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Garcia EB, Makalinaw SR, Manipon BV. Prevalence of HAI at Phil Gen Hosp, 2011-2014

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The authors declare that the data presented are original material and have not been previously published, accepted or considered for publication elsewhere; that the manuscript has been approved by all the authors, who have met the requirements for authorship.

ORIGINAL ARTICLE

PREVALENCE OF HEALTHCARE-ASSOCIATED INFECTIONS AMONG THE PEDIATRIC PATIENTS ADMITTED AT PHILIPPINE GENERAL HOSPITAL FROM THE YEARS 2011-2014

ABSTRACT

Introduction: Healthcare associated infections (HAIs) continue to be a major public health concern throughout the world particularly in developing countries wherein prevalence rates range from 5.7%-19.1%.

Objectives: The aims of this study were to determine the prevalence of HAIs among pediatric patients admitted at Philippine General Hospital and to describe the trends of annual prevalence of HAIs in relation to infection control programs implemented.

Methodology: A retrospective study was conducted at the 145-bed capacity wards and intensive care units of the Department of Pediatrics, Philippine General Hospital (PGH) from January 2011 to December 2014 wherein HAI records from the database of the Section of Infectious and Tropical Disease in Pediatrics (INTROP) were reviewed. The following data were collected and encoded: (1) number of patients admitted in the different areas: Pediatric wards (Ward 9 and Ward 11), PICU and NICU; (2) number of patients who developed HAIs; and (3) microbial isolates, sites and antibiotic susceptibility results. Trends of yearly prevalence of HAIs in relation to infection programs implemented were determined, and the microbial isolates and their antibiotic sensitivity patterns were described.

Results: Among 30,032 pediatric patients at risk for HAIs and admitted from January 2011 to December 2014, the prevalence of HAI was 11.37%. There was a decreasing trend in the yearly HAI rates from 2011 to 2014 which coincided with implementation of infection control programs and hiring of a part-time infection control nurse in 2012. The prevalence of HAIs was highest at the PICU (15.17%-27.81%) followed by the two Pediatric wards, ward 9 (9.03%-19.87%) and ward 11(8.75%-14.76%) and lowest at the NICU (7.52%-9.44%). Top isolates were *Pseudomonas putida*, *Pseudomonas aeruginosa*, and *Klebsiella pneumonia. Pseudomonas* organisms were still sensitive to Ceftazidime, and Klebsiella to Meropenem.

Conclusion: The overall HAI prevalence during the 4-year study period was 11.37% (9.14% - 13.65%) comparable to those seen in developing countries. There was a decreasing trend of prevalence annually that coincided with the implementation of various infection control programs and the hiring of a part-time infection control nurse. The microbial isolates obtained vary per area but overall the same organisms were isolated during the study periods which were susceptible to the empiric treatment given.

KEYWORDS:
Healthcare-associated infection, nosocomial infections, infection control program, Pseudomonas infection, Klebsiella infection

INTRODUCTION

Healthcare-associated infections (HAIs), previously referred to as "nosocomial" or "hospital-acquired" infection, are now defined as any infection that is neither present nor incubating at the time of admission to a healthcare facility, and that become clinically evident at least after 48 hours or more after admission or within 10 days after discharge from a healthcare facility.[1,2] HAIs continue to be a major public health concern throughout the world particularly in developing countries where its prevalence varies from 5.7% to as high as 19.1%, depending on the population surveyed and the definition used. The prevalence is significantly higher in intensive care units (ICU).[3, 4]

Surveillance is an essential component of HAI control and prevention and can identify outbreaks, establish baseline rates of infection and evaluate control measures.[5] In limited resource settings, conducting a prevalence surveillance is an effective way to determine the baseline HAI infection rate in a particular hospital, [6] and the common microbial isolates obtained and their susceptibility to antibiotics which can guide the Infectious Disease Specialists in recommending empiric antibiotic therapy. Determining the trends of annual prevalence is a good indicator on the effectiveness of infection prevention and control measures in a hospital.

