

procedures, asepsis of techniques, the duration of stay in the PICU and inappropriate use of antimicrobials.

Populations at stake are patients in Intensive Care Units (ICUs), burn units, undergoing organ transplant and neonates. According to Extended Prevalence of Infection in Intensive Care (EPIC II) study, the proportion of infected patients within the ICU is often as high as 51%.[43]Based on extensive studies in USA and Europe shows that pooled overall health-care-associated infection density in adult intensive-care units was 47·9 per 1000 patient-days and at least three times as high as densities reported from the USA.[44]

A Hospital Infection Prevalence Survey was conducted under auspices of the WHO in 55 hospitals of 14 countries representing 4 WHO Regions (Europe, the Eastern Mediterranean, the South-East Asia and the Western Pacific) revealed the mean prevalence rate of 8.7% HAI.[45]. According to a study conducted in Karnataka state, the Nosocomial incidence rate was found to be 10.51 per 100 admissions and the Incidence density was found to be 19.37 per 1000 patient days.[46]

Central line-associated bloodstream infections (CLABSI)

CLABSIs are the most fatal nosocomial infections with the death incidence rate of 12%–25%.[47] CDC defines a CLABSI as recovery of a pathogen from a blood culture (a single blood culture for organisms not commonly present on the skin and two or more blood cultures for organisms commonly present on the skin) in a patient who had a central line at the time of infection or within the 48-hour period before development of infection. The infection cannot be related to any other infection the patient might have and must not have been present or incubating when the patient was admitted to the facility.[47]

Although these catheters provide necessary vascular access,but their use puts the patients at risk for local and systemic infectious complications, including local site infection, septic thrombophlebitis, and other metastatic infections (e.g., lung abscess, brain abscess etc).[48]

Catheter associated urinary tract infections (CAUTI)

CAUTI is the most usual type of nosocomial infection globally.[49,50] According to acute care hospital stats in 2011, UTIs account for more than 12% of reported infections.[51] CAUTIs are caused by endogenous native microflora of the patients. Catheters placed inside serves as a conduit for entry of bacteria whereas the imperfect drainage from catheter retains some volume of urine in the bladder providing stability to bacterial residence.[50] CAUTI can develop to complications such as, orchitis, epididymitis and prostatitis in males, and pyelonephritis, cystitis and meningitis in all patients.[34]

Surgical site infections (SSI)

SSIs are nosocomial infections be fall in 2%–5% of patients subjected to surgery. These are the second most common type of nosocomial infections mainly caused by *Staphylococcus aureus* resulting in prolonged hospitalization and risk of death.[52] The pathogens causing SSI arise from endogenous microflora of the patient. The incidence may be as high as 20% depending upon procedure and surveillance criteria used.[53]

Ventilator associated pneumonia (VAP)

VAP is nosocomial pneumonia found in 9–27% of patients on mechanically assisted ventilator. It usually occurs within 48 h after tracheal incubation.[54,55,56]

2.6 IMPACT OF HAI

Nosocomial infection affects huge number of patients globally, elevating mortality rate and financial losses significantly. According to estimate reported of WHO, approximately 15% of all hospitalized patients suffer from these infection.[57] Hospital-acquired infections add to functional disability and emotional stress of the patient and may, in some cases, lead to disabling conditions that reduce the quality of life. Nosocomial infections are also one of the leading causes of death.[61] The economic costs are considerable.[61,62] The increased length of stay for infected patients is the greatest contributor to cost. [63,64,65] One study[66] showed that the overall increase in the duration of hospitalization for patients with surgical wound infections was 8.2 days, ranging from 3 days for gynaecology to 9.9 for general surgery and 19.8 for orthopaedic surgery.

2.7 RISK FACTORS AND DETERMINANTS FROM VARIOUS STUDIES

With increasing infections, there is an increase in prolonged hospital stay, long term disability, increased antimicrobial resistance, increase in socio-economic disturbance, and increased mortality rate. Spare information exists on burden of nosocomial infections because of poorly developed surveillance systems and inexistent control methods. For instance, while getting care for other diseases many patients probably get respiratory infections and it becomes troublesome to spot the prevalence of any nosocomial infection in continuation of a primary care facility.[67]

Determinants

Risk factors determining nosocomial infections depends upon the environment in which care is delivered, the susceptibility and condition of the patient, and the lack of awareness of such prevailing infections among staff and health care providers.[68,69]

Environment

Poor hygienic conditions and inadequate waste disposal from health care settings.

Susceptibility

Immunosupression in the patients, prolonged stay in intensive care unit, and prolonged use of antibiotics.

Unawareness

Improper use of injection techniques, poor knowledge of basic infection control measures, inappropriate use of invasive devices (catheters) and lack of control policies.[70]

Reservoirs and transmission

Microflora of patient

Bacteria belonging to the endogenous flora of the patient can cause infections if they are transferred to tissue wound or surgical site. Gram negative bacteria in the digestive tract cause SSI after abdominal surgery.

Patient and staff

Transmission of pathogens during the treatment through direct contacts with the patients (hands, saliva, other body fluids *etc*.) and by the staff through direct contact or other environmental sources (water, food, other body fluids).

Environment

Pathogens living in the healthcare environment i.e. water, food, and equipments can be a source of transmission. Transmission to other patient makes one more reservoir for uninfected patient.

2.8 METHODS OF HAI SURVEILLANCE

2.8.1 Prevalence study (cross-sectional/ transverse)

Infections in all patients hospitalized at a given point in time are identified (point prevalence) in the entire hospital, or on selected units. Typically, a team of trained investigators visits every patient of the hospital on a single day, reviewing medical and nursing charts, interviewing the clinical staff to identify infected patients, and collecting risk factor data. The outcome measure is a prevalence rate. Prevalence rates are influenced by duration of the patient's stay (infected patients stay longer, leading to an overestimation of patient's risk of acquiring an infection) and duration of infections. Another problem is determining whether an infection is still "active" on the day of the study. In small hospitals, or small units, the number of patients may be too few to develop reliable rates, or to allow comparisons with statistical significance. A prevalence study is simple, fast, and relatively inexpensive. The hospital-wide activity increases awareness of nosocomial infection problems among clinical staff, and increases the visibility of the infection control team. It is useful when initiating a surveillance programme to assess current issues for all units, for all kinds of infections, and in all patients, before proceeding to a more focused continuing active surveillance programme. Repeated prevalence surveys can be useful to monitor trends by comparing rates in a unit, or in a hospital, over time.

2.8.2 Incidence study (continuous/longitudinal)

Prospective identification of new infections (incidence surveillance) requires monitoring of all patients within a defined population for a specified time period. Patients are followed throughout their stay, and sometimes after discharge (e.g. post-discharge surveillance for surgical site infections). This type of surveillance provides attack rates, infection ratio and incidence rates (Table 2). It is more effective in

detecting differences in infection rates, to follow trends, to link infections to risk factors, and for inter-hospital and inter-unit comparisons.[72] This surveillance is more labour-intensive than a prevalence survey, more time-consuming, and costly. Therefore, it is usually undertaken only for selected high-risk units on an ongoing basis (i.e. in intensive care units), or for a limited period, focusing on selected infections and specialties (i.e. 3 months in surgery).[73,74,75,76,77,78]

Recent trends in "targeted surveillance" include:

● Site-oriented surveillance: priorities will be to monitor frequent infections with significant impact in mortality, morbidity, costs (e.g. extra hospital days, treatment costs), and which may be avoidable. Common priority areas are: — ventilator-associated pneumonia (a high mortality rate) — surgical site infections (first for extra-hospital days and cost) — primary (intravascular line) bloodstream infections (high mortality) — multiple-drug resistant bacteria (e.g. methicillin-resistant Staphylococcus aureus, Klebsiella spp. with extended-spectrum beta-lactamase). This surveillance is primarily laboratory-based. The laboratory also provides units with regular reports on distribution of microorganisms isolated, and antibiotic susceptibility profiles for the most frequent pathogens.

● Unit-oriented surveillance: efforts can focus on high-risk units such as intensive care units, surgical units, oncology/haematology, burn units, neonatalogy, etc.

● Priority-oriented surveillance: surveillance undertaken for a specific issue of concern to the facility (i.e. urinary tract infections in patients with urinary catheters in long-term care facilities). While surveillance is focused in high-risk sectors, some surveillance activity should occur for the rest of the hospital. This may be most efficiently performed on a rotating basis (laboratory-based or repeated prevalence studies).

Prevalence rate	Examples
Number of infected patients* at the time of study / Number of patients observed at the same time X100 (*or number of infections)	*Prevalence (%) of nosocomial infections (NI) for 100 hospitalized patients* *Prevalence (%) of urinary tract infections (UTI) for 100 hospitalized patients*
Number of infected patients at the time of the study / Number of patients exposed at the same time X100	*Prevalence (%) of UTI for 100 patients with a urinary catheter*
Attack rate (cumulative incidence rate)	
Number of new infections acquired in a period / Number of patients observed in the same period X100	*Attack rate (%) of UTI for 100 hospitalized patients*
Number of new infections acquired in a period / Number of patients exposed in the same period X100	*Attack rate (%) of surgical site infections (SSI) for 100 operated patients*
Incidence rate	
Number of new nosocomial infections acquired in a period / Total of patient-days for the same period X1000	*Incidence of bloodstream infection (BSI) for 1000 patient-days*
Number of new device-associated nosocomial infections in a period / Total device-days for the same period X1000	*Incidence of ventilator-associated pneumonia for 1000 ventilation-days*

Table 2: Prevalence and incidence rates

2.9 DATA COLLECTION FOR HAI SURVEILLANCE

Sources Data collection requires multiple sources of information as no method, by itself, is sensitive enough to ensure data quality. Trained data extractors (training should be organized by the infection control team or the supervisor) performing active surveillance will increase the sensitivity for identifying infections. Techniques for case-finding include:

● Ward activity: looking for clues such as: — the presence of devices or procedures known to be a risk for infection (indwelling urinary and intravascular catheters, mechanical ventilation, surgical procedures) — record of fever or other clinical signs consistent with infection — antimicrobial therapy — laboratory tests — medical and nursing chart review.

● Laboratory reports: isolation of microorganisms potentially associated with infection, antimicrobial resistance patterns, serological tests. Microbiology laboratory reports have low sensitivity because cultures are not obtained for all infections, specimens may not be appropriate, some infectious pathogens may not be isolated (e.g. virus), and the isolation of a potential pathogen may represent colonization rather than infection (e.g. for surgical site infections, pneumonia). Laboratory reports are, however, reliable for urinary tract infection, bloodstream infections, and multiple-drug resistant bacteria surveillance, because the definitions for these are essentially microbiological.

● Other diagnostic tests: e.g. white blood counts, diagnostic imaging, autopsy data.

● Discussion of cases with the clinical staff during periodic ward visits.

Continuing collaboration among infection control staff, the laboratory, and clinical units will facilitate an exchange of information and improve data quality.[79] The patient is monitored throughout the hospital stay, and in some cases (e.g. for surgical site infections), surveillance includes the post-discharge period.[80] The progressive reduction of the average length of stay with recent changes in health care delivery increases the importance of identifying post discharge infections.

Data elements Some examples of data collection forms for a prevalence study and for surgical site infection surveillance are given in Figures 1 and 2. One form is completed for each patient. Simple, validated, and standardized definitions are essential for credibility of the surveillance system and to ensure data quality. [81,82]

A complete guide for data collection should include:

● patient inclusion criteria

● precise definitions for each variable to be collected (not only definitions for infections)

● lists of codes for each variable, including specific codes for missing data. This data collection guide is also useful in training data extractors. The information to be collected should include:

● administrative data (e.g. hospital number, admission date)

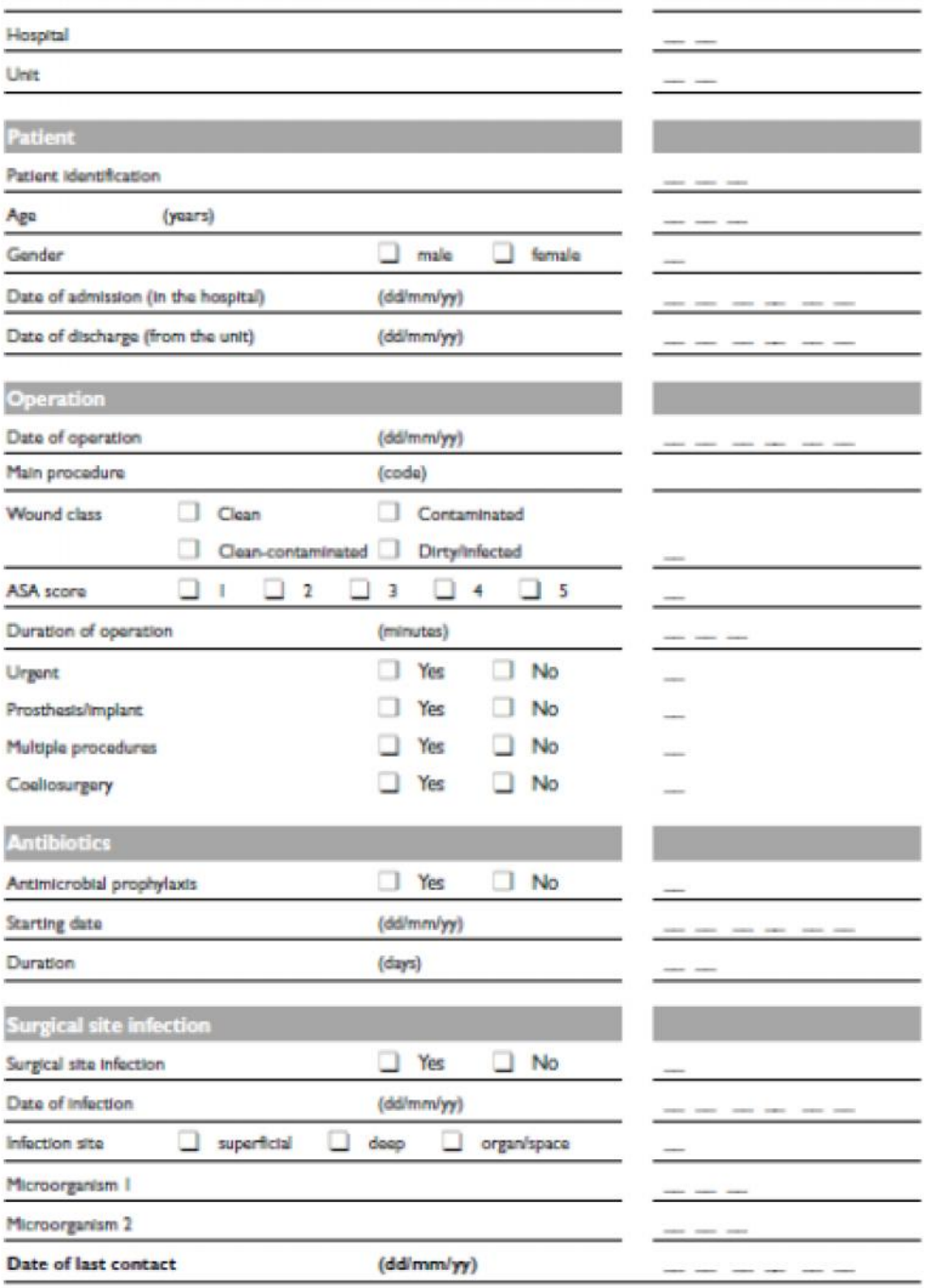
● additional information describing demographic risk factors (e.g. age, gender, severity of underlying illness, primary diagnosis, immunological status) and interventions (e.g. device exposure, surgical procedure, treatments) for infected and for non-infected patients

● presence or absence of infection: date of onset, site of infection, microorganisms isolated, and antimicrobial susceptibility. Data validation is essential to ensure correct interpretation and meaningful comparisons. Validation is a continuous process which may incorporate various methods:

● before data input, information validated by a second extractor

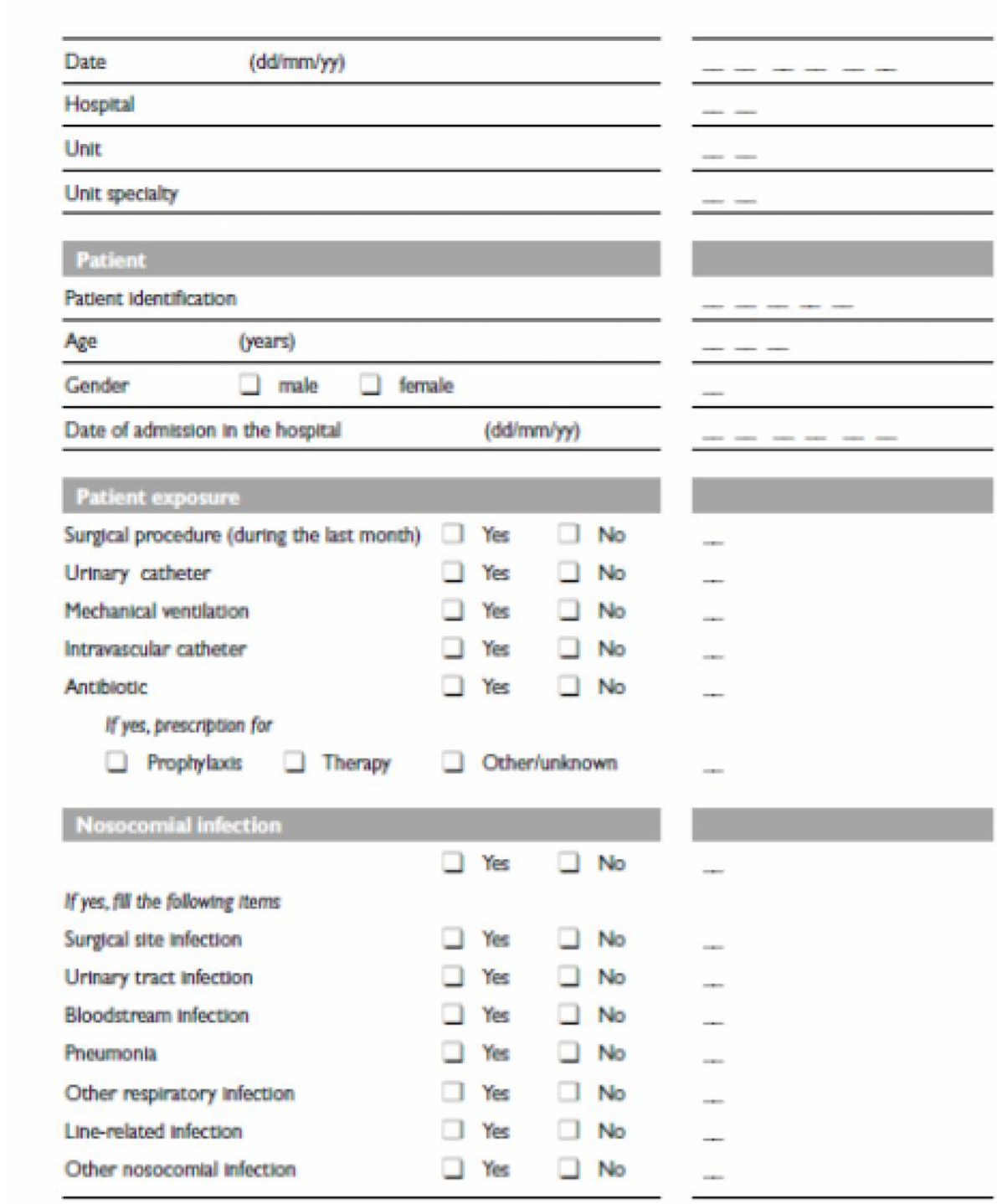
● If computerized data collection is used, the software should include input checks (each variable collected must be coded according to the protocol)

● before analysis, a retrospective data validation performed to identify missing values, inconsistencies, outliers/possible errors, unexpected values or codes.



Hospital		__ __
Unit		__ __
Patient		
Patient identification		__ __ __
Age	(years)	__ __ __
Gender	☐ male ☐ female	__
Date of admission (in the hospital)	(dd/mm/yy)	__ __ __ __ __ __
Date of discharge (from the unit)	(dd/mm/yy)	__ __ __ __ __ __
Operation		
Date of operation	(dd/mm/yy)	__ __ __ __ __ __
Main procedure	(code)	
Wound class	☐ Clean ☐ Contaminated ☐ Clean-contaminated ☐ Dirty/Infected	__
ASA score	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5	__
Duration of operation	(minutes)	__ __ __
Urgent	☐ Yes ☐ No	__
Prosthesis/implant	☐ Yes ☐ No	__
Multiple procedures	☐ Yes ☐ No	__
Coeliosurgery	☐ Yes ☐ No	__
Antibiotics		
Antimicrobial prophylaxis	☐ Yes ☐ No	__
Starting date	(dd/mm/yy)	__ __ __ __ __ __
Duration	(days)	__ __
Surgical site infection		
Surgical site infection	☐ Yes ☐ No	__
Date of infection	(dd/mm/yy)	__ __ __ __ __ __
Infection site	☐ superficial ☐ deep ☐ organ/space	__
Microorganism 1		__ __ __
Microorganism 2		__ __ __
Date of last contact	**(dd/mm/yy)**	__ __ __ __ __ __

Figure 1: Example of data collection form of a single patient of surgical site infection.(WHO)



Date	(dd/mm/yy)	__ __ __ __ __ __
Hospital		__ __
Unit		__ __
Unit specialty		__ __
Patient		
Patient identification		__ __ __ __ __
Age	(years)	__ __ __
Gender	☐ male ☐ female	__
Date of admission in the hospital	(dd/mm/yy)	__ __ __ __ __ __
Patient exposure		
Surgical procedure (during the last month)	☐ Yes ☐ No	__
Urinary catheter	☐ Yes ☐ No	__
Mechanical ventilation	☐ Yes ☐ No	__
Intravascular catheter	☐ Yes ☐ No	__
Antibiotic	☐ Yes ☐ No	__
If yes, prescription for		
☐ Prophylaxis ☐ Therapy	☐ Other/unknown	__
Nosocomial infection		
	☐ Yes ☐ No	__
If yes, fill the following items		
Surgical site infection	☐ Yes ☐ No	__
Urinary tract infection	☐ Yes ☐ No	__
Bloodstream infection	☐ Yes ☐ No	__
Pneumonia	☐ Yes ☐ No	__
Other respiratory infection	☐ Yes ☐ No	__
Line-related infection	☐ Yes ☐ No	__
Other nosocomial infection	☐ Yes ☐ No	__

Figure 2: Example of minimum data collection for Prevalence studies. (WHO)

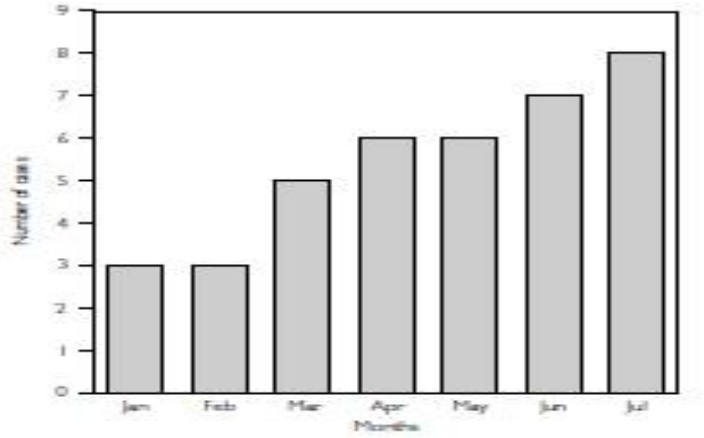
2.10 OUTBREAK

An outbreak is defined as an unusual or unexpected increase of cases of a known nosocomial infection or the emergence of cases of a new infection. Outbreaks of nosocomial infection should be identified and promptly investigated because of their importance in terms of morbidity, costs and institutional image. Outbreak investigation may also lead to sustained improvement in patient care practices.

Early identification of an outbreak is important to limit transmission among patients by health care workers or through contaminated materials. A potential problem may be initially identified by nurses, physicians, microbiologists, or any other health care worker, or through a nosocomial infection surveillance programme. Appropriate investigations are required to identify the source of the outbreak, and to implement control measures. The control measures will vary depending on the agent and mode of transmission, but may include isolation procedures or improvements in patient care or environmental cleaning.

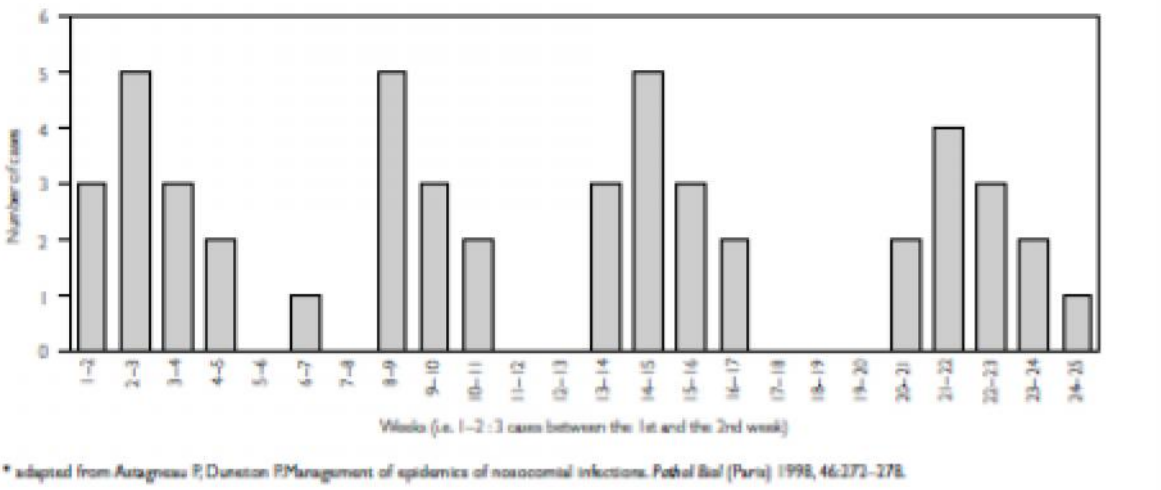
The detailed description includes person(s), place, and time. Cases are also described by other characteristics such as gender, age, date of admission, transfer from another unit, etc. The graphic representation of the distribution of cases by time of onset is an epidemic curve. The epidemic curve should distinguish between definite and probable cases. The shape of the epidemic curve may suggest a single point source (Figure 3), ongoing transmission (Figure 4), or an intermittent source (Figure 5).

Figure 3: Example of epidemic curve in case of a single point source outbreak.



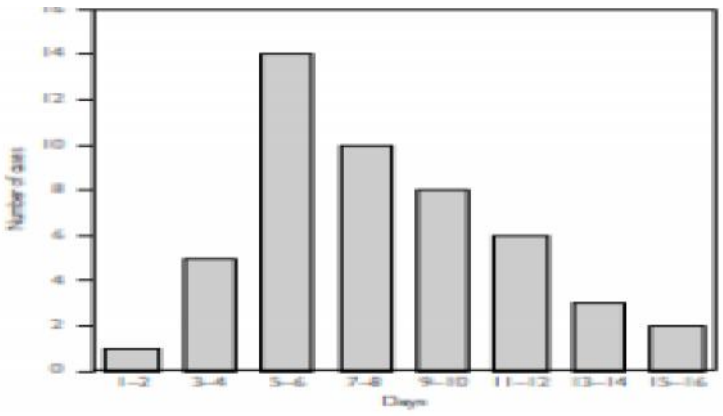
* Adapted from Astagneau P, Duneton P. Management of epidemics of nosocomial infections. *Pathol Biol* (Paris) 1998; 46:272–278.

Figure 4: Example of epidemic curve in case of an ongoing transmission.



* adapted from Astagneau P, Duneton P.Management of epidemics of nosocomial infections. *Pathol Biol* (Paris) 1998; 46:272–278.

Figure 5: Example of epidemic curve in case of intermittent sources.



* Adapted from Astagneau P, Duneton P. Management of epidemics of nosocomial infections. *Pathol Biol* (Paris) 1998; 46:272–278.

2.11 PREVENTIVE STRATEGY

Prevention of nosocomial infection

Being a significant cause of illness and death, nosocomial infections need to be prevented from the base line so that their spread can be controlled.

Transmission from environment

Unhygienic environment serves as the best source for the pathogenic organism to prevail. Air, water and food can get contaminated and transmitted to the patients under healthcare delivery. There must be policies to ensure the cleaning and use of cleaning agents on walls, floor, windows, beds, baths, toilets and other medical devices. Proper ventilated and fresh filtered air can eliminate airborne bacterial contamination. Regular check of filters and ventilation systems of general wards, operating theatres and ICUs must be maintained and documented. Infections attributed to water are due to failure of healthcare institutions to meet the standard criteria. Microbiological monitoring methods should be used for water analysis. Infected patients must be given separate baths. Improper food handling may cause food borne infections. The area should be cleaned and the quality of food should meet standard criteria.[83]

Transmission from staff

Infections can be transferred from healthcare staff. It is the duty of healthcare professionals to take role in infection control. Personal hygiene is necessary for everyone so staff should maintain it. Hand decontamination is required with proper hand disinfectants after being in contact with infected patients. Safe injection practices and sterilized equipments should be used. Use of masks, gloves, head covers or a proper uniform is essential for healthcare delivery.[84]

Hospital waste management

Waste from hospitals can act as a potential reservoir for pathogens that needs proper handling. 10–25% of the waste generated by healthcare facility is termed as hazardous. Infectious healthcare waste should be stored in the area with restricted approach. Waste containing high content of heavy metals and waste from surgeries, infected individuals, contaminated with blood and sputum and that of diagnostic laboratories must be disposed off separately. Healthcare staff and cleaners should be informed about hazards of the waste and it's proper management.[84]

2.12 WHO RECOMMENDED HOSPITAL INFECTION CONTROL PRACTICES: ROLE OF EXPERTS

2.12.1 Role of hospital management

The administration and/or medical management of the hospital must provide leadership by supporting the hospital infection programme. They are responsible for:

● establishing a multidisciplinary Infection Control Committee

● identifying appropriate resources for a programme to monitor infections and apply the most appropriate methods for preventing infection

● ensuring education and training of all staff through support of programmes on the prevention of infection in disinfection and sterilization techniques

● delegating technical aspects of hospital hygiene to appropriate staff, such as: — nursing — housekeeping — maintenance — clinical microbiology laboratory

● periodically reviewing the status of nosocomial infections and effectiveness of interventions to contain them

● reviewing, approving, and implementing policies approved by the Infection Control Committee

● ensuring the infection control team has authority to facilitate appropriate programme function

● participating in outbreak investigation.

2.12.2 Role of the physician

Physicians have unique responsibilities for the prevention and control of hospital infections: by providing direct patient care using practices which minimize infection

● by following appropriate practice of hygiene (e.g. handwashing, isolation)

● serving on the Infection Control Committee

● supporting the infection control team.

Specifically, physicians are responsible for:

● protecting their own patients from other infected patients and from hospital staff who may be infected

● complying with the practices approved by the Infection Control Committee

● obtaining appropriate microbiological specimens when an infection is present or suspected

● notifying cases of hospital-acquired infection to the team, as well as the admission of infected patients

● complying with the recommendations of the Antimicrobial Use Committee regarding the use of antibiotics

● advising patients, visitors and staff on techniques to prevent the transmission of infection

● instituting appropriate treatment for any infections they themselves have, and taking steps to prevent such infections being transmitted to other individuals, especially patients.

2.12.3 Role of the microbiologist

The microbiologist is responsible for:

● handling patient and staff specimens to maximize the likelihood of a microbiological diagnosis

● developing guidelines for appropriate collection, transport, and handling of specimens

● ensuring laboratory practices meet appropriate standards

● ensuring safe laboratory practice to prevent infections in staff

● performing antimicrobial susceptibility testing following internationally recognized methods, and providing summary reports of prevalence of resistance

● monitoring sterilization, disinfection and the environment where necessary

● timely communication of results to the Infection Control Committee or the hygiene officer

● epidemiological typing of hospital microorganisms where necessary

2.12.4 Role of the hospital pharmacist

The hospital pharmacist is responsible for:

● obtaining, storing and distributing pharmaceutical preparations using practices which limit potential transmission of infectious agents to patients

● dispensing anti-infectious drugs and maintaining relevant records (potency, incompatibility, conditions of storage and deterioration)

● obtaining and storing vaccines or sera, and making them available as appropriate

● maintaining records of antibiotics distributed to the medical departments

● providing the Antimicrobial Use Committee and Infection Control Committee with summary reports and trends of antimicrobial use

● having available the following information on disinfectants, antiseptics and other anti-infectious agents: — active properties in relation to concentration, temperature, length of action, antibiotic spectrum — toxic properties including sensitization or irritation of the skin and mucosa — substances that are incompatible with antibiotics or reduce their potency — physical conditions which unfavourably affect potency during storage: temperature, light, humidity — harmful effects on materials. The hospital pharmacist may also participate in the hospital sterilization and disinfection practices through:

● participation in development of guidelines for antiseptics, disinfectants, and products used for washing and disinfecting the hands

● participation in guideline development for reuse of equipment and patient materials

● participation in quality control of techniques used to sterilize equipment in the hospital including selection of sterilization equipment (type of appliances) and monitoring

2.12.5 Role of the nursing staff

Implementation of patient care practices for infection control is the role of the nursing staff. Nurses should be familiar with practices to prevent the occurrence and spread of infection, and maintain appropriate practices for all patients throughout the duration of their hospital stay. The senior nursing administrator is responsible for:

● participating in the Infection Control Committee

● promoting the development and improvement of nursing techniques, and ongoing review of aseptic nursing policies, with approval by the Infection Control Committee

● developing training programmes for members of the nursing staff

● supervising the implementation of techniques for the prevention of infections in specialized areas such as the operating suite, the intensive care unit, the maternity unit and newborns

● monitoring of nursing adherence to policies. The nurse in charge of a ward is responsible for:

● maintaining hygiene, consistent with hospital policies and good nursing practice on the ward

● monitoring aseptic techniques, including handwashing and use of isolation

● reporting promptly to the attending physician any evidence of infection in patients under the nurse's care

● initiating patient isolation and ordering culture specimens from any patient showing signs of a communicable disease, when the physician is not immediately available

● limiting patient exposure to infections from visitors, hospital staff, other patients, or equipment used for diagnosis or treatment

● maintaining a safe and adequate supply of ward equipment, drugs and patient care supplies. The nurse in charge of infection control is a member of the infection control team and responsible for:

● identifying nosocomial infections

● investigation of the type of infection and infecting organism

● participating in training of personnel

● surveillance of hospital infections

● participating in outbreak investigation

● development of infection control policy and review and approval of patient care policies relevant to infection control

● ensuring compliance with local and national regulations

● liaison with public health and with other facilities where appropriate

● providing expert consultative advice to staff health and other appropriate hospital programmes in matters relating to transmission of infections.

2.12.6 Role of the central sterilization service

A central sterilization department serves all hospital areas, including the operating suite. An appropriately qualified individual must be responsible for management of the programme. Responsibility for day-to-day management may be delegated to a nurse or other individual with appropriate qualifications, experience, and knowledge of medical devices. The responsibilities of the central sterilization service are to clean, decontaminate, test, prepare for use, sterilize, and store aseptically all sterile hospital equipment. It works in collaboration with the Infection Control Committee and other hospital programmes to develop and monitor policies on cleaning and decontamination of:

● reusable equipment

● contaminated equipment including — wrapping procedures, according to the type of sterilization — sterilization methods, according to the type of equipment — sterilization conditions (e.g. temperature, duration, pressure, humidity) (see Chapter V). The director of this service must:

● oversee the use of different methods — physical, chemical, and bacteriological — to monitor the sterilization process

● ensure technical maintenance of the equipment according to national standards and manufacturers' recommendations

● report any defect to administration, maintenance, infection control and other appropriate personnel

● maintain complete records of each autoclave run, and ensure long-term availability of records ● collect or have collected, at regular intervals, all outdated sterile units

● communicate, as needed, with the Infection Control Committee, the nursing service, the operating suite, the hospital transport service, pharmacy service, maintenance, and other appropriate services.

2.12.7 Role of the food service

The director of food services must be knowledgeable in food safety, staff training, storage and preparation of foodstuffs, job analysis, and use of equipment. The head of catering services is responsible for:

● defining the criteria for the purchase of foodstuffs, equipment use, and cleaning procedures to maintain a high level of food safety

● ensuring that the equipment used and all working and storage areas are kept clean

● issuing written policies and instructions for handwashing, clothing, staff responsibilities and daily disinfection duties

● ensuring that the methods used for storing, preparing and distributing food will avoid contamination by microorganisms

● issuing written instructions for the cleaning of dishes after use, including special considerations for infected or isolated patients where appropriate

● ensuring appropriate handling and disposal of wastes

● establishing programmes for training staff in food preparation, cleanliness, and food safety

● establishing a Hazard Analysis of Critical Control Points (HACCP) programme, if required.

2.12.8 Role of the laundry service

The laundry is responsible for:

● selecting fabrics for use in different hospital areas, developing policies for working clothes in each area and group of staff, and maintaining appropriate supplies

● distribution of working clothes and, if necessary, managing changing rooms

● developing policies for the collection and transport of dirty linen

● defining, where necessary, the method for disinfecting infected linen, either before it is taken to the laundry or in the laundry itself

● developing policies for the protection of clean linen from contamination during transport from the laundry to the area of use

● developing criteria for selection of site of laundry services: — ensuring appropriate flow of linen, separation of "clean" and "dirty" areas — recommending washing conditions (e.g. temperature, duration) — ensuring safety of laundry staff through prevention of exposure to sharps or laundry contaminated with potential pathogens.

2.12.9 Role of the housekeeping service

The housekeeping service is responsible for the regular and routine cleaning of all surfaces and maintaining a high level of hygiene in the facility.

In collaboration with the Infection Control Committee it is responsible for :

● classifying the different hospital areas by varying need for cleaning

● developing policies for appropriate cleaning techniques — procedure, frequency, agents used, etc., for each type of room, from highly contaminated to the most clean, and ensuring that these practices are followed

● developing policies for collection, transport and disposal of different types of waste (e.g. containers, frequency)

● ensuring that liquid soap and paper towel dispensers are replenished regularly

● informing the maintenance service of any building problems requiring repair: cracks, defects in the sanitary or electrical equipment, etc.

● caring for flowers and plants in public areas

● pest control (insects, rodents)

● providing appropriate training for all new staff members and, periodically, for other employees, and specific training when a new technique is introduced

● establishing methods for the cleaning and disinfection of bedding (e.g. mattresses, pillows)

● determining the frequency for the washing of curtains, screening curtains between beds, etc.

● reviewing plans for renovations or new furniture, including special patient beds, to determine feasibility of cleaning. There should be a continuing programme for staff training.This programme should stress personal hygiene, the importance of frequent and careful washing of hands, and cleaning methods (e.g. sequence of rooms, correct use of equipment, dilution of cleaning agents, etc.). Staff must also understand causes of contamination of premises, and how to limit this, including the method of action of disinfectants. Cleaning staff must know to contact staff health if they have a personal infection, especially infections of the skin, digestive tract and respiratory tract.

2.12.10 Role of maintenance:

● collaborating with housekeeping, nursing staff or other appropriate groups in selecting equipment and ensuring early identification and prompt correction of any defect

● inspections and regular maintenance of the plumbing, heating, and refrigeration equipment, and electrical fittings and air conditioning; records should be kept of this activity

● developing procedures for emergency repairs in essential departments

● ensuring environmental safety outside the hospital, e.g. waste disposal, water sources. Additional special duties include: — participation in the choice of equipment if maintenance of the equipment requires technical assistance — inspection, cleaning and regular replacement of the filters of all appliances for ventilation and humidifiers — testing autoclaves (temperature, pressure, vacuum, recording mechanism) and regular maintenance (cleaning the inner chamber, emptying the tubes) — monitoring the recording thermometers of refrigerators in pharmacy stores, laboratories, the blood bank and kitchens — regularly inspecting all surfaces — walls, floors, ceilings — to ensure they are kept smooth and washable — repairing any opening or crack in partition walls or window frames — maintaining hydrotherapy appliances — notifying infection control of any anticipated interruption of services such as plumbing or air conditioning.

2.12.11 Role of the infection control team (hospital hygiene service)

The infection control programme is responsible for oversight and coordination of all infection control activities to ensure an effective programme. The hospital hygiene service is responsible for:

● organizing an epidemiological surveillance programme for nosocomial infections

● participating with pharmacy in developing a programme for supervising the use of anti-infective drugs

● ensuring patient care practices are appropriate to the level of patient risk

● checking the efficacy of the methods of disinfection and sterilization and the efficacy of systems developed to improve hospital cleanliness

● participating in development and provision of teaching programmes for the medical, nursing, and allied health personnel, as well as all other categories of staff

● providing expert advice, analysis, and leadership in outbreak investigation and control

● participating in the development and operation of regional and national infection control initiatives

● the hospital hygiene service may also provide assistance for smaller institutions, and undertake research in hospital hygiene and infection control at the facility, local, national, or international level.

2.13 SPECIFIC COMMON HAI PATHOGENS & DETAILS ABOUT ORGANISMS

Nosocomial pathogens

Pathogens responsible for nosocomial infections are bacteria, viruses and fungal parasites. These microorganisms vary depending upon different patient populations, medical facilities and even difference in the environment in which the care is given.

Bacteria

Pathogenic bacteria have greater virulence, and cause infections (sporadic or epidemic) regardless of host status. For example: — Anaerobic Gram-positive rods (e.g. Clostridium) cause gangrene. — Gram-positive bacteria: Staphylococcus aureus (cutaneous bacteria that colonize the skin and nose of both hospital staff and patients) cause a wide variety of lung, bone, heart and bloodstream infections and are frequently resistant to antibiotics; beta-haemolytic streptococci are also important. — Gram-negative bacteria: Enterobacteriacae (e.g. Escherichia coli, Proteus, Klebsiella, Enterobacter, Serratia marcescens), may colonize sites when the host defences are compromised (catheter insertion, bladder catheter, cannula insertion) and cause

serious infections (surgical site, lung, bacteraemia, peritoneum infection). They may also be highly resistant. — Gram-negative organisms such as Pseudomonas spp. are often isolated in water and damp areas. They may colonize the digestive tract of hospitalized patients. — Selected other bacteria are a unique risk in hospitals. For instance, Legionella species may cause pneumonia (sporadic or endemic) through inhalation of aerosols containing contaminated water (air conditioning, showers, therapeutic aerosols)

Bacteria are the most common pathogens responsible for nosocomial infections. Some belong to natural flora of the patient and cause infection only when the immune system of the patient becomes prone to infections. *Acinetobacter* is the genre of pathogenic bacteria responsible for infections occurring in ICUs. It is embedded in soil and water and accounts for 80% of reported infections.[85] *A. baumannii* is a prevalent species that causes epidemic outbreaks of nosocomial *Acinetobacter* infections and has emerged as a troublesome pathogen globally.[86] *Clostridium difficile* cause inflammation of colon leading to antibiotic-associated diarrhea and colitis, mainly due to elimination of beneficial bacteria with that of pathogenic. *C. difficile* is transmitted from an infected patient to others through healthcare staff via improper cleansed hands.[86] Enterobacteriaceae (carbapenem-resistance) cause infections if travel to other body parts from gut; where it is usually found. Enterobacteriaceae constitute *Klebsiella* species and *Escherichia coli mainly*. Their high resistance towards carbapenem causes the defense against them more difficult.[87] Methicillin-resistant *S. aureus* (MRSA) transmit through direct contact, open wounds and contaminated hands. It causes sepsis, pneumonia and SSI by travelling from organs or bloodstream. It is highly resistant towards antibiotics called beta-lactams.[88]

Viruses

Besides bacteria, viruses are also an important cause of nosocomial infection. Usual monitoring revealed that 5% of all the nosocomial infections are because of viruses.[89] They can be transmitted through hand-mouth, respiratory route and fecal-oral route.[90] Hepatitis is the chronic disease caused by viruses. Healthcare delivery can transmit hepatitis viruses to both patients and workers. Hepatitis B and C are commonly transmitted through unsafe injection practices.[88] Other viruses include influenza, HIV, rotavirus, and herpes-simplex virus.[90]

Fungal parasites

Fungal parasites act as opportunistic pathogens causing nosocomial infections in immune-compromised individuals. *Aspergillus* spp. can cause infections through environmental contamination. *Candida albicans*, *Cryptococcus neoformans* are also responsible for infection during hospital stay.[89] *Candida* infections arise from patient's endogenous microflora while *Aspergillus* infections are caused by inhalation of fungal spores from contaminated air during construction or renovation of health care facility.[90]

METHODOLOGY

This longitudinal prospective surveillance study was conducted in the 14 bedded Paediatric Emergency Ward of a tertiary care centre. The samples were processed in the Department of Microbiology, Jawaharlal Nehru Medical College, KAHER, Belagavi. Study protocol was approved by the Ethical Committee of the Institute and written informed consent was obtained from parents/guardians of the patients.

Source of data: Paediatric Emergency Ward of Dr Prabhakar Kore Charitable Hospital, Belagavi. This unit admits approximately 800 to 1200 patients annually.

Study design: One year longitudinal study

Study period: One year (from January 2017 to December 2017)

Sample size estimation:

This study was conducted over a period of 1 year during which approximately 1000 patients were likely to admit to the pediatric emergency unit. The sample size estimation was done on the basis of detection rate of HAI in accordance with studies on similar subject from developed and developing countries, that is in between 1.5% - 23.5%. [91]In absence of any systemic data available on HAI incidence rates in pediatric emergency units in India, the sample size estimation was done taking the incidence rate from results of a study by Gupta et al regarding the incidence rate in PICU in Indian setup.[91] In this study approximately 36 of the 187 patients developed HAI. Using this assumption, a total sample size of 385 was calculated to detect HAI in the admitted children over a period of 1 year.

Sample size, $n = [Z\alpha / d]^2$

Where $Z\alpha = 1.96$ (constant)

d = absolute / relative precision (usually 10-20%of prevalence) for the current study (taken as 10%)

Therefore n = 385

Inclusion criteria: Patients of age group up to 16 years after 48 hours of admission in Pediatric Emergency Ward. Once the study sample size was identified, data on each patient's age, sex, diagnosis, device utilization rate, length of stay and outcome was gathered.