The objectives of this study are the following: (1) to determine the prevalence of HAIs among pediatric patients admitted at Philippine General Hospital; (2) to depict the trends of annual prevalence of HAI in relation to infection control programs implemented; and (3) to describe the microbial isolates, sites of isolation, and their susceptibility profile to antibiotics.

The data gathered from this study will be used to recommend infection control strategies and interventions to reduce the HAIs at the pediatric areas of the hospital.

MATERIALS AND METHODS:

A retrospective, descriptive study was conducted at the Department of Pediatrics of the Philippine General Hospital (PGH), a tertiary state-owned hospital administered and operated by the University of the Philippines Manila (UPM) and designated as the National University Hospital. The Department of Pediatrics has a total of 145 beds divided as follows: 90 beds in the general wards (45 beds in Ward 9 and 45 beds in Ward 11), 45 beds in the Neonatal Intensive Care Unit (NICU) and 10 beds in the Pediatric Intensive Care Unit (PICU). The study was reviewed and approved by the UPM Research Ethics Board.

Operational Definitions

Healthcare-associated infections (HAIs) were defined as infections that become clinically evident after the 48th hour from the time of admission and unrelated to the original illness that brings patients to the hospital, and are neither present nor incubating at the time of admission. HAIs can be classified into two (2) groups: 1) Clinical HAI, defined as the presence of systemic signs and symptoms of infection; and 2) Culture-proven HAI, defined as the presence of microbial isolates in the different sites of collection (blood, urine, endotracheal tube aspirate [ETA] and cerebrospinal fluid [CSF]). Patients are referred to the INTROP Section who then recommends empiric antibiotic coverage based on clinical presentation and on the antibiotic susceptibility patterns of the microbial isolates.

Methodology

Records of pediatric patients with HAI, gathered from the database of the Section of Infectious and Tropical Disease in Pediatrics (INTROP), who were admitted at the Pediatric wards, PICU and NICU form January 1, 2011 to December 31, 2014 were included for review. Individual reports of HAIs documented on a standard form from the INTROP Section from

resident physicians in the different clinical areas are collected monthly by the Section. Excluded were records of pediatric patients identified with HAIs and admitted at the other wards of the hospital, and patients who acquired their HAIs from other institutions and were subsequently transferred to PGH.

Records of HAI were tallied in a monthly census generated by the INTROP Section. Two period prevalence proportions were generated, yearly prevalence and 4-year prevalence. The period prevalence for HAIs was computed from the number of HAI cases (clinical and culture-proven) divided by total number of patients at risk per year and per 4-year period. The total number of patients at risk is equal to the number of inherited or carried over patients from the previous month plus the number of admitted patients for the specific period. HAI cases were tallied on the month they occurred. Patients who were carried over to the next month and who developed another HAI were recorded as new HAI for that month.

The following data were extracted and encoded in the data collection form: (1) number of patients admitted in the Pediatric Wards (9 and 11), PICU and NICU; (2) number of patients who developed HAIs; (3) microbial isolates, sites of isolation, and antibiotic susceptibility results and (4) infection control measures/programs implemented. Tallies were made in the data collection tables and summarized. Missing data on results of cultures were retrieved from the laboratory records.

Statistical Analysis

Microsoft Excel (Microsoft Office, 2013) was used to produce master databases, computation of prevalence proportion, and for data manipulation. Descriptive statistics that included frequency counts and percentages were used in the presentation of data.

RESULTS

The distribution of beds, bed occupancy rate and average length of stay in the different areas from 2011 to 2014 are shown in **Table 1**. The bed occupancy rate in a given month varied from 45.6 – 138% across all Pediatric areas from 2011 to 2014. The highest average bed occupancy rate is seen at the NICU (137.5%), while the lowest is at the PICU (83.1%). The average length of stay in a given month varied from 4 days to 75 days across all Pediatric areas from 2011 to 2014. The longest average length of stay is seen at the PICU (59.8 days) while the shortest is seen at the NICU (8.3 days).