Exclusion criteria Patients who were lost on follow up

Statistical analysis: All statistical analyses were performed using software STATA 9.0 (Stata Corp., College Station, TX, USA). Means and standard deviations were used to describe continuous variables. Clinical outcome variable in the form of length of stay was calculated using Mann Whitney Standard U Test.

The study was conducted on 410 patients who were admitted with common pediatric clinical diagnosis such as bronchopneumonia, convulsions under evaluation, fever under evaluation, anaemia under evaluation, clinically suspected septicaemia etc.

Such patients were assessed daily during their stay in the Paediatric Emergency Ward. Their blood cultures were sent for microbiological analysis upon admission, before administration of antibiotics as a routine practice in blood culture bottles containing BHI(Brain Heart Infusion) broth and SPS. Detailed data regarding

Invasive device usage such as peripheral venous catheters, central venous catheters, foleys catheters, endotracheal tubes , tracheostomy tubes , lumbar puncture, ascitic tap, pleural tap etc was taken only for patients who stayed in the Paediatric Emergency Ward for more than 48 hours.

On suspicion of development of HAI, like Unexplained fever (>380C) , Leukocytosis(>=10,000) , New infiltrate on the chest X-ray , Persistent tracheal aspirates or secretions, turbid urine, suprapubic tenderness, dysuria, burning micturition ,Thrombophlebitis, detailed examination of the patients included in the study was done as follows: Temperature, pulse, blood pressure, Respiratory system was examined for breath sounds and any other abnormal sounds, Abdominal examination was done for localized tenderness or tenderness over peritoneal dialysis catheter site, Purulent secretions for endotracheal tube, and a new representative sample for diagnosis of a site specific HAI was collected, processed and interpreted as per CLSI(Clinical and Laboratory Standards Institute) guidelines.

In suspected cases of Central line associated Bloodstream Infection (CLABSI), under aseptic precautions a second blood culture was sent in blood culture bottle containing BHI broth and SPS.

Where feasible, central venous catheters (CVCs) or Cental line tips were removed aseptically, and the distal 5 cm of the catheter was cultured using a semi quantitative method.[92]

In suspected cases of Ventilator Associated Pneumonia (VAP), sample such as Bronchoalveolar lavage (BAL) and Endotracheal Aspirate were sent for microbiological diagnosis.

For microbiologically diagnosing VAP, non-bronchoscopicbronchoalveolar lavage or Endotracheal tube aspirate samples were cultured semi quantitatively and a colony count of $\geq 10^4$ CFU/mL was taken as 'significant'.[92]

In cases of suspected Catheter associated Urinary Tract Infection (CAUTI), under aspetic precautions ,urine sample was collected from the sampling port and sent in universal container to the microbiology lab for further processing where the urine sample was cultured semi quantitatively to diagnose healthcare-associated urinary tract infection (HA-UTI).

Identification of bacterial isolates was done by conventional biochemical tests for identification. Antimicrobial susceptibility testing of the bacterial isolates was done by disc diffusion techniques using Kirby Bauer's method as per Clinical Laboratory Standards Institute.

Identifying Healthcare-associated Infections (HAI) for National Healthcare Safety Network (NHSN) Surveillance

To standardize the classification of an infection as present on admission (POA) or a healthcare-associated infection (HAI), the following objective surveillance definitions and guidance are used for NHSN surveillance:

•7-day Infection Window Period (IWP)

•Date of Event (DOE)

•POA (Present on Admission)

•HAI (Hospital Acquired Infection)

•14-day Repeat Infection Timeframe (RIT)

•Secondary BSI Attribution Period (SBAP)

•Pathogen Assignment Guidance

•Location of Attribution (LOA)

Infection Window Period:

The Infection Window Period (IWP) is defined as the 7-days during which all site-specific infection criteria must be met. It includes the collection date of the first positive diagnostic test that is used as an element to meet the site-specific infection criterion, the 3 calendar days before and the 3 calendar days after . For purposes of defining the Infection Window Period the following examples are considered diagnostic tests:

- laboratory specimen collection
- imaging test
- procedure or exam

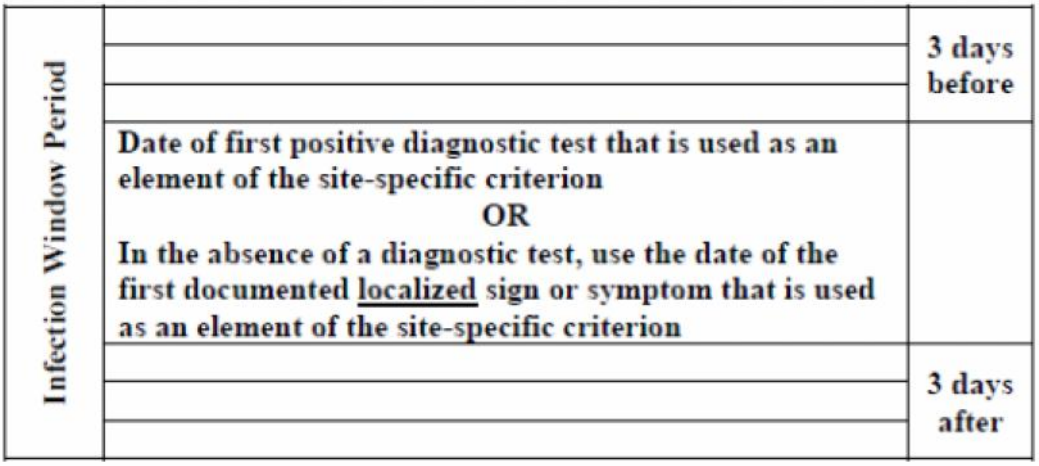


Figure 6: Infection window period. (WHO)

Date of Event (Event Date):

The Date of Event (DOE) is the date the first element used to meet an NHSN site-specific infection criterion occurs for the first time within the seven-day infection window period.

Present on Admission (POA):

An infection is considered **Present on Admission (POA)** if the date of event of the NHSN site-specific infection criterion occurs during the POA time period, which is defined as the day of admission to an inpatient location (calendar day 1), the 2 days before admission, and the calendar day after admission. For purposes of NHSN surveillance and determination of the Repeat Infection Timeframe if the date of event is determined to be either of the two days prior to inpatient admission, then the date of event will be hospital day 1.

Healthcare-associated Infection (HAI):

An infection is considered a **Healthcare-associated Infection (HAI)** if the date of event of the NHSN site-specific infection criterion occurs on or after the 3rd calendar day of admission to an inpatient location where day of admission is calendar day 1.

Note:

Accurate determination of DOE is critical because DOE is used to determine:

- if an event is HAI or POA
- location of attribution
- device association
- day 1 of the Repeat Infection Timeframe

Repeat Infection Timeframe:

The Repeat Infection Timeframe (RIT) is a 14-day timeframe during which no new infections of the same type are reported.

The RIT applies to both POA and HAI determinations.

The date of event is Day 1 of the 14-day RIT. If criteria for the same type of infection are met and the date of event is within the 14-day RIT, another new event is not identified for purposes of tracking or reporting, however, additional pathogens recovered during the RIT from the same type of infection are added to the event. Note the original date of event is maintained as is the original 14-day RIT. Additionally, device association determination location of attribution are not to be amended. The RIT will apply at the level of specific type of infection with the exception of BSI, UTI, and PNEU where the RIT will apply at the major type of infection.

Secondary BSI Attribution Period

The Secondary BSI Attribution Period (SBAP) is the period in which a blood specimen must be collected for a secondary bloodstream infection to be attributed to a primary site infection. This period includes the Infection Window Period combined with the Repeat Infection Timeframe (RIT). It is 14-17 days in length depending upon the date of event.

Pathogen Assignment Guidance:

The following provides guidance for reporting pathogens associated with site-specific infections that are identified during the RIT or during the secondary BSI attribution period. Additional eligible pathogens recovered during the RIT from the

same type of infection are added to the event. Report all site-specific pathogens before secondary BSI pathogens. SUTIs can only have two organisms entered according to NHSN application rules. However, if yes is selected for the secondary BSI field, the third pathogen field will become available for data entry.

If at least one BSI pathogen with a collection date in the secondary BSI attribution period matches organism from a specimen (either a site-specific specimen or a blood specimen) that was used to meet a site-specific infection criterion, additional eligible BSI pathogens are also considered secondary to the event.

BSI pathogens may be assigned to more than one infection source at the same time in the following scenarios:

Secondary BSI pathogen assigned to two different site-specific infections.

OR

Secondary BSI pathogen assigned to a site-specific infection and assigned as pathogen to a primary BSI event.

Location of Attribution (LOA):

The inpatient location where the patient was assigned on the date of event is the location of attribution (see Date of Event definition). Non-bedded patient locations, (for example Operating Room (OR) or Interventional Radiology (IR) are not eligible for assignment of location of attribution for HAI events. Location of attribution must be assigned to a location where denominator data (for example, patient days, device days) can be collected.

Case definitions

Patients were diagnosed with an HAI during his/her stay in the PEW, as per Centers for Disease Control & Prevention (CDC) criteria for site specific infections.

Healthcare associated blood stream infection (HA-BSI)

Healthcare associated blood stream infection must meet at least one of the following criteria:

(i) Patient has a recognized pathogen cultured from one or more blood cultures and organism cultured from blood is not related to an infection at another site, and/or

(ii) Patient has at least one of the following signs or symptoms: fever (>38°C), chills, or hypotension and positive laboratory results and signs and symptoms and positive laboratory results are not related to an infection at another site.

Healthcare associated urinary tract infection (HAUTI)

Healthcare associated urinary tract infection was diagnosed as: patient has at least one of the following signs or symptoms with no other recognized cause: fever (>38°C), urgency, frequency, dysuria, or suprapubic tenderness and patient has a positive urine culture, that is, ≥ 105 microorganisms per ml of urine with no more than two species of microorganisms.

Healthcare associated pneumonia (HAP)

Healthcare associated pneumonia was diagnosed using radiological, clinical and laboratory criteria as follows:

Radiologically; two or more serial chest radiographs

With at least one of the following:

new or progressive and persistent infiltrate,

consolidation,

cavitation

pneumatoceles in infants ≤1 yr old.

Clinically, for any patient, at least 1 of the following:

Fever (≥38°C or ≥100.4°F) with no other recognized cause leukopenia (≤4000 WBC/µl) or leukocytosis (≥12,000 WBC/µl) and at least two of the following:

(i) new onset of purulent sputum or change in character of sputum,

(ii) new onset or worsening cough, or dyspnoea, or tachypnoea,

(iii) rales or bronchial breath sounds

In laboratory, at least one of the following:

positive growth in blood culture not related to another source of infection or positive growth in culture of pleural fluids.

Ventilator Associated Pneumonia

The national Healthcare Safety Network (NHSN), Centers for Disease Control and Prevention 2018 describes VAP (Ventilator Associated Pneumonia) criteria common to all age groups as follows:

1. patient has mechanical ventilator (MV) in place for 2 days or more

OR

2. If removed, MV was in place on the day of sample collection or the day before.

Patient-days and device-days

The data for calculation of patient-days and device-days were collected using standardized CDC National Nosocomial Infection Surveillance (NNIS) protocols. Device-days were calculated for ventilators, CVCs, arterial catheters (ACs) and urinary tract catheters (UCs), i.e. ventilator-days (VDs), CVCDs, ACDs and UCDs respectively.

Incidence rates

The incidence or crude infection rate (CIR) and incidence density (ID) of HAIs were calculated using CDC NNIS protocols. They were calculated for all HAIs and site-specific HAIs. For CIRs, the denominator was the number of patients who stayed in PICU for $\geq$48 h. Similarly, CIR and ID were also calculated for specific device associated infections (DAIs), including VAP, CVC-BSI and CA-UTI. For CIRs, the denominator was the number of patients with a specific device for $\geq$ 48 h; for IDs, the denominator was specific device-days.

Device utilization rate (DUR)

The DUR of a particular device was calculated by dividing the device-days of that device by patient-days. It was calculated for mechanical ventilators (MVs), CVCs, urinary catheters (UCs) and arterial catheters (ACs).

Mean length of stay (LOS)

The mean length of stay was calculated as the total number of days spent in the PICU by patients who stayed for ≥48 h, divided by the total number of patients who stayed in PICU for ≥48 h. Similarly, the mean LOS of patients who developed and those who did not develop an HAI, VAP or CVC-BSI, was calculated.

Mean duration of ventilation (DOV)

The mean duration of ventilation was calculated by dividing the sum of the ventilator-days of patients who underwent mechanical ventilation (MV) for ≥ 48 h, by the number of patients who underwent MV for ≥48 h. Similarly, the mean DOV of patients who developed VAP and those who did not develop VAP was calculated.

Crude excess mortality (CEM)

Crude excess mortality was determined as the difference between the crude overall case-fatality rate of patients with an HAI and the crude case-fatality rate of patients hospitalized in the PICU during that period who did not develop an HAI. Similarly, the CEM for patients who developed VAP and CVC-BSI was calculated.

DAY 1

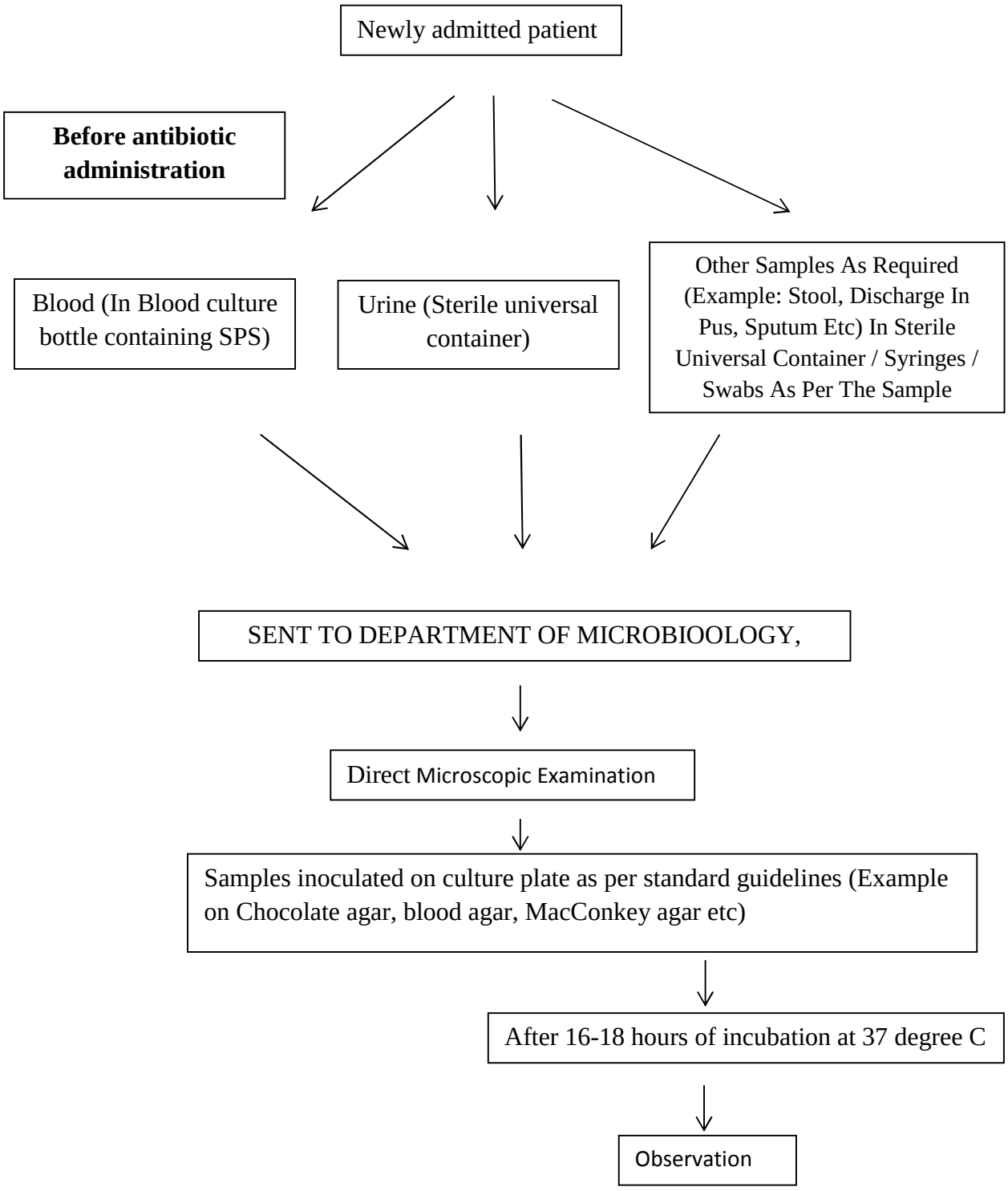


Figure 7: Sample processing methodology on Day 1 of hospitalization.

DAY 2

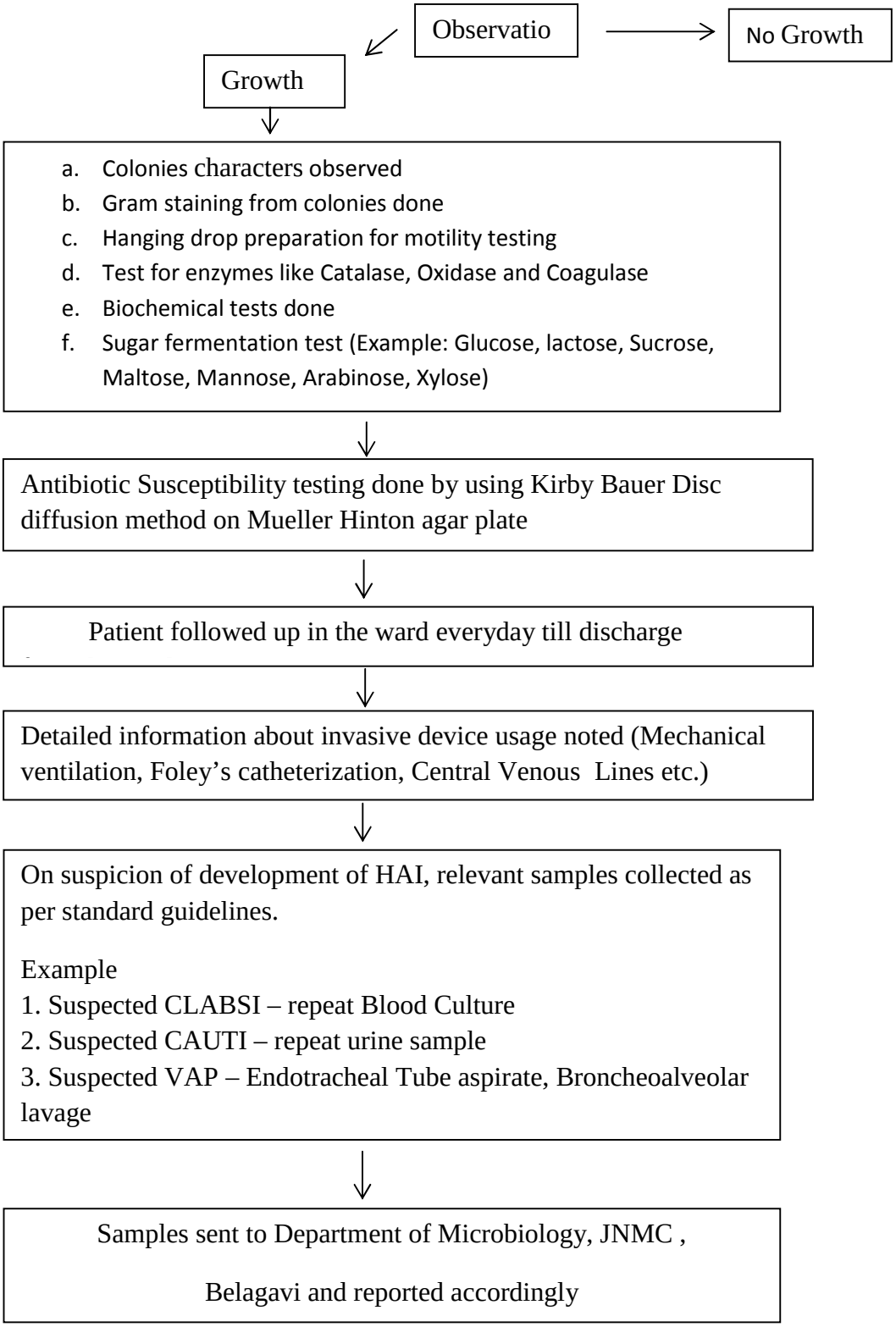
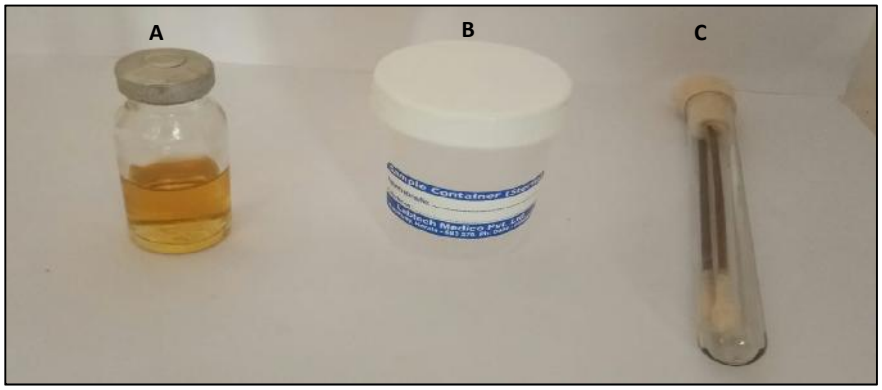


Figure 8: Further Sample processing methodology

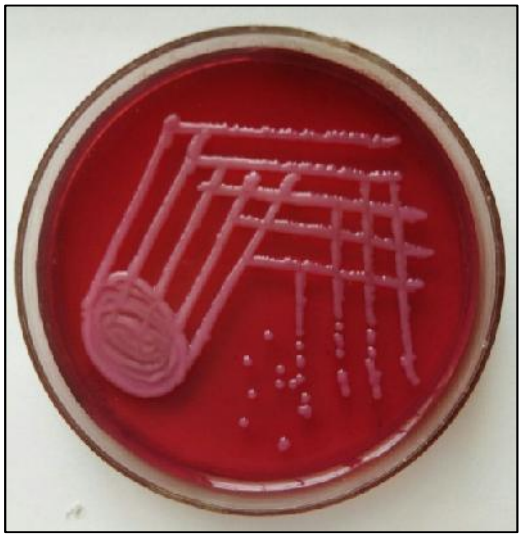
Image 1: Collection of samples



A. Paediatric blood culture bottle containing glucose broth and SPS
B.universal container C.sterile cotton swab

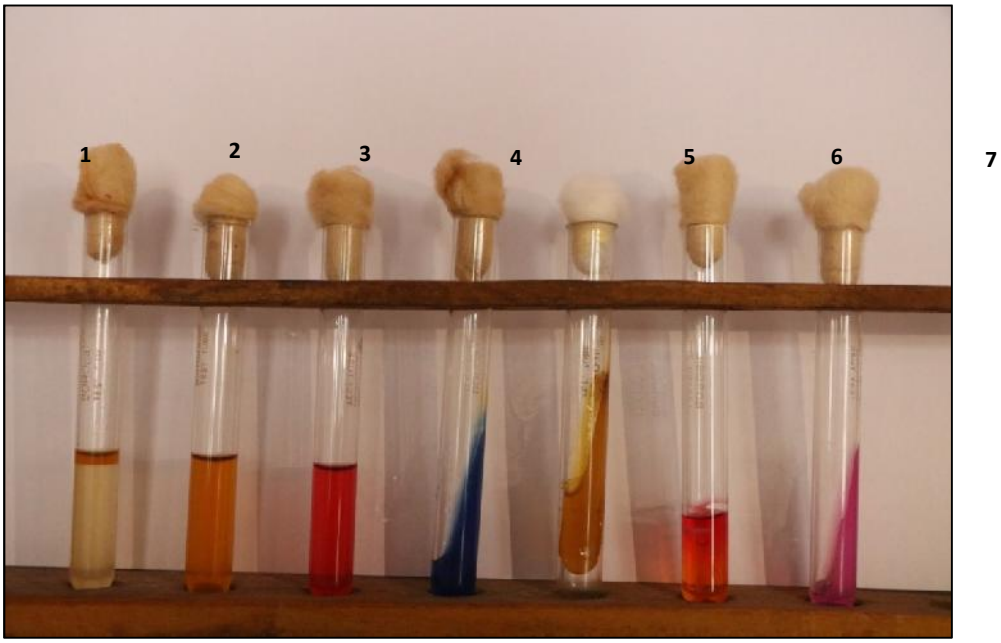
Image 2: Patient on mechanical ventilation in Pediatric Emergency Ward

Image 3: MacConkey agar plate with growth of Klebsiella pneumoniae..



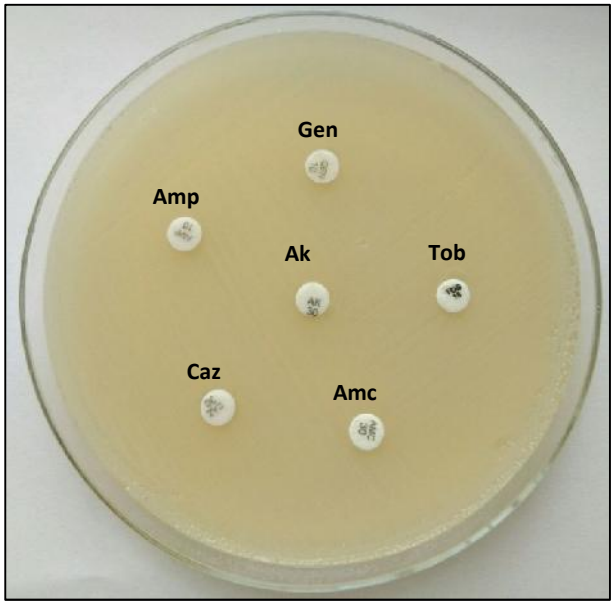
Lactose fermenting, circular, mucoid, low convex with entire edge.

Image 4: Biochemical reactions of Klebsiella pneumoniae.



1. Kovac's test – positive 2. Methyl red test –negative 3. Voges Proskeaur test – positive 4. Simmon citrate test – utilized 5. Triple sugar iron agar – A/A with gas production 6. Mannitol motility medium – fermented, non-motile 7. Christenson's Urease medium – hydrolyzed

Image 5: Antibiogram on Mueller Hinton Agar with Pan resistant Klebsiella pneumoniae.



(Amp- Ampicillin, Gen- Gentamicin , Tob- Tobramycin ,Ak – Amikacin, Amc- Amoxycillin clavulinic acid, Caz- Ceftazidime)

Image 6: Blood Agar plate showing colonies of Acinetobacter baumanii.

Circular, smooth, opaque, raised, non-hemolytic colonies.

Image 7: Gram stain of Acintobacter baumanii colonies showing Gram negative coccobacilli.

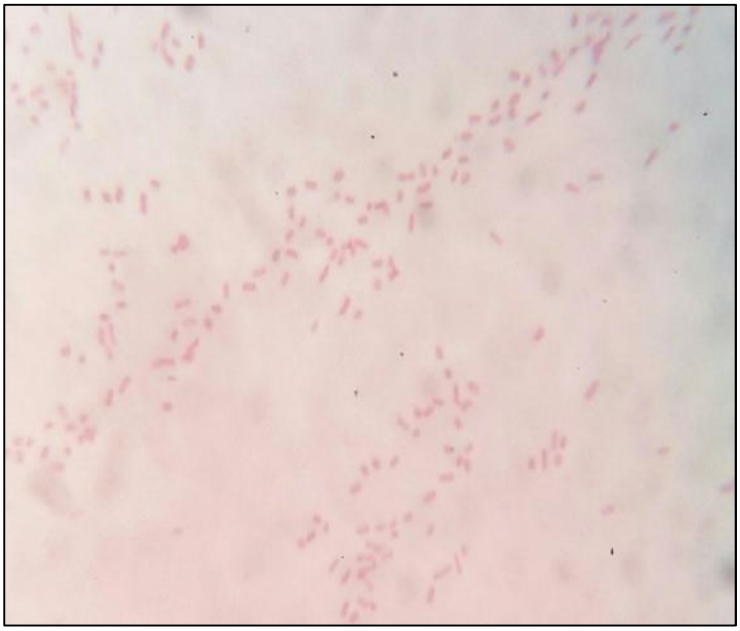
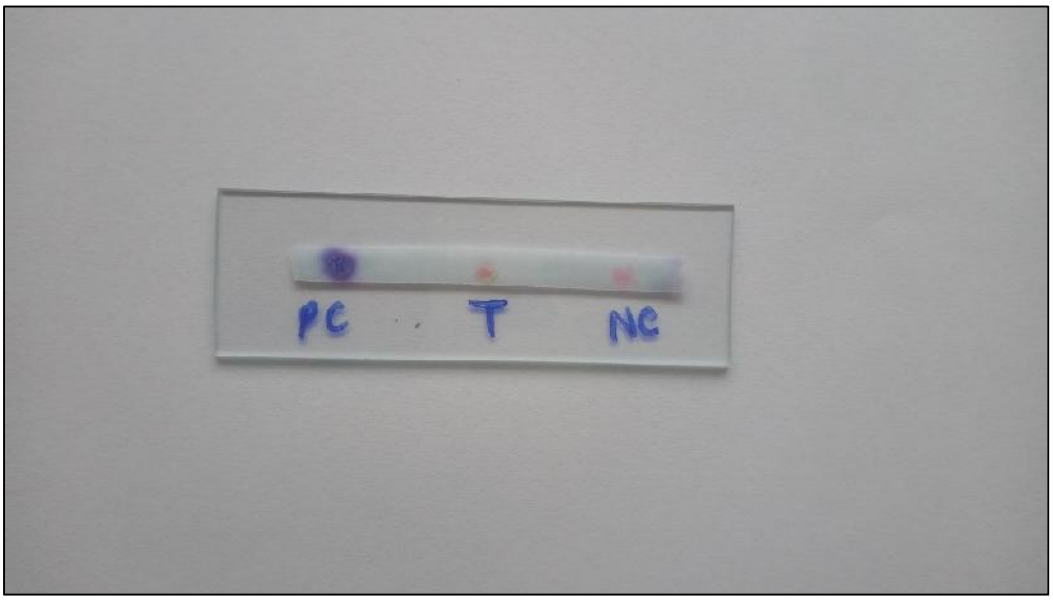
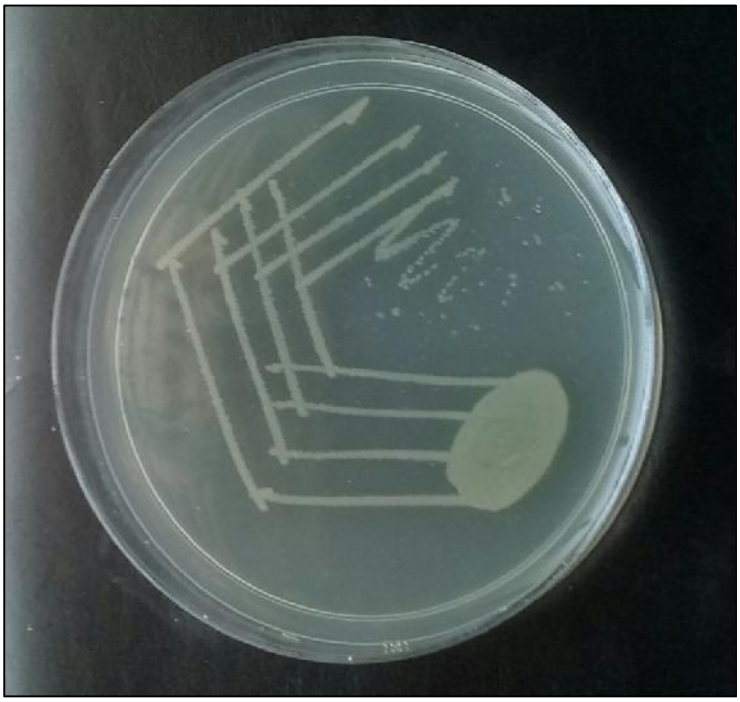


Image 8: Oxidase test from colonies of Acinetobacter baumannii – negative.



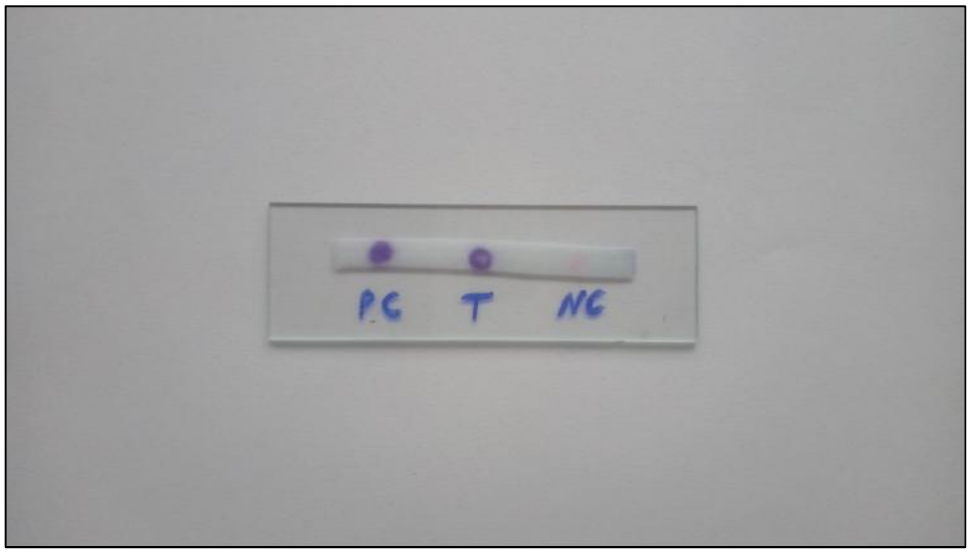
[PC – Positive Control (Pseudomonas aeruginosa ATCC 27853), T – Test (Acinetobacter baumanii), NC – Negative Control (Escherichia coli ATCC 25922)]

Image 9: Nutrient Agar plate with colonies of Pseudomonas aeruginosa



Small, irregular, low convex, rough colonies with serrated edges showing greenish pigmentation.

Image 10: Oxidase test from colonies of Pseudomonas aeruginosa – negative.



[PC – Positive Control (ATCC 27853), T – Test (Pseudomonas aeruginosa), NC – Negative Control (Escherichia coli ATCC 25922)]

RESULTS

Demographic characteristics of the study population

During the study period, 1066 patients were admitted to Paediatric emergency ward. Of these patients, 461 patients did not qualify for the study sample as they were discharged within 48 hours of admission. 195 patients were lost on follow up due to lack of sample availability, critical clinical condition or logistic challenges because of high load of patient admissions. Detailed information was collected for the 410 patients who stayed in Paediatric emergency ward for ≥48 h, and these patients were followed up daily. Of these, 225 (54.8%) were male and 185 (45.12%) were female. At the time of admission to the Paediatric emergency ward, 104 (25,36%) were aged <1 year (including 26 neonates), 168 (40.97%)were aged ≤6 years, and 138 (33.65%)were aged >6years. Of the 410 patients, 98 (52%) had pneumonia at the time of admission. Two (0.48%) patients underwent surgical procedures while they were in Paediatric Emergency Ward; one for Colostomy and another patient for incision and drainage of scalp Abscess.

Risk factors

Of 410 patients under study, 398 patients had peripheral venous catheter in situ and none of them developed BSI. 12 patients were managed without intravenous line. 25 patients had Foleys catheter in situ and none of them (0%) developed CAUTI. 12 patients were mechanically ventilated in pediatric emergency ward during the period of study, of whom 4 patients (33.3%) developed VAP. 6 patients had ascitic tap done and 4 patients underwent pleural tapping and 26 patients underwent lumbar puncture and none of them developed HAI. 2 patients underwent surgery under general anesthesia and one of them developed SSI. (Table 3)

Table 3: Anticipated risks in patients with HAI.

Risk factors	Number of patients exposed to the risk	Patients developing HAI in the at risk population	Number of episodes in the patients developing site specific HAI
IV Cannula (Peripheral Venous Catheterization)	398	0 (0%)	0
Foley's catheter (FC)	25	0 (0%)	0
Mechanical ventilation (MV)	12	4 (33.3%)	6
Lumbar puncture (LP)	26	0 (0%)	0
Central venous catheterization (CV)	8	1 (12.5%)	1
Ascitic tap	6	0 (0%)	0
Pleural tap	4	0 (0%)	0
Minor operative procedures (SSI)	2	1 (50%)	1

Incidence rates of HAIs

Of the 410 patients, 5 patients developed 8 episodes of HAI, which is a Crude Incidence Rate (CIR) of 1.95% (Figure 9). Incidence density of site specific HAI was found to be as follows: 0 for CAUTI, 8.7% for CLABSI, 24.53% for VAP and 16.4% for SSI. (Table 4)

Figure 9: Proportion of patients who developed HAI in study population in this study. 5 out of 410 patients acquired nosocomial infections.

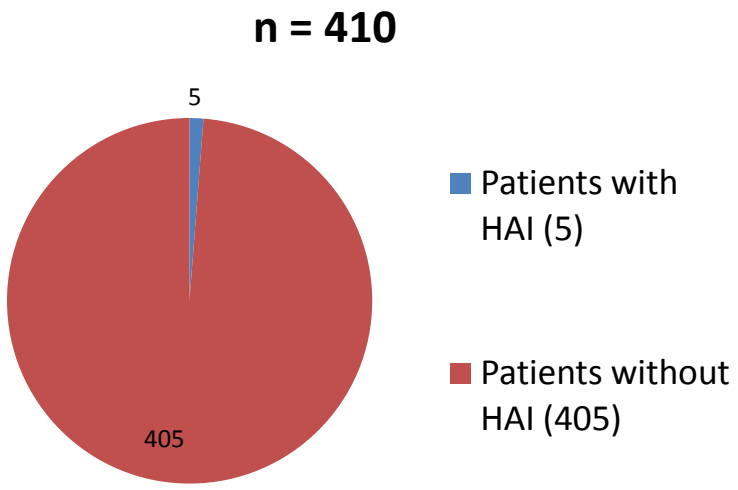


Table 4: HAI and site specific incidence rates

Crude incidence rate of HAI: **1.95%**
Crude incidence rate of SSI: **50% (1 out of two patients)**
Crude incidence rate of VAP: **33.33%**
Crude incidence rate of CLABSI: **16.6%**
Crude incidence rate of CAUTI: **0%**

3 site specific hospital acquired infections were documented; 3 patients (60%) had VAP, 1 patient (20%) had SSI and another patient (20%) had VAP and CLABSI. (Figure 10 and Figure 11)

Figure 10: Proportion of various site specific infection episodes in all 5 patients who developed HAI

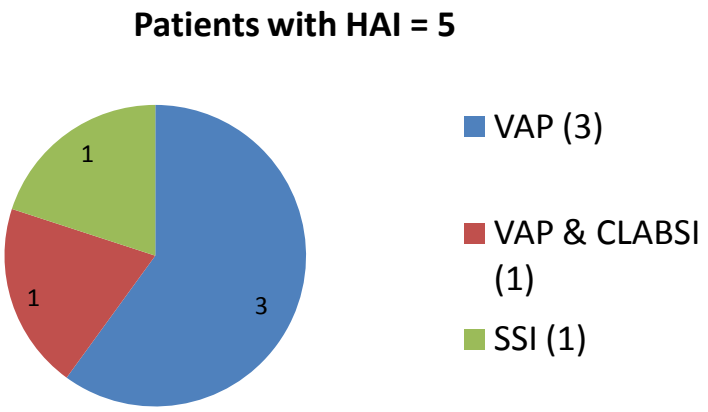
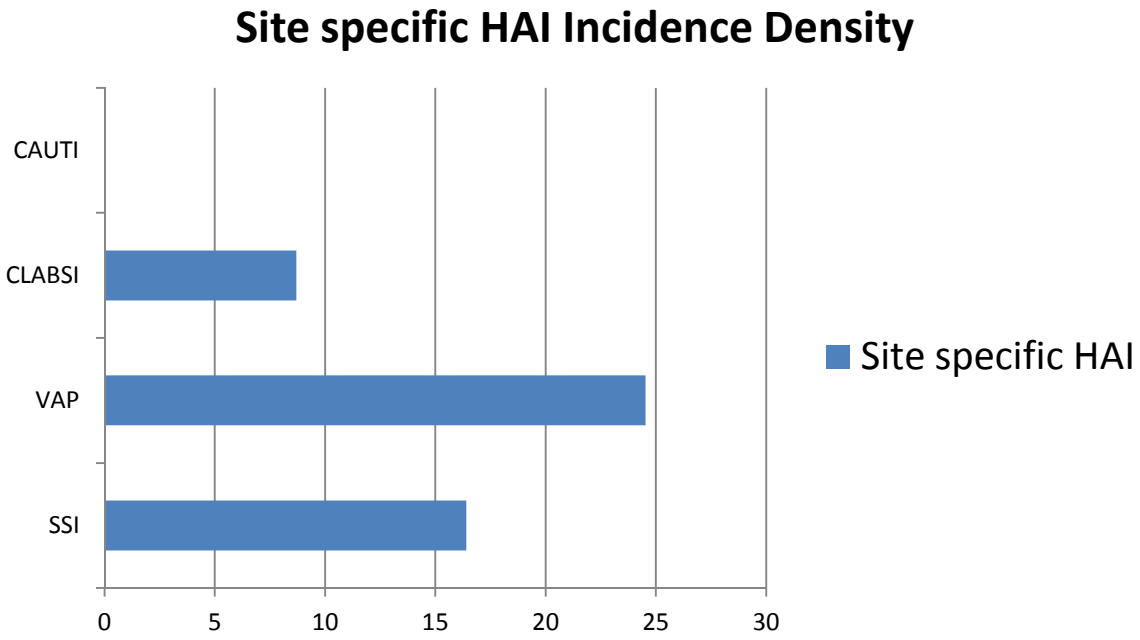


Figure 11: Incidence density of all site specific HAI (X Axis). (CAUTI: 0, CLABSI: 8.7, VAP: 24.53 and SSI: 16.4)

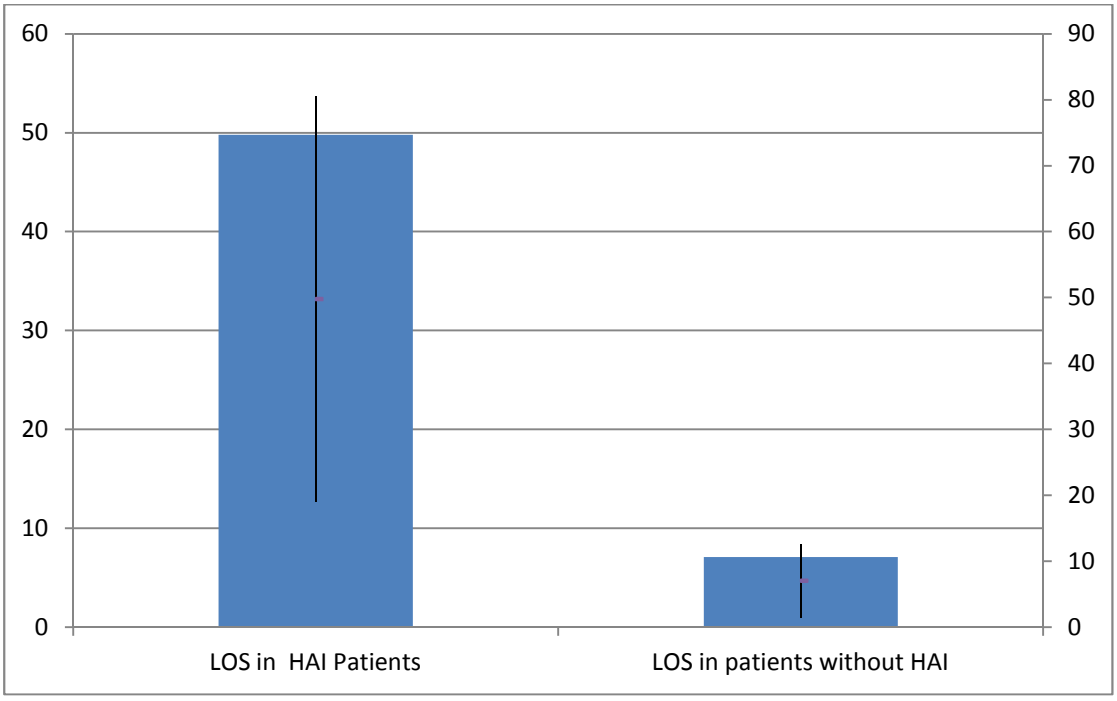


Mean LOS and outcome

The mean LOS of the 410 study patients was 7.43 days. The LOS in patients who developed an HAI was 49.8± 30.75 days (range: 20 days to 95 days; median: 56 days), and was significantly longer (MannWhitney test,P < 0.0001) than the mean LOS of patients without an HAI, which was 7.09 ± 5.56 days (range: 2 days to 40 days; median: 9 days). (Figure 12)

No mortality was observed in any of the patients who developed HAI in our study. 4 out of 5 patients were discharged from the Pediatric Emergency Ward without any clinical complaints and were asymptomatic. However, the patient who developed SSI shifted out of the hospital without any clinical improvement.

Figure 12: Length of Stay of patient with and without HAI represented by bar graphs



scale on the left. Spread of standard deviation is represented by vertical line, with scale on the right. Mean Length of stay for patients who developed HAI: 49.8 ± 30.75. Mean Length of stay for patients who did not develop HAI: 7.09 ± 5.56.