Prevalence of HAIs

The prevalence of HAIs in the different pediatric areas from 2011 to 2014 is shown in **Table 2**. Among the 30,032 patients at risk from January 2011 to December 2014 in the different pediatric areas, the overall prevalence of HAI was 11.37%. Decreasing trends of prevalence of HAIs were observed from 2011 to 2014, with the highest HAI recorded at 13.6% in 2011, followed by 11.35% in 2012, 10.8% in 2013 and 9.2% in 2014. The overall prevalence of HAI was highest in the Pediatric Intensive Care Unit (20.7%) followed by Ward 9 (14.9%), Ward 11(11.4%) and lowest at the Neonatal Intensive Care Unit (7.59%). **Figure 1** shows the prevalence of HAI per area from 2011 to 2014. **Culture-proven HAIs by site of microbial isolates**

The distribution of culture-proven HAI by site of microbial isolate is shown in **Table 3**. Bloodstream infection accounts for 85.6% of all HAIs documented from 2011 to 2014. Other sites of microbial isolates include endotracheal aspirate (7.9%), cerebrospinal fluid (2.8%), urine (2.7%), and others (0.8%).

Table 1. Distribution of beds, bed occupancy rate and average length of stay in the different Pediatric areas from 2011 to 2014

		2011	2012	2013	2014	Total	Mean
Ward 9 (45 beds)	Admissions	1,232	1,359	1,317	1,290	**5,198**	**1299.5**
	Patient days	16,232	16,425	14,572	13,411	**60,640**	**15160**
	Bed occupancy rate (%)	92.6	100	88.7	81.6	**363**	**90.7**
	Length of stay (days)	13	12	11	10	**46**	**11.5**
Ward 11 (45 beds)	Admissions	1,232	1,153	1,229	1,023	**4,637**	**1159.3**
	Patient days	16,232	15,560	13,781	13,411	**58,984**	**14746**
	Bed occupancy rate (%)	92.6	94.7	83.9	81.6	**353**	**88.2**
	Length of stay (days)	13	14	11	13	**51**	**12.8**
PICU (10 beds)	Admissions	60	88	71	52	**271**	**67.8**
	Patient days	666	2,818	2,909	2,896	**9,289**	**2322**
	Bed occupancy rate (%)	45.6	88.2	100.6	98	**332**	**83.1**
	Length of stay (days)	42	63	59	75	**239**	**59.8**
NICU (45 beds)	Admissions	5,379	4,640	4,268	4,608	**18,895**	**4723.8**
	Patient days	27,944	31,977	30,284	30,211	**120,416**	**30104**
	Bed occupancy rate (%)	127.6	146	138.3	138	**550**	**137.5**
	Length of stay (days)	4	4	10	15	**33**	**8.3**

Table 2. Healthcare-associated infection (HAI) prevalence per year in the different areas

YEAR		Ward 9 (No. of beds = 45)	Ward 11 (No. of beds = 45)	PICU (No. of beds =10)	NICU (No. of beds = 45)	Total No. of beds =145
2011	No. of HAI	365	257	99	413	1,134
	Total population at risk	1,837	1,741	356	4,375	8,309
	Prevalence	19.87%	14.76%	27.81%	9.44%	13.65%
2012	No. of HAI	320	219	64	356	959
	Total population at risk	1,966	1,864	314	4,307	8,451
	Prevalence	16.28%	11.75%	20.38%	8.27%	11.35%
2013	No. of HAI	281	159	49	226	715
	Total population at risk	1,857	1,817	323	2,621	6,618
	Prevalence	15.13%	8.75%	15.17%	8.62%	10.80%
2014	No. of HAI	179	174	54	201	608
	Total population at risk	1,983	1,705	292	2,674	6,654
	Prevalence	9.03%	10.21%	18.49%	7.52%	9.14%
2011-2014	No. of HAI	1,145	809	266	1,196	3,416
	Total population at risk	7,643	7127	1,285	13,977	30,032
	Period Prevalence	15.0%	11.35%	20.7%	8.56%	11.37%