Table 5: Site specific infections device utilization

Total patient days - 3049

Total device days - 503 (central line, Mechanical ventilation and foleys catheter)

Device utilization rate of Central line - 115 (in 8 patients)

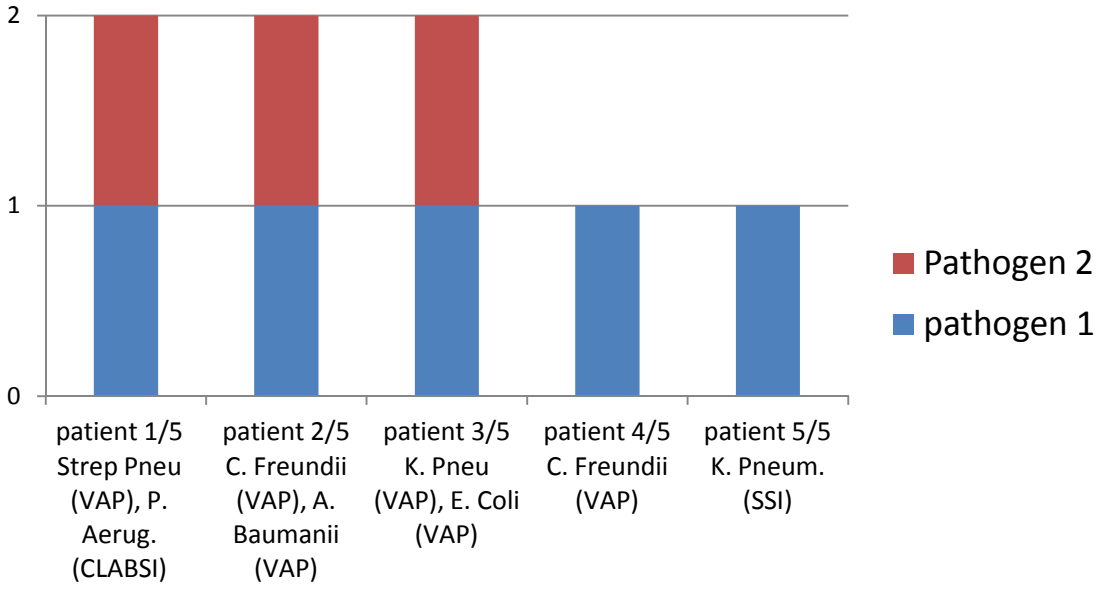
Device utilization rate of mechanical ventilation - 163 (in 12 patients)
(Mean duration of ventilation - 13.6)

Device utilization rate of Urinary catheter - 225 (in 25 patients)

Bacterial isolates (Figure 13)

In 5 patients that experienced HAI, 1 patient experienced SSI, 1 patient had single episode of VAP, 2 patients developed 2 episodes of VAP each and one patient developed episodes of VAP and CLABSI each. 6 different types of bacterial isolates were obtained in 8 episodes of HAI. Streptococcus Pneumoniae, Acinetobacter baumannii, Citrobacter freundii and Escherichia coli were isolated in 4 episodes of VAP. Pseudomonas aeruginosa was isolated from patient who developed CLABSI. Klebsiella pneumoniae was isolated both from a patient with SSI and another patient who developed VAP.

Figure 13: Number of pathogens isolated from each of the 5 patients with HAI.

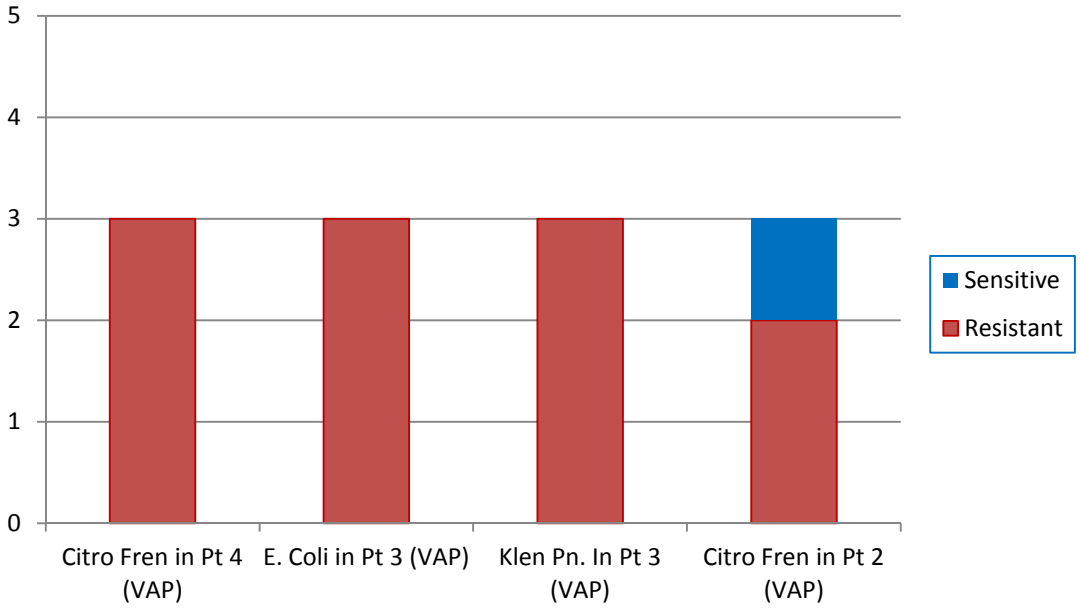


Antimicrobial susceptibility profile of bacterial isolates

5 gram negative isolates and 1 gram positive isolate were obtained from the patients who developed VAP. Isolates were tested against Group A, B and C antibiotics as depicted in Figure 14,15,16,17,18.

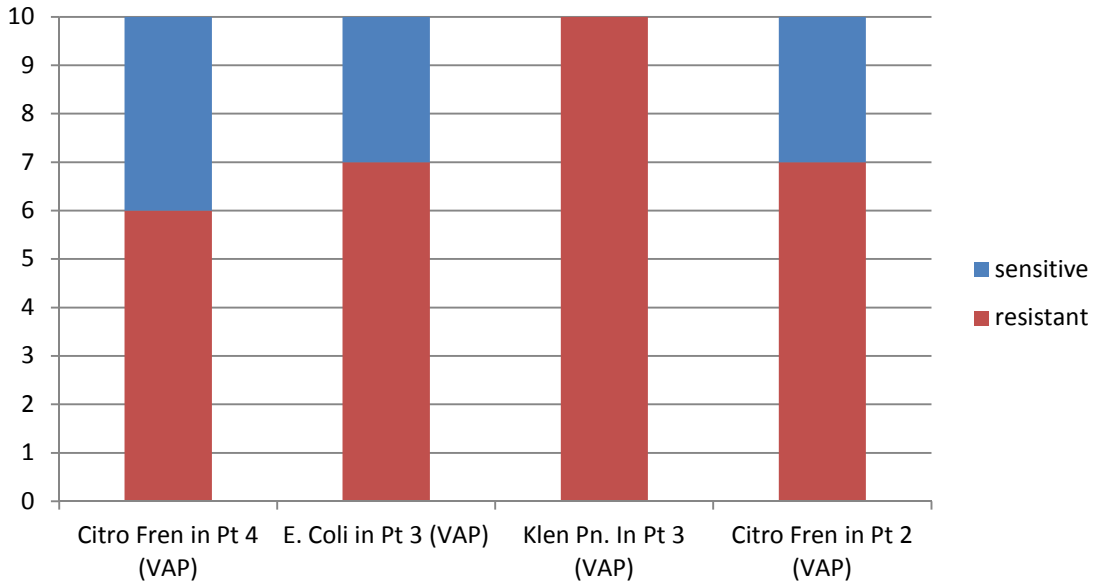
The antibiotic susceptibility profiles of the isolates obtained from the patient with CLABSI and Surgical site infection are depicted in the Tables 6 and 7.

Figure 14 - Antibiogram of the Gram negative isolates of VAP patients



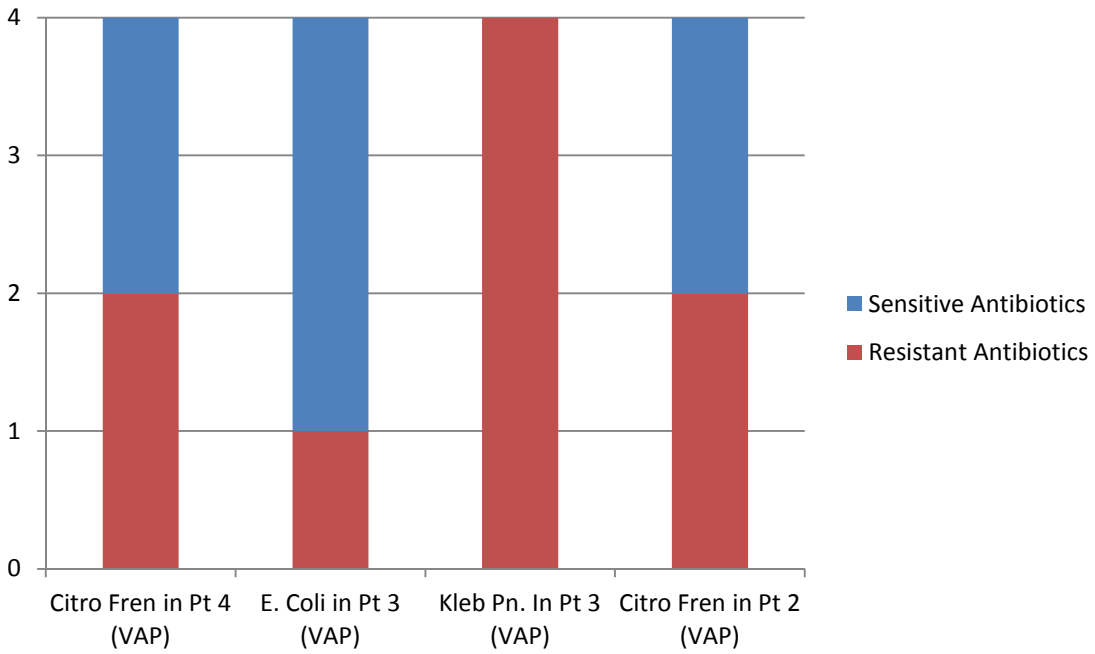
*Group A antibiotics: Ampicillin, Gentamicin, Tobramycin.

Figure 15 : Antibiogram of the Gram negative isolates of VAP patients



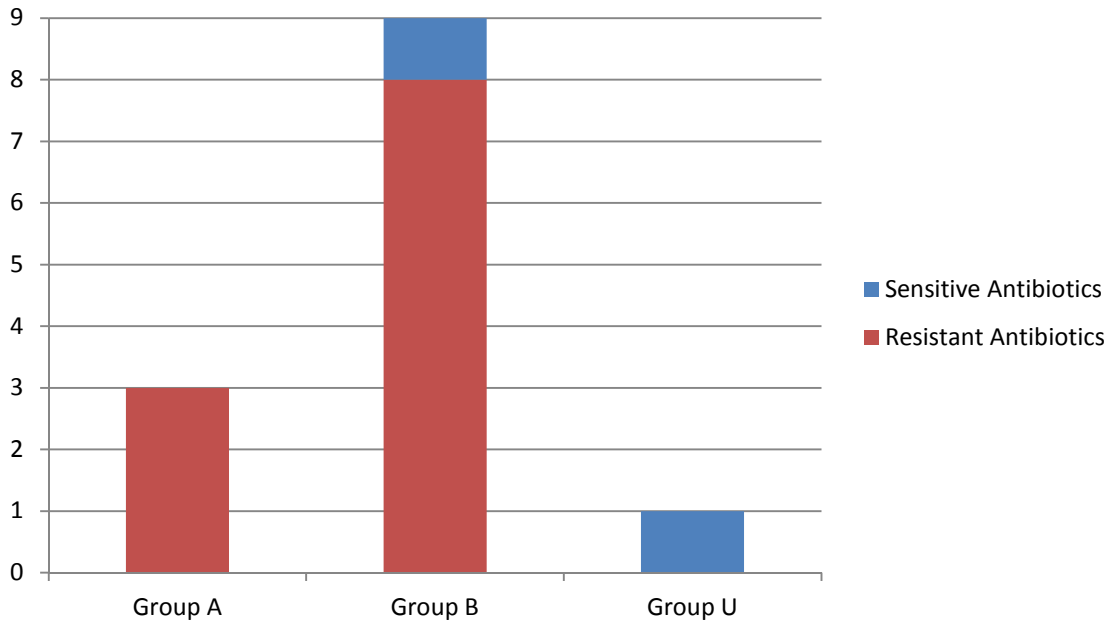
*Group B antibiotics: Amikacin, Amoxicillin-Clavulanate, Piperacillin-Tazobactum, Ceftriaxone, Ciprofloxacin, Levofloxacin, Imipenem, Meropenem, Cotrimoxazole.

Figure 16: Antibiogram of the Gram negative isolates of VAP patients



*Group C antibiotics: Ceftazidime, Chloramphenicol, Tetracycline, Aztreonam.

Figure 17: Bar graph demonstrating number of times antibiotic group A, B or C resistant in Acinetobacter baumanii isolated from one of the episodes of VAP.

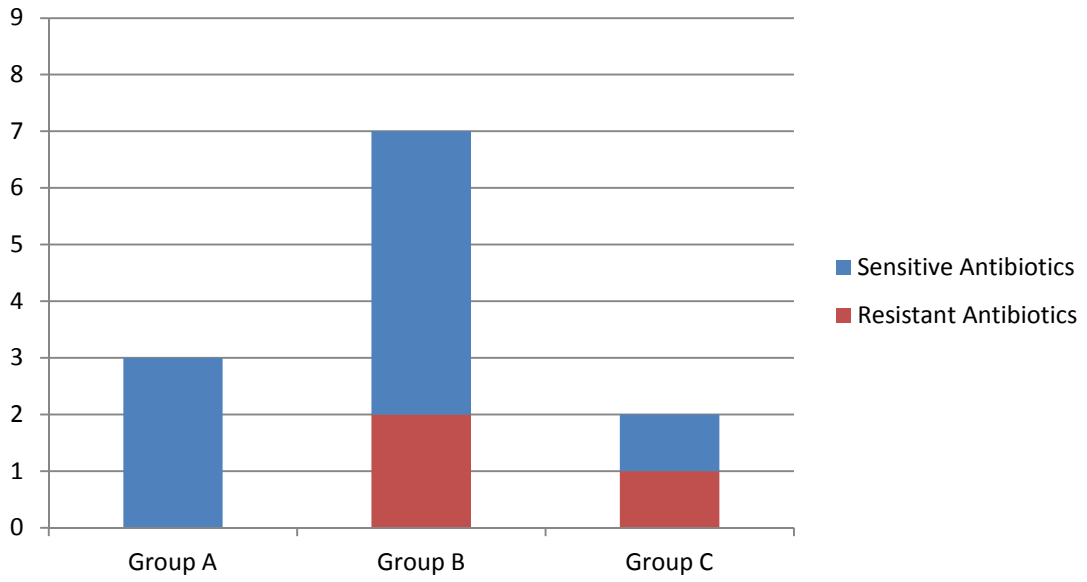


Group A antibiotics: Ampicillin, Gentamicin, Tobramycin.

Group B antibiotics: Amikacin, Amoxicillin - Clavulanate, Piperacillin-Tazobactum, Ceftriaxone, Ciprofloxacin, Levofloxacin, Imipenem, Meropenem,Cotrimoxazole.

Group C antibiotics: Ceftazidime.

Figure 18: Bar graph demonstrating number of times antibiotic group A, B or C resistant in Streptococcus pneumoniae isolated from one of the episodes of VAP.



Group A antibiotics – Erythromycin, Penicillin, Trimethoprim-Sulfamethoxazole.

Group B antibiotics – Clindamycin, Levofloxacin, Tetracycline, Ceftriaxone, Cefotaxime, Vancomycin

Group C antibiotics – Amoxicillin, Amoxicillin-Clavulunate, Chloramphenicol, Linezolid

Table 6: Antibiogram of the Gram negative isolate isolated from the CLABSI patient.

	Pit	**Caz**	**Gen**	**Tob**	**Ak**	**Le**	**At**	**Cip**	**Imp**	**Mrp**
Pseudomonas aeruginosa	R	S	R	S	S	S	S	S	S	S

Group A: Pit – Piperacillin – tazobactam, Caz- ceftazidime , Gen – Gentamicin , Tob – Tobramycin

Group B : Ak- Amikacin , Le – Levofloxacin , At – Aztreonam , Cip- Ciprofloxacin , Imp – Imipenem , Mrp - Meropenem

Table 7: Antibiogram of the Gram negative isolate from a patient with SSI

.

	Amp	**Gen**	**Tob**	**Ak**	**Amc**	**Pit**	**Le**	**Cip**	**Imp**	**Mrp**	**At**	**Caz**	**C**	**Te**
Klebsiella pneumoniae	R	R	R	R	R	R	R	R	R	R	R	R	R	R

Group A antibiotics: Amp -Ampicillin, Gen - Gentamicin, Tob-Tobramycin.

Group B antibiotics: Ak - Amikacin, Amc-Amoxicillin-Clavulanate, Pit-Piperacillin-tazobactam, Cip- Ciprofloxacin, Le-Levofloxacin, Imp- I mipenem, Mrp-meropenem, Cot- Cotrimoxazole

Group C antibiotics: Caz-Ceftazidime, C-Chloramphenicol, Te - Tetracycline, At-Aztreonam.

DISCUSSION

Nosocomial infections are complications of hospitalization that lead to increased morbidity and mortality.[1,2] These infections prolong hospitalization, require more extensive diagnostics and treatment, and are associated with additional costs.[3,4] Infection with multidrug-resistant pathogens can also further complicate treatment. The primary aims of this study were to provide incidence of HAI in pediatric emergency unit, compare different site specific nosocomial infection rates and identify drug resistance pattern of the isolated pathogens. Limited studies are available that have assessed incidence of HAI in emergency units. There is abundance of HAI epidemiological studies in critical care areas. Critically ill patients in intensive care units are at a higher risk of nosocomial infection due to multiple causes including disruption of barriers to infection by endotracheal intubation and tracheostomy, urinary bladder catheterization and central venous catheterization.[17] The most common reported nosocomial infection in ICUs is urinary tract infection, followed by pneumonia and primary blood stream infection.[50,51] Various studies report incidence of nosocomial infection in ICUs between 6.1% to as high as 19.3%. (Wide range of HAI crude incidence rates have been attributed to patient demographics, country's GDP (high in middle and low income countries), area of hospital (low in general wards and high in surgical units), awareness of hand hygiene and other aseptic practices, nursing staff to patient ratio, availability of antimicrobial drugs, immunosuppressant drugs, incidence of risk factors and study design. The current study was carried out in pediatric emergency ward of a tertiary care center. Crude incidence rate was found to be 1.95% which was significantly lower than crude incidence rates documented in other ICU HAI surveillance studies. Low incidence rates have been attributed to shorter length of stay of patients in Paediatric emergency

ward, immediate transfer out of critical patients to ICUs and lesser frequency of invasive interventions. The most common infection detected was ventilator-associated pneumonias (VAP) followed by surgical site infection (SSI) then Central Line Associated Blood Stream Infections (CLABSI).

SN	Studies	CIR (%)	Predominant HAI	Predominant Pathogen
1	**Present study**	**1.97**	**VAP**	**Citrobacter freundii**
2	Millikin J et al. 1998	6.1	VAP	Acinetobacter baumanii
3	Raymond J 2000	7.4	CAUTI	Escherichia coli
4	Gupta et al. 2011	19.3	VAP	Acinetobacter species
5	Geneva WHO 2011	17.5	CAUTI	Escherichia coli
6	Tikkhomirov E. 1987	8.7	CAUTI	Klebsiella pneumoniae

Table 8: Comparison of Crude incidence rate, predominant HAI and predominant etiological agent obtained in various studies.

There was a statistically significant difference ($p < 0.0001$) in mean Length of Stay (LOS) between patients who developed HAI (49.8 ± 30.75) and those who did not (7.09 ± 5.56). This significant difference is attributable to multiple risk factors. First, in our study patients who developed HAI already had severe or complicated conditions. Added infections delayed the recovery time. Second, non-critical care areas are under equipped to promptly diagnose and manage nosocomial infections. Third, in this study VAP was found to be the most common site specific nosocomial infection. 8 out of 12 events of mechanical ventilation; that is two thirds of patients who developed VAP had another episode of VAP. Recurrent episodes of VAP are

associated with longer hospitalization stay. In this study, effect of length of stay on healthcare related cost to the patient and to the hospital was not determined. However, previous studies indicate that Healthcare-associated infections (HAIs) in hospitals impose significant economic consequence. Meta-analysis by Anderson et al. weighed the various cost results by giving higher weight to estimates from larger studies. The resulting attributable costs of various HAIs included: $10,443 for SSI, $23,242 for BSI, $25,072 for VAP, and $758 for CAUTI.

CAUTI is the most common and frequent nosocomial infection seen in critically ill patients as reported in various studies. Richards and colleagues reported in the National Nosocomial Infections Surveillance System (NNIS) database that UTI was responsible for 20–30% of nosocomial infections in medical/surgical ICUs. Finkelstein and colleagues determined an incidence of 10–14% among 337 patients in a single Israeli ICU. These studies enumerated complicated UTIs, multiple pathologies in single patient, more than 8 days of urinary catheterization and heavy patient load in ICUs as frequent risk factors. Of 25 patients that were catheterized, none developed CAUTI. Nosocomial pneumonia is the second most frequent nosocomial infection in critically ill patients, and represents the leading cause of death from infection acquired in hospital. Over 90% of ICU acquired pneumonia develops during mechanical ventilation (VAP), and 50% cases of VAP occur in first 4 days after intubation. The frequency of VAP reported in different studies was between 9% and 21%.[54,55,56] The predominant pathogens commonly isolated in VAP are *Pseudomonas aeruginosa*, Klebsiella pneumoniae, Acinetobacter baumanii and *Streptococcus pneumonia*. In this study 12 patients were mechanically ventilated and 6 episodes of VAP were documented in 4 patients. Crude incidence rate of VAP was 50% and of these 6 pathogens two were Citrobacter freundii, and single isolation

each of Streptococcus pneumoniae, Acinetobacter baumanii, Klebsiella pneumoniae and Escherichia coli. These isolates correlated with the common pathogens identified in other epidemiological studies evaluating VAP in pediatric population.

High incidence rate of VAP in this study could be due to the high number of critical and end of life support care patients presenting in pediatric emergency unit. Ideally patients need to be managed in the ICU for mechanical ventilation and maintenance of aseptic precautions. However, due to unavailability of ICU beds, some of the patients were mechanically ventilated in the Paediatric emergency ward where strict asepsis while intubations and care of patients is not feasible. PICU remains overburdened leading to intubation, mechanical ventilation and maintenance of patients in the pediatric emergency unit. Strict adherence to ICU protocols in emergency unit, like barrier nursing care, physical partitions isolating emergency from outside environment and reducing numbers of transfer in and transfer out patients to decrease exposure of critically ill mechanically ventilated patients, can reduce incidence of VAP which was expectedly higher. Also, the relatively higher incidence of VAP in our study could probably be because of overburdened nursing staff. NABH guidelines for large hospitals state that in Emergency rooms patient to nursing staff ration should not drop below 2:1. In our study based on daily observation, at any given point, the ratio varied between 3:1 and 4:1.

Moreover, half the patients who had first episode of VAP later developed recurrent episode of VAP. This might have been probably due to prolonged duration of mechanical ventilation which leads to repeated intubations. Also, complicated medical conditions such as Encephalitis, GBS with hepatitis and chronic conditions such as Bronchiectasis in these patients could be responsible for longer need for assisted ventilation. Data suggests that patients with VAP had hospital length of stay

between 14 and 46 days which was higher than length of stay of patients who did not develop VAP (2-19 days).Device utilization rate of ventilator was higher as compared to device utilization rates of Central line (Table 5) in paediatric emergency ward. This correlated with highest proportion of VAP cases among all site specific nosocomial infections.

Ventilator-associated bacterial pneumonia (VABP) can be caused by a wide variety of bacteria that originate from the patient flora or the health care environment. Results of the SENTRY Antimicrobial Surveillance Program (1997-2008) established the pathogens most likely to cause HABP or VABP. In all studies, a consistent 6 organisms (*Staphylococcus aureus* [28.0%], *Pseudomonas aeruginosa* [21.8%], *Klebsiella* species [9.8%], *Escherichia coli* [6.9%], *Acinetobacter* species [6.8%], and *Citrobacter* species [6.3%]) caused ~90% of episodes, with lower prevalences of *Serratia* species, S*tenotrophomonas maltophilia*, and community-acquired pathogens, such as pneumococci and *Haemophilus influenzae*. Results of SENTRY also demonstrated that gram negative bacilli are overwhelmingly responsible for majority of the ventilator and hospital associated bacterial Pneumonia. In the current study it was found that gram negative bacilli were responsible for 5 out of 6 episodes of VAP. Citrobacter freundii was the predominant isolate followed by Acinetobacter baumanii, Klebsiella pneumoniae, Escherichia coli. There was only a single isolate of gram posistive cocci (Streptococccus pneumoniae).

Nosocomial infections in Pediatric Intensive Care Units (PICUs) caused by multidrug-resistant bacterial organisms are increasing. Studies show that the impact of multidrug resistance on the outcome of nosocomial infection might differ depending on the study population, type of infection, type of pathogen and appropriateness of

therapy. However, for physicians management of multidrug resistant organisms is far more challenging than treatment of wild variety of pathogens. Generally outcome and prognosis of multidrug resistant organisms causing HAIs is poorer than other pathogens causing HAI.[51,56,82,89]

A review of emerging resistant bacterial pathogens includes methicillin-resistant *Staphylococcus aureus*, Vancomycin-resistant *Enterococcus sp.*, *Clostridium difficile,* extended-spectrum β-lactamase producing Gram-negative organisms, *Klebsiella pneumoniae* carbapenemase-producing strains and multi-drug resistant *Acinetobacter baumannii.*

During the last few years, HAI caused by multidrug and pan resistant Acinetobacter baumannii and Klebsiella pneumoniae have been commonly reported in hospital setting These pathogens are inherently resistant to the commonly used antibiotics and are able to colonize the mucosa of the patients and surface of various devices. They are particularly common in hospital settings.[48]

Acinetobacter baumannii is a bacteria that takes advantage of patients with compromised immune systems and children with a chronic condition are at a higher risk of infections of the lung, urinary tract, or other sites after surgery, intubation, trauma, or catheterization. The amount of Acinetobacter baumannii samples in infected children that were resistant to the antibiotics cephalosporin and carbapenem increased between 1999 and 2012 overall.

Similarly, WHO studies report that *Klebsiella* bacteria have become highly resistant to antibiotics. When bacteria such as *Klebsiella pneumoniae* produce an enzyme known as a carbapenemase (referred to as KPC-producing organisms), then

the carbapenems class of antibiotics do not work to kill the bacteria and treat the infection. Klebsiella species are examples of Enterobacteriaceae, a normal part of the human gut bacteria, that can become carbapenem-resistant.CRE, which stands for carbapenem-resistant Enterobacteriaceae, are a family of pathogens that are difficult to treat because they have high levels of resistance to antibiotics. Unfortunately, carbapenem antibiotics often are the last line of defense against Gram-negative infections that are resistant to other antibiotics.

In this study, Acinetobacter baumannii and Klebsiella pneumoniae were found to be panresistant. They were tested resistant to Ampicillin, Tobramycin and Gentamicin (First line drugs), Amoxicillin Clavulinic Acid combination, Amikacin, Piperacillin-Tazobactam combination, Ceftriaxone, Levofloxacin, Imipenem, Meropenem, Cotrimoxazole (Second line drugs), Ceftazidime (Third Line drug).

The emergence of VAP due to multidrug-resistant Gram-negative bacteria led to the revival of ‘forgotten’ antibiotics, such as polymyxins. Recent studies suggest that colistin administered as monotherapy or combination therapy is an effective and safe antimicrobial agent for multidrug-resistant Gram-negative bacteria infections. The reported colistin nephrotoxicity is 20% or lower. Although colistin is commonly administered intravenously, it can also be administered via inhalation for pneumonia/ventilator-associated pneumonia treatment or by the intraventricular/intrathecal route for meningitis/ventriculitis treatment.

In this study, of the 410 study patients, 8 patients had Central Venous Catheter (CVC) or central venous line in place for more than 48 hours and 1 out of these 8 patients developed CLABSI.CVC are inserted for many emergent indications in the pediatric emergency ward including volume resuscitation in trauma, early goal-

directed therapy in sepsis, and when peripheral vascular access is not possible. Central line-associated blood stream infections (CLABSI) extend ICU and hospital length of stay. CLABSIs can also increase attributable mortality by up to 30%. The only case documented as CLABSI was found in the same patient who had an earlier episode of VAP. Pseudomonas aeruginosa was the pathogen identified and it is one of the most common isolated pathogen in CLABSI patients.

Isolated Pseudomonas aeruginosa from the patient was resistant to one Group A antibiotic, that is Gentamicin and one Group B antibiotic that is Piperacillin-Tazobactum. This observation is in contrast with the isolates obtained from other CLABSI patients where Pseudomonas aeruginosa was commonly found to be pan resistant or multi drug resistant. SSIs are common complications in acute care facilities. SSI is now one of the most common and most costly HAI.[51]

However, in this study only 2 patients underwent surgical procedures (colostomy in Hirschprung's Disease and incision and Drainage of scalp Abscess). Out of these two patients, one patient developed SSI and pan-resistant Klebsiella pneumoniae was isolated. Outcome of this patient remained poor.

CAUTI is the most common and frequent nosocomial infection seen in critically ill patients as reported in various studies. Richards and colleagues reported in the National Nosocomial Infections Surveillance System (NNIS) database that UTI was responsible for 20–30% of nosocomial infections in medical/surgical ICUs. Finkelstein and colleagues determined an incidence of 10–14% among 337 patients in a single Israeli ICU. In our study no (0.0%) patients were diagnosed to acquire urinary tract infection out of 4 patients exposed to the risk of CAUTI. The source of nosocomial UTIs was placement of Foley's catheter for a longer duration. The nil incidence rate of CAUTI in our study was probably because of the widespread use of

condom catheters than Foleys catheter in emergency unit. Also of note, most catheterizations were done by the trained and dedicated senior nursing staff under strict aseptic cover.

No CAUTI related mortality data exists for Indian population, in the USA central venous catheterization is the cause of up to 28,000 deaths annually among patients in ICU's. In the current study, no CAUTI incidence was observed. This observation can also be attributable to extensive CAUTI prevention drives and resident awareness. Other studies have reported high number of CAUTI related morbidity data. In a study by Rizvi et al, the frequency was 27%, probably because this study was conducted among critically ill patients admitted in nephrology and neurology intensive care units.

Based on this study, appropriate HAI prevention steps were recommended and implemented after due consultation with Hospital Infection Control experts. On an individual case to case basis, appropriate authorities were communicated the results of antibiotic susceptibility pattern of HAI pathogens. All of these cases, except the patient that developed surgical site infection, improved after relevant antimicrobial therapy was administered.

During and after the completion of study, based on observation, few recommendations were made. For the mechanically ventilated patients, simple and low-cost strategies such as hand hygiene and regular change of ventilator tubing were recommended to minimize aspiration of secretions, reduce colonization of the patient's respiratory tract with pathogenic bacteria and prevent contamination of mechanical ventilation equipment. These recommendations also included hand hygiene practices, routine suctioning above the endotracheal cuff, elevating the head of the bed at least 30 degrees, and providing oral hygiene with 1.5% hydrogen

peroxide solution. These were suggested in the pediatric Emergency Ward with appropriate education. Further follow up is recommended in the Pediatric emergency ward to assess the measures taken and their impact on HAI reduction and compliance.

CONCLUSION

The study carried out in a Paediatric emergency ward of a tertiary care center shows crude incidence rate of HAI to be 1.95% which is significantly lower than crude incidence rates documented in other ICU HAI surveillance studies. Low incidence rates have been attributed to shorter length of stay of patients in Paediatric emergency ward, immediate transfer out of critical patients to ICUs and lesser frequency of invasive interventions. In terms of occurrence, ventilator associated pneumonia was followed by bloodstream infections and Catheter associated urinary tract infections.

There was a statistically significant difference ($p < 0.0001$) in mean Length of Stay (LOS) between patients who developed HAI (49.8 ± 30.75) and those who did not (7.09 ± 5.56). This significant difference is attributable to multiple risk factors. Complications, with superadded infection due to non-critical care areas are under equipped to manage nosocomial infections have led to prolonged hospital stay.

In this study VAP was found to be the most common site specific nosocomial infection.

Half the patients who had first episode of VAP later developed recurrent episode of VAP. This might have been probably due to prolonged duration of mechanical ventilation which leads to repeated intubations. Also, complicated medical conditions such as Encephalitis, GBS with hepatitis and chronic conditions such as Bronchiectasis in these patients could be responsible for longer need for assisted ventilation. Data suggests that patients with VAP had hospital length of stay between 14 and 46 days which was higher than length of stay of patients who did not develop VAP (2-19 days).Device utilization rate of Mechanical ventilation was higher

as compared to that of Central line in Paediatric emergency ward . This correlated with highest proportion of VAP cases among all site specific nosocomial infections.

In this study, Acinetobacter baumannii and Klebsiella pneumoniae were found to be panresistant.

APPENDIX

1. Gram stain Procedure: Hucker's modification

Principle: After treatment with decolorizing agents, gram positive bacteria retain para- rosaniline dyes and appear violet color while gram negative bacteria lose the dye and take up counter stain and appear pink in color.

Procedure:

a) A clean grease free glass slide was labelled and a thin smear was made on it using the first high vaginal swab and allowed to air dry.

b) The smear was fixed by passing the slide three to four times through the flame of a Bunsen burner.

c) Slide was then placed on the slide rack and the smear overlaid with crystal violet solution.

d) After 20 seconds, the slide was washed thoroughly with tap water.

e) Subsequently, the smear was overlaid with Gram iodine solution for 20 seconds and washed again with water.

f) The smear was held between the thumb and fore finger and the surface flooded with a few drops of acetone-alcohol decolorizer, until no color washed off.

g) The smear was washed with running water and placed back on the staining rack. Surface of the smear was overlaid with safranin (counter stain) for 10 seconds and washed with running water.

h) The slide was placed in an upright position in a rack, allowing excess water to drain off.

i) The stained smear, after being dried was examined under 100 X (oil) immersion objective lens.

Quality control: Gram positive: *Staphylococcus aureus* ATCC 25923

Gram negative: *Escherichia coli* ATCC 25922

2. Indole Test

The indole test is a biochemical test performed on bacterial species to determine the ability of the organism to convert tryptophan into indole. This division is performed by a chain of a number of different intracellular enzymes, a system generally referred to as "tryptophanase."

3. Kovacs reagent

Kovacs reagent is a biochemical reagent consisting of isoamyl alcohol, para-dimethylaminobenzaldehyde (DMAB), and concentrated hydrochloric acid. It is used for the diagnostical indole test, to determine the ability of the organism to split indole from the amino acid tryptophan. The indole produced yields a red complex with para-dimethylaminobenzaldehyde under the given conditions.

4.Methyl red Test

Methyl red is used in the methyl red test (MR test), used to identify bacteriaproducing stable acids by mechanisms of mixed acid fermentation of glucose.

The MR test, the "M" portion of the four IMViC tests, is used to identify enteric bacteria based on their pattern of glucose metabolism. All enterics initially

produce pyruvic acid from glucose metabolism. Some enterics subsequently use the mixed acid pathway to metabolize pyruvic acid to other acids, such as lactic, acetic, and formic acids. These bacteria are called methyl-red positive and include *Escherichia coli* and *Proteus vulgaris*. Other enterics subsequently use the butylene glycol pathway to metabolize pyruvic acid to neutral end products. These bacteria are called methyl-red-negative and include *Serratia marcescens* and *Enterobacter aerogenes*.

5. Voges – Proskauer Test

Voges–Proskauer or VP is a test used to detect acetoin in a bacterial broth culture. The test is performed by adding alpha-naphthol and potassium hydroxide to the Voges-Proskauer broth which has been inoculated with bacteria. A cherry red color indicates a positive result, while a yellow-brown color indicates a negative result.

6. Simmons' citrate test

Simmons' citrate test is used for differentiating gram-negative bacteria on the basis of citrate utilization. It is useful for selecting for organisms that use citrate as its main carbon and energy source. It is a defined, selective and differential medium that tests for an organism's ability to use citrate as a sole carbon source and ammonium ions as the sole nitrogen source.

7.Triple Sugar Iron (TSI) test

The Triple Sugar Iron (TSI) test is a microbiological test roughly named for its ability to test a microorganism's ability to ferment sugars and to produce hydrogen

sulfide. It is often used in the selective identification of enteric bacteria including *Salmonella* and *Shigella*.

8.Mannitol motility medium

Mannitol motility medium is a bacterial growth medium used to detect the ability of bacteria to ferment mannite and produce nitrogen gas; and to indicate the motility of the organism.

9.*Christenson's Urease medium*

Urease broth is a differential medium that tests the ability of an organism to produce an exoenzyme, called urease that hydrolyzes urea to ammonia and carbon dioxide. The broth contains two pH buffers, urea, a very small amount of nutrients for the bacteria, and the pH indicator phenol red.

10. *Oxidase test*

The oxidase test is used to identify bacteria that produce cytochrome c oxidase, an enzyme of the bacterial electron transport chain. (note: All bacteria that are oxidase positive are aerobic, and can use oxygen as a terminal electron acceptor in respiration.

11. Optochin sensitivity

Optochin (ethyl hydrocupreine hydrochloride) sensitivity test is used for the presumptive identification of alpha-hemolytic streptococci as *Streptococcus pneumoniae*. Optochin is used to differentiate *Streptococcus pneumoniae* from other alpha-hemolytic streptococci. The Optochin test is performed on a blood-agar medium using a disk diffusion principle. Optochin sensitive *Streptococcus*

pneumoniae surrounding the disk impregnated with optochin are lysed, due to changes in surface tension, creating a clear zone of inhibition.

12. Bile Solubility

Bile solubility test is used to differentiate *Streptococcus pneumoniae* from other alpha-hemolytic Streptococci. *Streptococcus pneumoniae* is bile soluble whereas all other alpha-hemolytic streptococci are insoluble. Bile or a solution of bile salt, like sodium desoxycholate rapidly lyses the pneumococcal colonies. This lysis depends on the presence of intracellular autolytic enzyme. Bile salts help to lower the surface tension between the bacterial cell and the medium, thus enhancing the organism's natural autolytic process.

13. Antibiotic Susceptibility Testing

The Kirby-Bauer test, known as the disk-diffusion method, is the most widely used antibiotic susceptibility test in determining what choice of antibiotics should be used when treating an infection. A culture medium, specifically the Mueller-Hinton agar, is uniformly and aseptically inoculated with the test organism and then filter paper discs, which are impregnated with a specific concentration of a particular antibiotic, are placed on the medium. If the organism is susceptible to a specific antibiotic, there will be no growth around the disc containing the antibiotic. Thus, a "zone of inhibition" can be observed and measured to determine the susceptibility to an antibiotic for that particular organism.

14. SPS (Sodium polyanethol sulfonate)

Sodium polyanethol sulfonate (SPS; Liquoid, Hoffman-La Roche) is an anticoagulant and a surface-active agent which is widely employed as an additive to fluid blood culture media. It

is generally considered to enhance the rate and speed of bacterial isolations by counter-acting the bacterial inhibitors of human blood. SPS is known to neutralize the bactericidal activity of fresh human serum and to inhibit phagocytosis. There is a significant favorable effect of 0.05% SPS upon the rate and speed of isolations of both gram-positive and gram-negative pathogenic bacteria.

SUMMARY

In this study, the burden of HAIs in a Paediatric emergency ward of a tertiary care multispecialty hospital was estimated. Further bacteria causing HAI were identified with special emphasis on their antibiotic sensitivity. In this year-long study, 410 patients were selected as cohort with HAI as risk factor.

This study showed that because of relatively frequent shift outs of critical patients and reduced length of stay, the crude infection rate of HAI was lesser than contemporary studies in pediatric ICU settings. However, keeping with the trend, in terms of occurrence, ventilator associated pneumonia was followed by bloodstream infections and Catheter associated urinary tract infections.

Length of stay is found to be the major risk factor for acquiring HAI, among the factors studied. Expectedly mean length of stay and mortality were higher in patients who developed an HAI. This difference was statistically significant.

Gram negative bacilli are the predominant pathogen causing HAI, with VAP being the most common type of HAI. Acinetobacter baumannii.,Citrobacter freundii and Klebsiella pneumoniae were the most common isolates in cases with HAI. This also echoed with the trends documented in developing countries.

Multi drug resistance further narrows down the possibility of recovery, though all the patients in this study have recovered.

Relevance of this study lies in the fact that although several studies exist to document HAI incidence rates in adult ICU settings, very few studies are available in paediatric ICU settings. Further still, in recent years no studies were found which elaborate prevalence and trends of HAI in paediatric emergency wards.

During and after the study, practical low cost measures were recommended in the paediatric emergency ward to limit the spread of infection. Also, antibiograms derived from this study were suggested to the paediatricians for more appropriate selection of antibiotics as empirical therapy.

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ANNEXURE

K.L.E.UNIVERSITY'S
JAWAHARLAL NEHRU MEDICAL COLLEGE,
NEHRU NAGAR, BELAGAVI-590010 (KARNATAKA-INDIA)
(Accredited 'A' Grade by NAAC)

Website: http//www.jnmc.edu
E-Mail : dome@jnmc.edu

Phone: (+ 91-(0)831 Office : 2471350
Principal: 2471701
Fax No. +91 (0)831 – 2470759

Ref: MDC/DOME/ 89 **Date: 17/10/2016**

To,

PG student in Microbiology,
J.N.Medical College,
BELAGAVI.

Sub: Institutional Ethical Clearance for the study.

With reference to the above, we wish to inform you that your proposed research project titled **"INCIDENCE OF HOSPITAL ACQUIRED INFECTIONS IN PATIENT ADMITTED TO PAEDIATRIC EMERGENCY WARD IN A TERTIARY CARE HOSPITAL – ONE YEAR LONGITUDINAL STUDY",** is ethical and justifiable. The proposed research project has been cleared by the JNMC Institutional Ethics Committee on Human Subjects Research.

(Dr. Arathi Darshan)
Member Secretary
JNMC Institutional Ethics Committee
on Human Subjects Research,
J.N.Medical College, Belagavi.

(Dr. Ganga Pilli)
Chairman,
JNMC Institutional Ethics Committee
on Human Subjects Research,
J.N.Medical College, Belagavi.

90

Consent forms (English, Kannada & Marathi)

PARTICIPANTS INFORMATION SHEET

Dear Sir/Madam,

Kindly read this document which provides information on a medical research to identify…

TITLE: Incidence of Hospital Acquired Infections in patients admitted to Paediatric Emergency Ward in a Tertiary Care Hospital- one year longitudinal study.

Study Investigator Dr.

Department of Microbiology,

Jawaharlal Nehru Medical College,

KLE University, Belgaum – 590 010

Guide **Dr.**

Professor,
J. N. Medical College, KLE University,
Belgaum – 590 010.

Co Guide **Dr**

Professor,
J. N. Medical College, KLE University,
Belgaum – 590 010.

INTRODUCTION:

Hospital Acquired Infections are those which are developed by patients during their stay in the hospital . Hospital acquired infections, are important cause of morbidity and mortality. They increase the days of hospital stay and increase the cost of treatment. Patients are monitored for HAI, to prevent or treat them if encountered. So, this study is being conducted to diagnose Hospital Acquired Infections as soon as possible and start appropriate antibiotic treatment. You are requested to participate in this study. During the study you will be asked some questions and you are requested to answer to the best of your knowledge.

PROCEDURE INVOLVED:

Blood sample, urine sample and any other sample as per indication will be taken using aseptic precautions. The organisms will be detected and appropriate antibiotics will be given as per antibiotic sensitivity testing.

RISKS AND BENEFITS:

There are no risks/minimal risks involved. Benefits are to be evaluated.

PRIVACY AND CONFIDENTIALITY:

No information about you or provided by you, during research will be disclosed to others without your written permission, except in emergency to protect your rights and welfare.

AUTHORIZATION TO PUBLISH RESULTS:

When the results of research are published or discussed, in a conference no information will be displayed that would disclose your identity. Any information that is obtained in connection with this study and that can be identified with you will remain confidential.

FINANCIAL INCENTIVES FOR PARTICIPATION:

You will not have to pay/offer any gifts for participating in the research. You will not be reimbursed for expenses.

In case you have any questions related to the study, you can contact Dr. no. or Dr under whose guidance study will be conducted.

In case you have any questions about your rights as a participant, you can contact Dr Professor of pathology and Chairman, J.N. Medical College Institutional Ethical Committee for Human Subjects Research,(Ph.) at J.N. Medical College, Belgaum.

CONSENT STATEMENT

I undersigned _____have been explained in my vernacular language about the study and my participation in the study is voluntary. If I want, I can withdraw at any time. Also I have been given enough time to clear my doubts and rights as study participant.

Participants Name _____signature_____

Witness Name _____signature_____

Experimenters Name _____ signature_____

Date : Place:

ರೋಗಿಗಳ ಮಾಹಿತಿ ಬಗ್ಗೆ

ಡಿಯರ್, ಸರ್, ಮೆಡಮ್,

ದಯವಿಟ್ಟು ಈ ದಾಖಲಾತಿಗಳು ಬಗ್ಗೆ ಮಾಹಿತಿ ಕೊಡುತ್ತಿದ್ದೇವೆ.