Table 3. Distribution of culture-proven HAIs by sites of microbial isolates

Diseases	2011 (N=957)	2012 (N=679)	2013 (N=550)	2014 (N=335)	TOTAL (N=2521)
Blood	770 (80.5%)	620 (91.3%)	497 (90.4%)	272 (81.2%)	2159 (85.6%)
Endotracheal Aspirate	72 (7.5%)	36 (5.3%)	30 (5.4%)	62 (18.5%)	200 (7.9%)
Urine	58 (6.1%)	10 (1.4%)	1 (0.2%)	0 (0%)	69 (2.7%)
CSF	44 (4.6%)	11 (1.6%)	15 (2.7%)	1 (0.3%)	71 (2.8%)
Others	13 (1.3%)	2 (0.4%)	7 (1.3%)	0 (0%)	22 (0.8%)

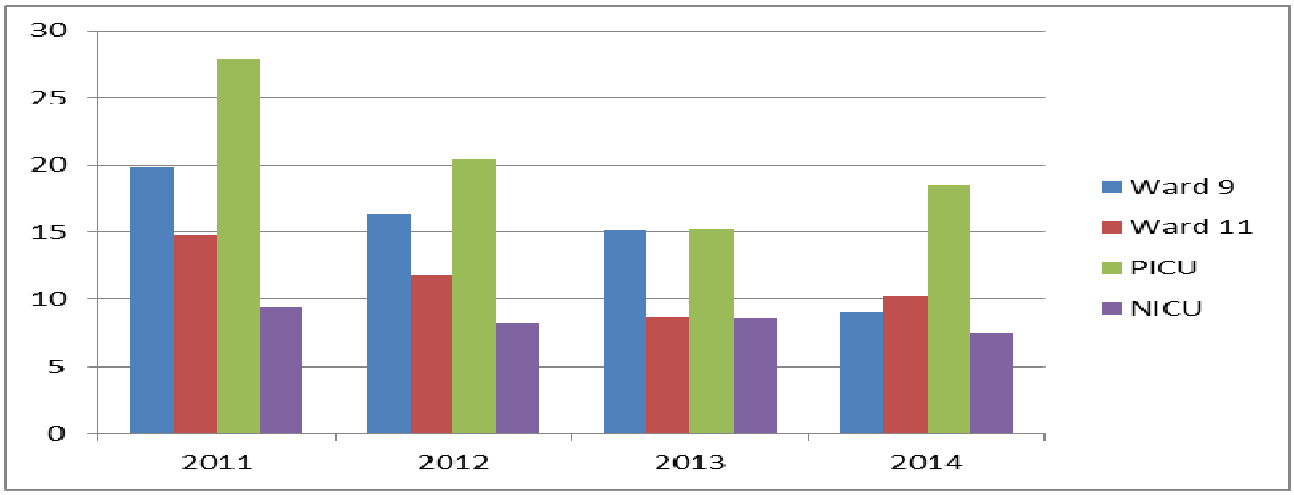