ಟೈಟಲ್

ಪೆಡಿಯಾಟ್ರಿಕ್ ತುರ್ತು ಚಿಕಿತ್ಸೆ ವಾರ್ಡ ಅಥವಾ ಆಸ್ಪತ್ರೆಯಲ್ಲಿ ದಾಖಲ ಆಗುವ ಸಂಧರ್ಭದಲ್ಲಿ ರೋಗಿಗೆ ಆಗುವ ಕಾಯೆಲೆ ಒಂದು ವರ್ಷದ ಬಗ್ಗೆ ಅಧ್ಯಾಯ

ಅಧ್ಯಯನದ ಪರಿವಿಕ್ಷಕರು:

ಡಾ॥
ಮೈಕ್ರು ಬೈಲುಜಿ ವಿಭಾಗ
ಜವಾಲಾಲ ನೆಹರು ವೈಧ್ಯಕೀಯ ಕಾಲೇಜ
ಕೆ.ಎಲ್.ಇ. ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ–590010

ಮಾರ್ಗದರ್ಶಕ:

ಡಾ॥
ಅಧ್ಯಾಪಕರು ಜೆ.ಎನ್. ವೈಧ್ಯಕೀಯ ಕಾಲೇಜ
ಕೆ.ಎಲ್.ಇ. ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ–590010

ಪರಿಚಯ:

ಈ ಅಧ್ಯಯನದಲ್ಲಿ ರೋಗಿಯು ಆಸ್ಪತ್ರೆಯಲ್ಲಿ ದಾಖಲ ಆಗುವ ಆ ಸಂಧರ್ಭದಲ್ಲಿ ರೋಗಿಗಳಿಗೆ ಅನೇಕ ರೋಗಗಳು ಅಂಟಿಕೊಂಡಿರುತ್ತೇವೆ. ಆದ್ದರಿಂದ ರೋಗಿಗಳಿಗೆ ಅನೇಕ ತೋಂದರೆಗಳು ಆಗುತ್ತದೆ. ಆದ್ದರಿಂದ ಆಸ್ಪತ್ರೆಯ ಹೆಚ್ಚು ರೋಗಿಗಳು ಮತ್ತು ವೆಚ್ಚ ಅಧಿಕವಾಗುತ್ತದೆ. ಅದಕ್ಕೆ ನಾವು ರೋಗಿಗಿ ಆಗುವ ರೋಗುಗಳ ಬಗ್ಗೆ ಮೊದಲೆ ಪ್ರಯತ್ನ ಮಾಡಿದ್ದರೆ ರೋಗಿಗಿ ಯೋಗ್ಯ ಚಿಕತ್ಸೆಯನ್ನು ಕೊಡಲು ಅನುಕೊಲ ಆಗುತ್ತದೆ. ಅದಕ್ಕಾಗಿ ನಾವು ನಿಮಗಿ ವಿನಂತಿ ಮಾಡುತ್ತೇವೆ. ಈ ಅಧ್ಯಯನದಲ್ಲಿ ನೀವು ಭಾಗವಹಿಸಬೇಕು. ಇದರಲ್ಲಿ ಭಾಗವಹಿಸುವುದು ನಿಮ್ಮ ಸ್ವಇಚ್ಚಿಸುವುದು ಮತ್ತು ಬೀಡುವುದು. ನಿಮಗೆ ಬಿಟ್ಟದ್ದು., ನಿಮಗೆ ಇಷ್ಟ ಇಲ್ಲದಾಗ ಈ ಅಧ್ಯಯನವನ್ನು ಬೀಡಬಹುದು ಇದಕ್ಕೆ ಯಾವದೇ ವಿರೋದ ಇರುವುದಿಲ್ಲ.

ಅಧ್ಯಯನದ ವಿಧಾನ

ಈ ಅಧ್ಯಯನದಲ್ಲಿ ರಕ್ತ ಪರಿಕ್ಷೆ, ಮಲಮೂತ್ರ ಪರಿಕ್ಷೆ, ಅಥವಾ ಬೇರೆ ಯಾವದೇ ಪರೀಕ್ಷೆ ಇದ್ದರೆ ಅದನ್ನು ಅತ್ಯಂತ ಕಾಳಜಿಪೂರಕವಾಗಿ ನಾವು ಮಾಡುತ್ತೇವೆ. ಮತ್ತು ಕ್ರಿಮಿ ಕಿಟಗಳನ್ನು ಪರೀಕ್ಷೆ ಮಾಡಿ ಅದಕ್ಕೆ ಉಪಚಾರವು ನೀಡುತ್ತೇವೆ.

ಅಪಾಯ ಮತ್ತು ಲಾಭಗಳು:

ಈ ಅಧ್ಯಯನದಿಂದ ನಿಮಗಿ ಯಾವದೇ ಅಪಾಯವಿರುವುದಿಲ್ಲ ಇದರಿಂದ ನಿಮಗಿ ಲಾಭ ಆಗುತ್ತದೆ.

ಈ ಅಧ್ಯಯನದ ಗೌಪ್ಯತೆ ಮತ್ತು ಗೌಪ್ಯತೆಯನ್ನು

ಈ ಅಧ್ಯಯನದಲ್ಲಿ ರೋಗಿಯು ಯಾವದೇ ಮಾಹಿತಿ ಕೊಟ್ಟರೆ ನಾವು ಬೇರೆಯವರಿಗೆ ಮಾಹಿತಿಯನ್ನು ಕೊಡುವುದಿಲ್ಲ ಯಾವದೇ ಪ್ರಕಟಣೆ ಮಾಡಿದರೆ ನಿಮ್ಮ ಮಾಹಿತಿಯನ್ನು ನೀಡುವುದಿಲ್ಲ.

ಈ ಅಧ್ಯಯನಕ್ಕಾಗಿ ಪಾಲುಗೊಳ್ಳುವ ಪ್ರೊತ್ಸಾಹ ಧನ

ಈ ಅಧ್ಯಯನದಿಂದ ರೋಗಿಗಿ ಯಾವದೇ ವೆಚ್ಚ ಮಾಡಬೇಕಾಗಿಲ್ಲ.

ಈ ಅಧ್ಯಯನದ ಬಗ್ಗೆ ನಿಮಗಿ ಯಾವದೇ ಪ್ರಶ್ನೆ ಇದ್ದರೆ ಕೇಳಬಹುದು. ಡಾ॥
, ಸಂಪರ್ಕವನ್ನು ಮಾಡಬಹುದು . ಮೊಬೈಲ ನಂ.: ಅಥವಾ
ಹರಕುಣಿ: ಇವರ ಮಾರ್ಗದರ್ಶನದಲ್ಲಿ ಅಧ್ಯಯನ ಮಾಡುತ್ತಿದ್ದಾರೆ. ಮೊಬೈಲ ನಂ.

ಈ ಅಧ್ಯಯನದ ಬಗ್ಗೆ ನಿಮಗಿ ಯಾವದೇ ಪ್ರಶ್ನೆ ಇದ್ದರೆ ರೋಗಿಯೂ ನಿಮ್ಮ ಹಕ್ಕಿನ ಬಗ್ಗೆ ಇವರನ್ನು ಡಾ॥ ಪಾತೊಲಿಜಿ ಮತ್ತು ಚೆರ್ಮನ ಜೆ ಎನ್ ವೈದ್ಯೆಕೀಯ ಕಾಲೇಜ, ಇನ್ಸುಟುಶನ್ ಅರ್ತಿಕಲ್ ಕಮಿಟಿ ಅಥವಾ ಹೂಮನ್ ಸಬೆಕ್ಟ ರಿಸರ್ಚ ಸಂಪರ್ಕ ಮು: ಜೆ. ಎನ್. ಮೆಡಿಕಲ್ ಕಾಲೇಜ, ಬೆಳಗಾವಿ

ಒಪ್ಪಿಗೆ ಪತ್ರ

ನಾನು ಈ ಕೆಳ ಸಹಿ ಮಾಡಿದ _____

ನಾನು ಮಾಹಿತಗಳು ನನಗೆ ತಿಳಿದ ಮಟ್ಟಿಗೆ ಹಾಗೂ ನಾನು ಅದನ್ನು ನನ್ನ ಮಾತೃ ಭಾಷೆಯಲ್ಲಿ ಓದಿ, ಓದಿಸಿ ಹೇಳಲಾಗಿದೆ ಮತ್ತು ಈ ಅಧ್ಯಯನದಲ್ಲಿ ಭಾಗವಹಿಸುವುದು ನನ್ನ ಸ್ವ ಇಚ್ಚಿ ಇದೆ ಮತ್ತು ಈ ಅಧ್ಯಯನದಲ್ಲಿ ಯಾವಾಗಲೂ ಬೀಡಬಹುದು ಮತ್ತು ನನಗೆ ಕೆಲವು ಸಮಯ ನೀಡಿ ನನ್ನ ಪ್ರಶ್ನೆ ಮತ್ತು ಹಕ್ಕಿನ ಬಗ್ಗೆ ಮಾಹಿತಿ ನೀಡಲಾಗಿದೆ. ಅಂತಾ ಒಪ್ಪಿಗೆ ಪತ್ರ.

ಭಾಗವಹಿಸುವರ ಹೆಸರು _____ ಸಹಿ _____

ಸಾಕ್ಷಿದಾರರ ಹೆಸರು _____ ಸಹಿ _____

ಪ್ರಯೋಗ ಮಾಡುವವರ ಹೆಸರು _____ ಸಹಿ _____

ದಿನಾಂಕ: ಸ್ಥಳ:

सहभागी संशोधकांचे माहिती पत्रक

प्रिय सर/मॅडम,

लहान मुलांना इस्पितळातील होणाऱ्या संसर्गाबाबतच्या वैद्यकीय संशोधनाची माहिती देणारे हे पत्रक कृपया वाचा.

शीर्षक : इस्पितळातील आणिबाणी बालरुग्ण विभागात उपचार घेताना बालकांना होणाऱ्या संसर्गावर आधारित एक वर्षाच्या कालावधीत केलेले संशोधन.

अभ्यास केलेल्या संशोधकाचे नाव : डॉ.
डिपार्टमेंट ऑफ मायक्रोबायोलॉजी,
जवाहरलाल नेहरु मेडिकल कॉलेज,
के.एल.ई. विद्यापीठ, बेळगाव - ५९००१०.

मार्गदर्शक : डॉ.
प्राध्यापिका,
जवाहरलाल नेहरु मेडिकल कॉलेज,
के.एल.ई. विद्यापीठ, बेळगाव - ५९००१०.

सहमार्गदर्शक : डॉ. रुपा बेल्लद, एम.डी. (पेडिॲट्रिक्स)
प्राध्यापिका,
जवाहरलाल नेहरु मेडिकल कॉलेज,
के.एल.ई. विद्यापीठ, बेळगाव - ५९००१०.

परिचय : इस्पितळात होणारा संसर्ग म्हणजे रुग्णाला बालरुग्ण इस्पितळात उपचार घेताना होणारा संसर्ग होय. या संसर्गामुळे रुग्णाचे जीवन धोक्यात येते. त्याशिवाय रुग्णाचा इस्पितळात उपचारांचा कालावधी आणि उपचारांचा खर्चही वाढतो. असा संसर्ग झाला आहे का याची आम्ही तपासणी करुन उपचारही करतो. त्यामुळेच इस्पितळात होणारा संसर्ग तपासण्यासाठी आणि तातडीने वैद्यकीय उपचार देण्याच्या उद्देशाने आम्ही हा अभ्यास सुरु केला आहे. आपण या अभ्यासात सहभागी व्हावे ही विनंती. या अभ्यासादरम्यान आपणास काही प्रश्न विचारण्यात येतील व आपण त्यांची यथायोग्य उत्तरे द्यावीत.

या अभ्यासातील आपला सहभाग हा आपला स्वेच्छाधिकार आहे. यात सहभागी व्हावे किंवा नाही या आपल्या निर्णयामुळे जवाहरलाल नेहरु मेडिकल कॉलेजशी असलेल्या आपल्या नात्यावर काहीच परिणाम होणार नाही. अथवा उपचार पद्धतीतही बदल होणार नाही. जर आपण सहभागी झाल्यानंतर आपण माघारी घेऊ शकता.

आवश्यक प्रक्रिया

आपणास कसलीही बाधा होणार नाही याची दक्षता घेऊन रक्त, मूत्र अथवा अन्य नमुने चाचणीसाठी घेण्यात येतील. संसर्ग झाल्याची चाचणी घेऊन योग्य ते औषध उपचार करण्यात येतील.

जोखीम आणि फायदे:

सहभागी नाही धोके आहेत आणि लाभ प्रतिजैविक ते, ते संवेदनाक्षम आहे व योग्य उपचार दिले जाऊ शकते जेणेकरून प्रयोजक जीवाणू आणि माहित आहे.

पर्याय:

संशोधन आपला सहभाग ऐच्छिक आहे. अभ्यासात सहभागी होण्यासाठी किंवा नाही आपला निर्णय जवाहरलाल नेहरू वैद्यकीय महाविद्यालय आपल्या संबंध परिणाम होणार नाही. आपण सहभागी करण्याचा निर्णय घेतला तर, आपण कोणत्याही वेळी पैसे काढण्याची मुक्त आहेत.

गोपनीयता आणि गोपनीयता: फक्त आपण एक संशोधन विषय आहेत हे जाणून घेणे संशोधन संघ सदस्य आहेत. आपण किंवा संशोधन दरम्यान आपण प्रदान माहिती आपले अधिकार आणि कल्याण संरक्षण करण्यासाठी आणीबाणी वगळता, आपल्या लेखी परवानगीशिवाय इतर उघड जाईल.

अधिकार परिणाम प्रकाशित करण्यासाठी:

संशोधन निकाल प्रकाशित किंवा एक परिषद चर्चा झाल्यावर त्याची माहिती आपली ओळख उघड करू की विस्थापित जाईल. आणि आपण या अभ्यास संबंधात मिळवता की ओळखले जाऊ शकते आहे की कोणतीही माहिती गोपनीय राहील.

सहभागाबद्दल आर्थिक लाभ :

अभ्यासात सहभागी होणाऱ्या कोणत्याही सहभागीदारास कोणत्याही प्रकारचे पैसे, भेटवस्तू, लाभांश, खर्च वा भरपाई दिली जाणार नाही.

आपणास अभ्यासाबाबत काहीही शंका अथवा प्रश्न असल्यास आपण संशोधकांशी खाली दिलेल्या मो. नंबरवर संपर्क साधू शकता.

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यांच्या मार्गदर्शनाखाली हा अभ्यास करण्यात येईल.

अभ्यासात सहभागी झाल्यानंतर आपले अधिकार व आपले प्रश्नांचे उत्तर जाणून घेण्यासाठी डॉ. पॅथॉलॉजी विभाग, जे.एन.एम.सी. अध्यक्ष प्राध्यापक (मो.नं

संमती विधान

मी निम्न _____have अभ्यास बद्दल माझ्या देशी भाषांमध्ये स्पष्ट केला आणि अभ्यास माझा सहभाग ऐच्छिक आहे. मी इच्छित असल्यास, मी कोणत्याही वेळी काढू शकतात. मी अभ्यास सहभागी म्हणून माझे शंका आणि अधिकार साफ करण्यासाठी पुरेसा वेळ देण्यात आला आहे.

स्वाक्षरी किंवा सहभागी डाव्या हाताच्या अंगठ्याचा प्रिंट किंवा कायदेशीर अधिकृत प्रतिनिधी.

या सहभागी य नाव स्वाक्षरी

साक्षीदार नाव स्वाक्षरी

Experimenter नाव स्वाक्षरी

तारीख:

स्थान:

QUESTIONNARE (PROFORMA) USED FOR COLLECTING THE DATA

Name: Age:

OPD No: Sex:

Address:

Clinical diagnosis:

Date of IV Cannula Insertion:
1.
2.
3.
4.

Date of IV Cannula Removal:
1.
2.
3.
4.

Appearance of any signs of phlebitis : Date:

Date of Central Line Insertion:
1.
2.
3.

Date of Central Line Removal:
1.
2.
3.

Total central line days:

Appearance of any signs of CLABSI: Date:

Date Blood Culture sent:

Blood Culture Report:

Organism isolated: Antibiotic sentivity:

Date of Foleys catheter insertion:
1.
2.
3.

Date of Foleys catheter removed:
1.
2.
3.

Total Foleys catheter days:

Appearance of any signs of UTI: Date:

Date of Urine Culture sent:

Urine culture Report:

Organism isolated: Antibiotic sensitivity:

Date of intubation done :

Date when put on ventilator: Date when removed from ventilator:

Total ventilator days:

Appearance of any signs of pneumonia: Date:

Date of sputum/Broncho Alveolar Lavage sent :

organism isolated : antibiotic sensitivity:

Any other invasive procedure done:

Type: Date:

Appearance of any sign of SSI: Date:

Others:

Date	Antibiotics administered	Duration

Outcome of the treatment:

Discharge date: Trasnfer date: Death date:

Length of stay:

KEY TO MASTER CHART

MSSA	:	Methicillin Sensitive Staphylococcus aureus
MRSA	:	Methicillin Resistant Staphylococcus aureus
E.coli	:	Escherichia coli
Abaumannii	:	Acinetobacter baumannii
Pseud aeruginosa	:	Pseudomonas aeruginosa
C.freundii	:	Citrobacter freundii
Kleb pneu	:	Klebsiella pneumoniae
Skin comm	:	Skin commensals
NG	:	no growth
NOGC	:	No organism grown on culture
NSB	:	Non Significant Bacteriuria
NEPI	:	No Enteric Pathogen Isolated
Pan R	:	Pan Resistant
S	:	Sensitive
R	:	Resistant
F	:	Female
M	:	Male
MV	:	Mechanical Ventilation
FC	:	Foley catheter
CL	:	Central Line
PC	:	Peripheral Catheterisation
LP	:	Lumbar Puncture
ETA	:	Endotracheal tube Aspirate
CSF	:	Cerebrospinal fluid

DAMA	:	Discharge against medical advice
Rt ear d/s	:	Right ear discharge
GBS	:	Guillian barre syndrome

SN	IP Number	Age	Sex	Clinical Diagnosis	First Culture			Second Culture	Risk factors	Remarks if any	Length of stay
					Blood	Urine	Any Other				
1	780825	6m	F	Patent Ductus Arteriosus							8
2	781008	6y	M	Bronchiectasis	MRSA	NG	ETA-Streptococcus pneumoniae	Blood -Pseudomonas aeruginosa	MV, FC, CL,PC	FC – 8, MV-17 CL-16	20
3	781110	4y	F	Chronic liver failure	NG						21
4	781106	11y	F	Bronchial Asthma	NG						3
5	781451	2y	F	Febrile convulsions	NG						6
6	781455	6m	M	Dengue fever with warning signs	NG						5
7	781807	5m	F	Acyanotic Heart Disease in CCF	NG		Pus - Klebsiella pneumoniae				3
8	781968	3m	F	Septicaemia	NG		Pus – Staphylococcus aureus	Klebsiella pneumoniae(3 times)	Incision and drainage		37
9	782325	11y	F	Acute Rheumatic Fever	NG						6
10	782449	6y	M	Post viral dilated cardiomyopathy	NG						11
11	785133	5y	F	Portal hypertension, ascites,microcephaly	NG						5
12	782035	14y	M	Steroid dependent Nephrotic syndrome	NG				Ascitic tap		15
13	782762	12y	M	Rheumatic heart disease (PSGN)	NG					Aslo positive	13
14	782472	9y	M	Septic arthritis with Infective endocarditis	NG		Pus – Klebsiella pneumoniae		FC	FC-9	30
15	783270	3y	F	jaundice	NG						9
16	783330	4y	F	pancytopenia	NG						5
17	784116	2y	F	Haemolytic anaemia	NG					Widal positive	13
18	782457	1m	M	Hirschsprungs disease	NG					COLOSTOMY	24
19	784483	11y	M	Cerebral palsy	NG						10
20	784033	5m	F	Enteric fever with Acute GE	NG						6
21	785047			Dengue fever	NG						7
22	785026	7y	M	Hemolytic uremic syndrome	NG						2
23	784826	3y	M	Febrile seizures with GE	NG						4
24	783140	1y	F	Tubercular meningitis	NG		CSF-NOGC		Lumbar puncture,gastric lavage	FC - 9	28
25	785316	16y	F	Corrosive poisoning	NG					death	2
26	785273	9m	F	Bronchopneumonia	NG						7
27	785247	8y	M	Hemolytiv uremic syndrome	NG	NSB		Urine – E. coli	Renal biopsy, Steroid therapy		6
28	785442	10m	M	Wheeze associated lower respiratory tract infection	NG						6
29	785403	11m	F	Wheezea ssociated lower respiratory tract infection	NG						5
30	785201	5y	M	Tubercular meningitis	NG				Gastric lavage, FC	FC-23	45
31	785542	16y	F	Acute pancreatitis	NG						4
32	785595	4y	M	Metachromatic leukodystrophy	NG					FC -1	5
33	784520	2y	M	Thalassemia	NG						8

34	785581	8y	F	Status epilepticus	NG					death	8
35	785563	8d	F	Bronchopneumonia with sepsis	NG						4
36	785552	1y	F	Acute GE	NG						3
37	785773	9y	F	Leukodystrophy	NG						11
38	786009	12y	M	GBS	NG						6
39	785901	6y	F	Type I DM	NG						4
40	785923	20m	F	Tubercular meningitis	NG				LP in PICU		15
41	785670	11y	F	Thymoma	NG				FC	FC-5	7
42	785614	1m	M	Wheeze associated lower respiratory tract infection	NG						5
43	786101	3y	M	Seizures Cerebral palsy	NG						14
44	786093		M	Severe anaemia	NG						8
45	786641	11y	M	GBS	NG						14
46	786673	1y	M	Cerebral palsy	NG						12
47	784456	12y	M	Nephrotic syndrome	NG						8
48	787894	6y	F	Post viral cardiomyopathy	NG						6
49	784070	1.5m	M	Congenital hypertrophic pyloric stenosis	NG						4
50	787030	11y	F	Dilated cardiomyopathy	NG						6
51	787443	15y	F	Bilateral bronchopneumonia with Glomerulonephritis	NG		Pleural fluid - NG		Pleural tap,FC	FC-9	13
52	788050	1y	M	Cyanotic heart disease	NG						11
53	788263	1m	M	Lower respiratory tract infection	NG						10
54	788240	1y	M	Bronchopneumonia	NG						9
55	788530	14y	F	Pain abdomen	NG					FC -1	5
56	788593	3m	F	Wheeze associated lower respiratory tract infection	NG						4
57	788794	7m	M	Acute GE	NG						5
58	788243	15y	M	Right orbital cellulitis	NG		Pus-commensals				10
59	788971	1y	F	Convulsions under evaluation	NG						3
60	788844	9y	F	Congestive cardiac failure	NG						6
61	786788	5y	M	Bronchopneumonia	NG						3
62	789250	4m	F	Lower respiratory tract infection	NG						9
63	789278	14y	M	Acute GE with septic shock	NG		Central line tip-commensals Stool- NEPI		CL	CL-18	25
64		1y	F	Nutritional anaemia	NG						9
65	789459	8y	M	Nephrotic syndrome	NG	Kleb pneu		Urine-enterococcus	Immunosuppressed, Ascitic tap	IMMUNOSUPRESSED	19
66	789492	4y	M	Cyanotic CHD	NG						6
67	785748	1y	F	Nephrotic syndrome	NG	E.coli		Urine - NSB	FC	FC-11	14
68	789949	7y	F	Acute myeloid leukemia	NG						3
69	790087	3m	M	Pyogenic meningitis	NG		CSF-NG		LP		12
70	790309	8m	F	Bronchopneumonia	NG						13
71	790394	3y	M	Bronchopneumonia	NG						3
72	790689	5m	F	Bronchiolitis	NG						3
73	790521	12y	F	Liver cirrhosis	NG					death	3
74	790478	13y	M	Pancytopenia	NG						17