Figure 1. Healthcare-associated infection prevalence per area from 2011 to 2014

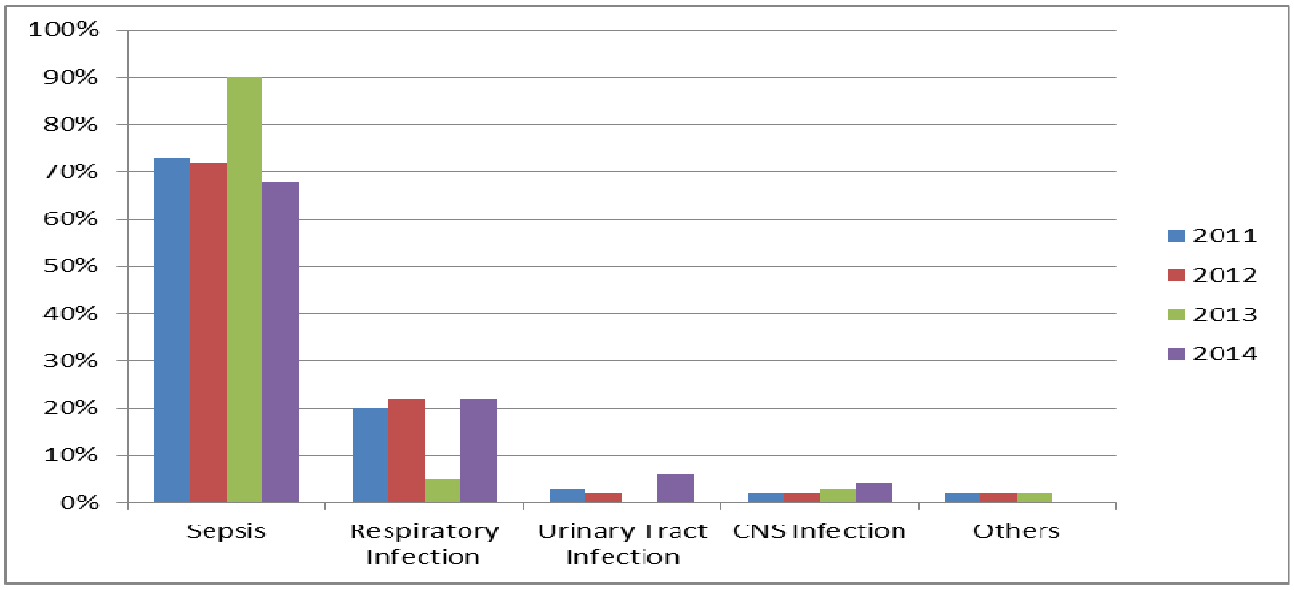

Figure 2. Distribution of HAIs by disease entity

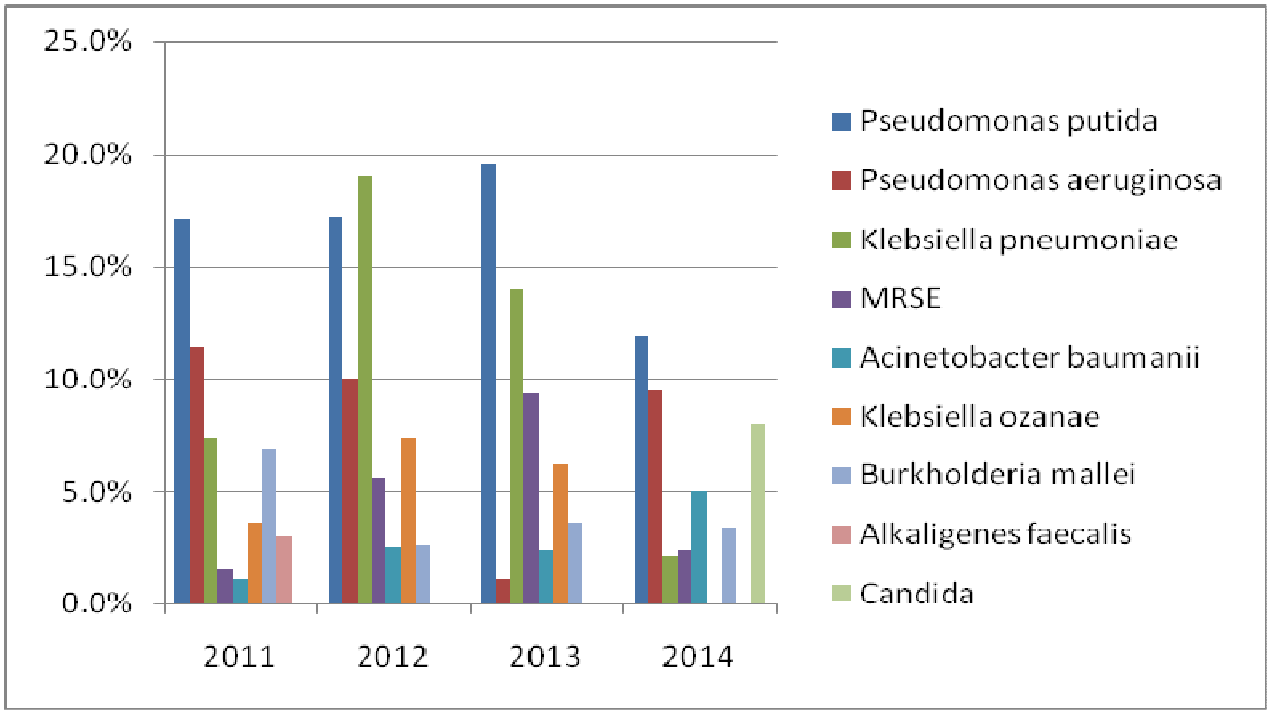

Figure 3. Microbial isolates from culture-proven HAIs

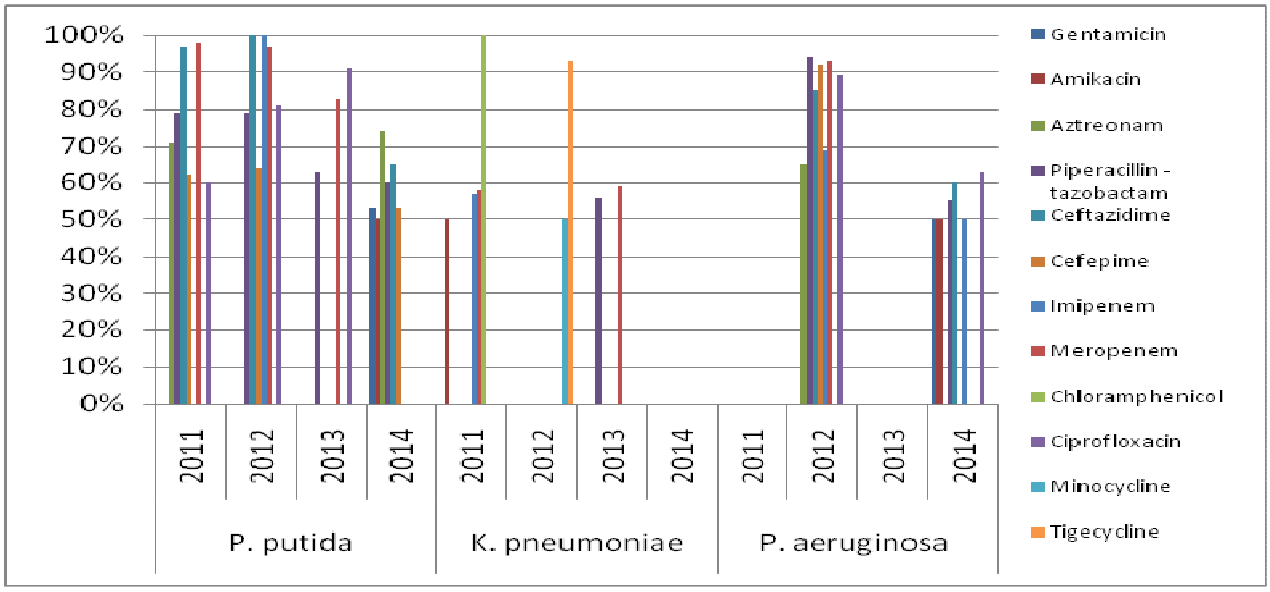

Figure 4. Antibiotic susceptibility pattern of microbial isolates from culture-proven HAIs.

Clinical HAIs although often are not culture-proven, nevertheless cause significant complications and mortality in patients admitted in the pediatric wards. **Figure 2** illustrates the distribution of clinical HAIs by disease entity from 2011 to 2014.

Microbial Isolates

Microbial isolates were available in 2563 patients out of 3416 patients diagnosed with HAI and the top three isolates were the following: *Pseudomonas putida*, *Pseudomonas aeruginosa* and *Klebsiella pneumonia* **(Figure 3),** the first two were both sensitive to Ceftazidime, the latter to Meropenem (**Figure 4**).