75	791126	12y	M	Cerebral Palsy , Lower respiratory tract infection	NG						4
76	791030	3m	M	Lower respiratory tract infection,Failure to thrive	NG						5
77	791199	3m	F	Ventricular septal defect	NG						5
78	791848	9m	M	CHD	NG						3
79	791740	11y	F	Thalassemia, CCF	NG						6
80	791559	14m	M	ASD, bronchopneumonia	NG						9
81	791818	9m	F	Hydrocephalus	NG		CSF-NG		LP		24
82	791247	8m	M	Subacute Meningoencephalitis , Tubercular Meningitis	NG						3
83	791799	16y	F	Type 1 DM	NG						6
84	793317	2m	F	Cerebral palsy , Failure to thrive	NG	E.coli					8
85	793522	1.5y	F	Foreign body aspiration	NG						4
86	793224	7y	M	Tubercular meningitis	NG		CSF-NG		LP	FC - 6	12
87	793167	14y	M	Epilepsy	NG						5
88	792912	1.5y	M	Bronchpopneumonia	NG						9
89	794376	7y	M	Lower lobe consolidation	NG	NG	Throat swab-commensals				13
90	793876	9y	F	Rheumatic Heart Disease with CCF	NG	NG			FC	FC-9	14
91	794442	8m	M	Bronchopneumonia	NG						6
92	794711	4y	M	Hypocalcemia	NG	NG					9
93	793885	8y	M	Acute viral hepatitis	NG						4
94	794920	17m	F	Bronchopmeumonia	NG	NG					
95	795005	9y	M	Submandibular abscess	NG	NG					10
96	795371	5m	M	CHD with Failure to thrive	NG						3
97	795107	14y	M	Wilsons disease	NG	NG					5
98	795165	14y	M	Encephalomyopathy	NG						5
99	795844	11y	M	Right ear CSOM	NG	NG					5
100	795523	6y	M	Empyema	NG	NG					13
101	795747	3y	M	Lower respiratory tract infection with CHD	NG	NG					3
102	795213	5y	M	Cyanotic CHD	NG						4
103	795930	1y	F	TGA	NG						3
104	796130	7y	F	Nephrotic syndrome	NG	NG	Stool- NEPI				8
105	796258	1.5m	M	Lower lobe pneumonia with sepsis	NG	NG					7
106	795665	12y	F	Pleural effusion	NG	NG					12
107	796272	15y	M	Right hemiparesis with cellulitis of face,meningitis	NG	NG	Pus-commensals, CSF-NG		LP,FC	FC-16	19
108	796224	12y	M	Ankle cellulitis	NG	NG					25
109	796361	3y	F	Dengue fever	NG	E.coli					6
110	796533	15y	M	Lower lobe pneumonia	NG	NG					4
111	796527	3m	F	Acyanotic CHD	NG	NG					4
112	796200	8y	M	Focal segmental GlomeruloNephritis	NG	NG					5
113	793497	6y	M	Hydrocephalus	NG	NG					7
114	795864	7y	M	Hypoalbuminuria	NG						3
115	796255	12y	M	Type I DM	NG	NG					3
116		6y	F	Dengue fever	NG	NG					8
117	796664	10y	M	CCF	NG	NG					6

118	796704	9m	M	Bronchopneumonia with sepsis	NG						7
119	797028	2m	F	Bronchiolitis	NG						5
120	797005	4m	F	CHD	MRSA						2
121	797046	10m	M	Bronchopneumonia	NG						6
122	797005	5y	M	Diaphragmatic exenteration	NG						3
123	797403	5m	F	CHD	NG		CSF-NG		LP		5
124		2m	M	Bronchopneumonia	NG	NG					6
125	797490	9y	M	Acute hepatitis	NG	NG					5
126	797788	1y	M	Bronchopneumonia	NG						4
127	798411	6y	M	Fever under evaluation	NG				FC	FC-4 Shifted to PICU	4
128	798439	4m	F	Convulsions under evaluation	NG						10
129	790788	6y	F	Fever under evaluation	NG	NG					12
130	796528	12y	F	GBS	NG	NG					5
131	795717	1.5y	M	Cerebral Palsy with Lower respiratory tract infection	NG						5
132	795662	5y	F	Febrile seizures	NG						4
133	795484	9d	M	Bronchiolitis	NG						7*
134	794663	5y	M	Acute Glomerulonephritis	NG						8
135	793537	10m	M	Pneumonia	NG						7
136	793383	15y	F	Acute Renal failure	NG						4
137	793126	3y	F	Lower respiratory tract infection	NG						3
138	792956	4y	M	Convulsions under evaluation	NG						3
139	790309	3m	M	Bronchopneumonia	NG						7
140	791638	14y	M	Mitochondrial cytopathy	NG						3
141	798609	13y	M	Dengue fever	NG	NG					7
142		2m	M	Cholestatic jaundice	NG						5
143	798771	16y	F	Diabetic keto acidosis	NG	NG					6
144	798784	7m	F	VSD	NG						6
145	797054	1.5m	M	Seizures under evaluation	NG						13
146	799241	1m	M	Lower respiratory tract infection	NG						11
147	799234	7m	M	Arachnoid cyst	NG						3
148	799057	15y	F	Diabetic keto acidosis	NG						8
149	799899	11m	M	Bronchopneumonia	NG						5
150	800033	7y	F	Seizure disorder	NG						9
151	800031	4y	M	Febrile seizures	NG	NG	CSF-NG		LP		3
152	800064	4y	M	CHD with respiratory distress	NG						12
153	800140	5y	F	Encephalitis	NG						3
154	800304	11m	M	Lower respiratory tract infection	NG	NG					6
155	800345	4y	M	Bronchopneumonia	NG						7
156	800453	7m	M	GM1 gangliosidosis	NG		CSF-NG				5
157	800495	1y	M	MELAS	NG		CSF-NG		LP,FC	FC-8	10
158	800684	2y	M	Cerebral Palsy, Dengue fever	NG						4
159	800749	8y	F	Autoimmune encephalopathy	NG		CSF-NG		LP		5
160	800559	10y	F	Acute leukemia	NG						5
161	801045	12y	M	Convulsions , acute gastritis	NG	NG					5

162	801123	15y	F	Autoimmune encephalitis	NG						4
163	801077	12y	F	Seizure disorder	NG						4
164	801086	4m	M	Convulsions under evaluation	NG						3
165	801302	2y	F	Febrile convulsions	NG						3
166	801341	6m	M	Acute bronchiolitis	NG						4
167	801508	1.5y	M	Abdominal distension	NG						7
168	801652	7y	F	Viral fever	NG						11
169	801849	3y	F	Afibroginemia	NG						6
170	801983	6m	F	CHD,Failure to thrive, ?UTI	NG	NG					15
171	800125	4y	F	Respiratory distress	NG	NG			CL	CL-8	10
172	802252	6y	M	Bronchiectasis	NG						14
173	802288	16y	F	Menorrhagia	NG						18
174	802311	4y	M	ITP	NG						14
175	802526	1m	M	Bronchopneumonia	NG						10
176	802944	5m	F	Thrombocytopenia	NG						4
177	802982	13y	M	Mental retardation with epilepsy	NG					FC - 1	3
178	803166	2.5 y	M	Febrile convulsions	NG						4
179	803189	11y	F	Bleeding disorder	NG						5
180	803206	5y	F	Dengue fever	NG						5
181	803214	2y	M	Wheeze associated lower respiratory tract infection	NG						5
182	803396	9y	F	Rubenstein Tayley syndrome	NG						4
183	803606	11y	F	Nephrotic syndrome with bronchopneumonia	NG	NG	Ascitic fluid-NG Pleural fluid-NG		Ascitic tap, Pleural tap		18
184	803627	1y	M	Febrile convulsions ,Acute GE	NG						3
185	803845	7y	M	Global developmental delay	NG						6
188	803565	11y	F	GBS	NG		ETA-NG, CL tip - NG		MV	MV-1O	15
189	802504	5y	F	Fever under evaluation	NG		CSF-NG		LP		12
190	802298	9y	F	RHD with Mental retardation	NG						5
191	804295	18d	M	Neonatal late onset sepsis , ?Aspiration	NG						8
192	804489	1y	M	Tetrology of fallot	NG						7
193	804080	7m	F	Aspiration pneumonia	NG						3
194	804739	1.5y	F	Febrile convulsions	NG		CSF-NG		LP		6
195	804886	9m	F	Bronchopneumonia with empyma ,pneumothorax	NG	NSB	Pus- MSSA, stool -NEPI		CL	CL-10	24
196	805012	10y	M	Seizures under evaluation	NG	NG					10
197	806535	1y	M	GDD with Wheeze associated lower respiratory tract infection	NG						4
198	807178	9m	M	Bronchopneumonia	NG						5
199	808144	3m	M	Neonatal hepatitis	NG						6
200	807194	13y	M	Dengue fever	NG						7
201	807311	14y	M	Anaemia	NG						3
202	807375	1m	F	Bronchopneumonia with acyanotic CHD	NG						4
203	807676	11y	M	CCF	NG	NG					10
204	807766	2.5y	M	Foreign body aspiration	NG						3
205	807849	4y	M	GBS	NG						3

206	808084	13y	M	Dengue fever	NG						3
207	802501	8y	F	Seizure disorder	NG						4
208	808863	14y	F	?pyogenic meningitis	NG		CSF-NG		LP, gastric lavage		11
209	809224	10y	F	Nephrotic syndrome	NG						8
210	809279	6y	F	RTA with Hypoxic ischaemic encephalopathy	NG	NG			FC	FC-6	13
211	809049	15y	M	T1DM with bleeding disorder	NG						4
212	808175	13y	M	Dengue fever	NG						4
213	809594	11m	F	Febrile convulsions	NG						3*
214	899741	5y	F	Dengue fever	NG						9
215	809733	6y	F	RTA with head injury	NG		ETA-NG		MV,CL,FC	MV-6,CL- 14, FC- 14	22
216	809771	6y	M	Dengue fever							8
217	809857	12y	F	Dengue shock syndrome							4
218	809509	15y	M	GBS							11
219	810330	9y	F	Enteric fever							5
220	810457	15y	F	History of poisoning							4
221	809955	8y	M	Polyarthritis, empyma ,bronchopneumonia							15
222	808835	5y	F	Acute GE							5
223	810455	9y	F	Fever under evaluation							5
224	810457	15y	F	Fever under evaluation							4
225	810802	12y	M	Hypertensive encephalopathy							7
226	811673	9y	M	k/c/o epilepsy							3
227	811898	11y	M	Acute resp distress							3
228	812169	1m	M	Abdominal distension							5
229	812077	9m	M	Febrile convulsions							8
230	812450	4y	F	Dengue fever							7
231	812230	7y	F	Acute GE			Stool- E.coli				6
232	812679	16y	M	Dengue fever	NG	NG					6
233	813136	14y	F	Fever under evaluation	NG	NG			FC	FC-8	9
234	813164	4y	F	Dengue fever	NG						8
235	813420	8y	M	Convulsion under evaluation	NG						3
236	813430	1y	F	Type1DM	NG						6
237	813512	11y	M	RHD	NG				FC	FC-6	9
238	813608	5m	M	ASD with CCF	NG						4
239	813643	13y	F	Dengue fever	NG						5
240	814669	6m	F	Bronchopneumonia	NG		ETA-NG		MV	MV-5	5(DAMA)
241	817029	13y	M	Fever under evaluation	NG						5
242	814633	9y	F	Encephalitis	NG		CSF-NG		LP		7
243	815695	3y	M	Hydrocephalus	NG		ETA-NG		MV,FC	MV-6 FC-9	12
244	816806	1y	F	Cerebral Palsy with Global developmental delay	NG						4
245	816481	10y	M	Atypical nephrotic syndrome	NG						3
246	817866	1.5m	M	Bronchopneumonia	NG						6
247	817842	6y	M	Diabetic keto acidosis	NG						4
248	817138	14y	F	Type 1 DM	NG						7
249		8y	M	Dengue fever	NG						4

250	818672	2y	F	Bronchopneumonia	NG						7
251	816649	7m	F	Croup	NG						5
252	816151	11m	M	Acute GE with bronchopneumonia	NG						8
253	816017	10y	M	Necrotising fascitis	NG		Wound swab-skin comm				4
254	817903	2.5y	F	Dengue shock syndrome	NG						7
255	818527	1.5y	M	Bronchopneumonia	NG						2
256	818456	13y	M	Dengue fever	NG						5
257	818466	1y	M	Febrile convulsions	NG						7
258	818272	1.5y	M	Febrile convulsions	NG						4
259	819924	1y	M	Chronic kidney disease	NG	NG					6
260	820051	4m	M	Bronchopneumonia	NG						4
261	819940	1y	M	Pneumonia	NG						4
262	819953	1.5y	M	Fever under evaluation	NG		CSF-NG				4
263	819795	11m	M	Anaemia under evaluation	NG						3
264	819693	5y	F	ITP	NG						8
265	819779	13y	F	Type 1 DM with TB	NG	NG					3
266	819375	2y	M	Fever under evaluation	NG						4
267	819312	11m	M	ASOM	NG						3
270	819210	15y	F	Chronic kidney disease	NG						3
271	818923	8y	F	Dengue fever	NG						3
272	818466	1y	M	Febrile convulsions	NG						5
273	819182	8y	F	Fever under evaluation	NG						7
274	820072	4y	M	Dengue fever	NG						5
275	820066	3y	F	Bronchopneumonia	NG						5
276	820739	4y	F	Seizures under evaluation	NG						4
277	820933	3y	F	Hepatitis with pleural effusion	NG						12
278	821104	8m	F	Bronchopneumonia	NG						4
279	821115	6m	F	Bronchopneumonia	NG						4
280	821136	1.5y	M	Bronchopneumonia	NG						5
281	822027	6y	M	Cardiomyopathy	NG				FC	FC-14	17
282	822039	1y	F	Dengue fever	NG						6
283	821859	15m	F	Bronchopneumonia with anaemia	NG						5
284	820307	6y	F	Left sided emphysema	NG						8
285	822097	15d	M	Swelling left knee	NG						9
286	822142	8y	F	Dengue fever	NG						3
287	822249	2y	M	Convulsions under evauationl	NG						6
288	822325	8m	F	Bronchopneumonia	NG						7
289	820953	3y	M	Hepatitis with pleural effusion	NG		Pleural fluid- NG		Pleural tap		9
290	822147	10m	M	CHD	NG						12
291	822317	4y	M	Gauchers type 1	NG						8
292	822476	2y	F	Bronchopneumonia	NG		Pleural fluid -NG		Pleural tap		7
293	822931	7y	M	Dengue fever	NG						7
294	822566	14y	F	Menorrhagia	NG						6
295	821461	12y	M	GBS	NG				MV	MV-46days	67
296	823979	7y	M	Dengue fever	NG						9
297	822408	6y	M	Haemophilia	NG						8
298	822611	2y	M	DIC with ?sepsis	NG		CSF-NG		LP	FC - 3	11

299	822548	2y	F	Febrile convulsions	NG						6
300	823223	8y	M	Dengue fever	NG						6
301	823734	7y	F	Wilsons disease	NG						8
302	823916	10m	M	Severe dehydration	NG						5
303	823954	8m	M	Bronchopneumonia	NG						5
304	824037	6y	M	Bronchopneumonia	NG						6
305	824422	11y	M	Convulsions under eva uation	NG						5
306	824448	3y	F	Diabetic keto acidosis	NG						5
307	824439	5y	M	Nephrotic syndrome	NG				CL	CL - 14	16
308	824680	1y	F	Wheeze associated lower respiratory tract infection	NG						5
309	824889	8y	M	Astrocytoma	NG						8
310	842817	13m	M	Convulsions under evaluation	NG						4
311	824828	10m	M	Convulsions under evaluation	NG						3
312	825006	8m	M	Bronchopneumonia	NG						5
313	824973	6m	F	Bronchopneumonia	NG						7
314	826315	12y	M	Nephrotic syndrome	NG						7
315	825918	3y	F	Nephrotic syndrome	NG						5
316	826354	5y	M	Convulsions under evaluation	NG						7
317	826363	12y	M	RTA with Lt side pneumonia	NG	NG	ETA- Pan R Kleb pneu		MV	MV-8	11
318	826359	2y	M	TEN	NG						7
319	825802	10m	M	Bilateral thigh cellulitis	NG						6
320		3y	M	Conulsions under evaluation	NG						5
321	827336	2y	M	Convulsions under evaluation	NG		CSF-NG		LP		4
322	827470	8m	M	Lower respiratory tract infection	NG						5
323	827969	6m	M	Convulsions under evaluation	NG						8
324	828080	4m	F	Nephrotic syndrome with ascitis	NG	NG	Ascitic fluid –NG		Ascitic tap		8
325	828074	5m	M	Lower respiratory tract infection with sepsis	NG						8
326	827828	11y	M	Enteric fever with ? UTI	NG	NG					9
327	827935	9m	F	Lower respiratory tract infection	NG						5
328	827725	1.5y	F	Fever under evaluation	NG						6
329	827937	9y	M	Suspected UTI	NG	NSB					5
330	827999	16y	M	Drug reactions, connective tissue disorder	NG	NG	Rt ear d/s-NG				12
331	828513	11m	M	Febrile convulsions	NG						3
332	828908	1y	F	Convulsions under evauationl	NG						7
333	828782	2y	M	Lower respiratory tract infection	NG						6
334	829478	2m	F	Bronchopneumonia	NG						8
335	827000	11y	F	HSP	NG						4
336	829591	2m	M	Failure to thrive	NG						10
337	830275	8y	M	Acute glomerulonephritis with severe Hypertension	NG						5
338	830358	6y	M	Dengue fever	NG						5
339	830538	16y	M	Dengue fever	NG						4

340	830751	12y	F	Dengue fever	NG						5
341	830926	1.5m	F	CCF	NG						4
342	831197	2y	M	Lower respiratory tract infection with CCF	NG	NG					3
343	831268	6m	F	Bronchopneumonia	NG						5
344	831387	6y	M	Hypertensive encephalopathy	NG						8
345	831449	6y	F	Cyclical vomiting syndrome	NG						4
346	831589	15y	F	Fever under evaluation	NG						7
347	831675	5y	F	DM	NG						8
348	831911	1y	M	VSD with Lower respiratory tract infection	NG						5
349	832125	2y	M	Bronchopneumonia	NG						5
350	832223	2m	M	Bronchiolitis	NG						4
351	832486	3m	M	Bronchopneumonia	NG						3
352	832559	2y	F	Convulsions under evaluation	NG						5
353	832047	3y	F	Bronchopneumonia	NG				Gastric lavage		8
354	833001	10y	F	Dengue fever	NG						7
355	833273	7y	F	Dengue fever with ITP	NG						5
356	831647	5y	M	Leftt lung consolidation	NG		ETA-C.freundii		MV,FC	MV-14 FC-24	30
357	833584	3y	F	Bronchopneumonia	NG						6
358	833590	4y	M	Febrile convulsions	NG						3
359	833282	3m	M	Bronchiolitis	NG						3
360	834136	2m	M	Bronchopneumonia	NG						4
361	834191	4m	M	Bronchopneumonia	NG						3
362	834456	12y	M	Typhoid fever	NG						4
363	834471	8y	F	Absence seizures	NG						3
364	834609	1.5m	M	Croup	NG						6
365	835119	2m	M	Bronchopneumonia	NG					MV - 5	11
366	833504	12y	M	Fever under evaluation	NG						3
367	836266	1y	F	Bronchopneumonia with pleural effusion	NG		Pleural fluid - NG		Pleural tap		6
368	836335	3y	F	Viral encephalitis	NG						5
369	836344	5y	M	Fever under evaluation	NG						4
370	836938	7m	M	Chylous ascites	NG					MV – 2, FC - 1	10
371	836316	3y	M	Convulsions under evaluation	NG						4
372	836899	3m	M	Septicaemia	NG						9
373	835293	10y	M	Dengue fever	NG						5
374	835319	5y	M	Acute Liver Failure	NG						6
375	833584	6y	F	Bronchopneumonia	NG						4
376	835169	1.5y	M	Dengue fever	NG						5
377	837234	5m	M	Bronchopneumonia	NG						5
378	837469	2y	M	Convulsions under evauation	NG	NG	CSF-NG		LP		6
379	837374	15m	M	Fever under evaluation	NG	NG					5
380	837409	1.5y	F	Drowning	NG						3
381	837366	3m	M	Bronchiolitis	NG	NG					4
382	837638	8y	F	Convulsions under evaluation	NG						5
383	837116	8m	M	Fever under evaluation	NG						5
384	837495	1.5m	M	Failure to thrive	NG						6
385	841145	11y	M	Convulsions under evaluation	NG						3

386	840017	5y	M	Bronchopneumonia	NG						6
387	841163	1y	M	Fever under evaluation	NG						3
388	843433	11y	F	k/c/o Thalassemia	NG						3
389	843162	5y	M	Lower respiratory tract infection with Acute Kidney Injury	NG						3
390	843917	6y	M	Febrile seizures	NG						6
391	844537	7m	M	Severe anemia with Lower respiratory tract infection	NG						4
392	845191	5y	M	SAM with chr diarrhoea and vomitting	NG	NG	Stool-NEPI				8
393	844685	12y	M	Road traffic accident	NG						5
394	845555	14y	F	Meningo encephalitis	NG		CSF-NG		LP		4(DAMA)
395	845689	1.5 y	M	Bronchopneumonia	NG						7
396	845545	4m	M	Bronchopneumonia	NG						3
397	843541	9y	M	k/c/o CHD	NG						7
398	844311	14y	M	Dengue encephalitis with resp failure with VAP	NG	C.freundii	ETA- Pseud aeruginosa		MV-39days	From PICU stay 28 days	40
399	846541	5m	F	Complete AV canal defect with bronchopneumonia	NG						7
400	846061	12y	M	GBS with autonomic dysfunction with MV	NG				CL,MV,FC	FC-20 CL-19 MV-19	22
401	846889	1y	F	?Meningitis	NG		CSF-NG		LP		7
402	847481	15y	F	Autoimmune encephalitis	NG		CsSF-NG		LP		5
403	847946	9Y	M	Japanese encephalitis respiratory failure	NG		ETA-C freundii	ETA –A. baumanii	MV,CL	CL-16 MV-32	95
404	848144	18m	M	Global developmental delay with convulsions	NG						4
405	848249	5y	M	Nephrotic syndrome	NG	NSB					4
406	848361	13m	M	Nystagmus under evaluation	NG		CSF-NG				4
407	849012	13y	M	Severe an with portal HTN	NG						3
408	848816	1.5m	M	Bronchopneumonia	NG						4
409	847061	2y	M	Acute GE with cyanotic VSD	NG		Stool-NEPI				4
410	849592	7m	M	Bronchopneumonia	NG						3

SN	IP Number	Sample	Isolate	Sensitivity Pattern																					Interventions	Remarks if any
				Ampicillin	Gentamicin	Tobramycin	Cefatazidime	Amoxi Clav	Amikacin	Piperacillin tazobactum Taz.	Cefuroxime	Levofloxacin	Imipenem	meropenem	Cotrimoxazole	Penecillin	Erythromycin	Ceftriaxone	Vancomycin	Clindamycin	Chloramphenicol	Aztreonam	Ciprofloxacin			
1	781968	pus	Klebsiella pneumoniae	R	R	R	R	R	R	R	R	R	R	R	R										Incision and Drainage	Immunosuppressed Discharged with infection.
2	781008	Blood	Pseudomonas aeruginosa		R	S	S	S	S	R		S	S	S									R		Cental line	Improved outcome
		ETA	Streptococcus pneumoniae	R	S		S			R		S			R	S	S	S	S	R	R	R			MV, FC, PC	
3.	821461	Bronchial secretions	Klebsiella pneumonia	R	R	R	R	R	R	R	R	R	R	R	R										MV, PC	Improved outcome
			Escherichia coli	R	R	R	S	S	R	S	R	R	R	S	S											
4.	847946	ETA	Citrobacter freundii	R	R	S	S	R	R	R	S	S	R	S	S										MV,PC	Improved outcome
			Acinetobacter baumanii	R	R	R	R	R	R	R	R	R	R	R	R											
5	831647	ETA	Citrobacter freundii	R	R	R	R	R	R	R	R	R	R	S	S										MV, PC	