DISCUSSION:

HAI continue to be a major public health concern throughout the world. Healthcare-associated infections lead to the several patient burdens, notable of which are prolonged hospital stay, long term disability, additional financial burden for the patients and their families, increased resistance of microorganisms to antimicrobial agents, and increased mortality.[7]

The global burden remains unknown because of the difficulty in gathering reliable data due to the complexity and lack of uniformity of diagnostic criteria, and lack of or virtually nonexistent surveillance systems for HAIs in most countries.[3] Monitoring prevalence of HAI allows benchmarking and provides baseline data for planning preventive interventions and assessing effectiveness. Point prevalence surveys are cheaper and easier than incidence rate monitoring, but can be just as useful, especially when repeated. [8]

HAI prevalence

The overall HAI prevalence of 11.37% in the Philippine General Hospital from 2011 to 2014 is comparable to the prevalence of HAI in other developing countries with most studies reporting values higher than 10%; in Thailand, 7.3% and in Malaysia, 13.9%.[3]

The PICU has the highest HAI prevalence at average of 20.7% which may be attributed to the high frequency of invasive procedures and instrumentation, the presence of serious and aggressive illness, the rampant use of broad spectrum therapeutic agents, and prolonged hospital stay. In a literature review of national or multicenter studies published from 1995 to 2008, the proportion of infected patients in special units like Intensive Care Units can be as high as 51%, majority of which are HAIs and the risk of infection increases with prolonged ICU stay. [3]

The high rates of HAI in the pediatric wards can be attributed to the following factors: large patient load with a low nurse-to-patient ratio of 1:15, of which 2-3 patients were intubated and required special nursing care. Patients who required more specialized care were not admitted at the intensive care units due to lack of vacancy in the ICU. The lack of medical supplies also contributed to increased prevalence of HAIs in the different areas. Suction catheters were not replaced immediately after use as recommended. Sterile gloves were not regularly available for procedures and the supply of antiseptics also frequently run out and were not readily replenished. These observations were in agreement with the systematic review done by Allegranzi, that the high HAI rate in developing countries was attributed to deficient infrastructures, shortage of basic equipment, understaffing and low levels of staff preparedness and knowledge, and a population widely affected by malnutrition and endemic infection. [9, 10]

In this study, the yearly HAI prevalence in the NICU was 7.52 -8.52%, which was lower compared to the previous prevalence of 14 - 19.6% [11, 4] and noted to coincide with the decreased number of admissions during the regular quarterly closing of the OB Admitting Section for cleaning and maintenance.

Trend of yearly prevalence

The decreasing trend of yearly prevalence of HAIs was noted to coincide with the strengthening of infection control programs in 2012 through stricter implementation of policies and the supervision and surveillance done by an infection control nurse. These infection control programs included the yearly Hospital Infection

Control Unit (HICU) workshop, hand hygiene workshops, rational antibiotic use workshops, and information campaigns on the prevention and control of infection. The decreasing trend of yearly prevalence of HAIs also occurred when the number of patient admissions decreased because of the closure of various pediatric areas during outbreak of infection. Documented infection outbreaks included a Varicella outbreak in October 2014 and outbreaks of various microorganisms at the Neonatal Intensive Care Unit since 2011. Hospital infection control efforts have also provided for an augmentation of hospital supplies to prevent the spread of infection. Personal protective equipments have also been provided by the hospital for the protection of healthcare workers and to prevent disease transmission. Cohorting in the ward, which was implemented on 2001 after surveillance study showed that it reduced healthcare-associated infections, [12] was re-enforced.

Although HAI is impossible to eradicate, a well-conducted infection control and prevention program may significantly reduce HAI and its associated costs.[13] The surveillance of HAI is an essential part of infection control and prevention. Surveillance establishes baseline infection rates, identifies outbreaks, and evaluates infection control and prevention measures. There are different surveillance strategies for surveillance of HAI, each with its own advantages and disadvantages; [5] the choice of surveillance strategy depends on the type and size of the hospital, case mix, and the availability of resources. In resource-limited settings such as in the Philippine General Hospital, prevalence studies are particularly useful because these can be conducted quickly, periodically, and without sophisticated techniques, making it inexpensive and time-efficient. However, prevalence studies may overestimate rates and cannot be compared with incidence rates or other national benchmarks.[6, 14, 15]

Microbial Isolates

The most frequent site of HAI in this study was the bloodstream, followed by the respiratory tract, comparable to findings in areas with limited resources. The results of this study confirmed previous reports that bloodstream infections were the most frequent HAIs in the pediatric age group. Bloodstream infection rates ranged from 68%-90%. In this study, not all cultures underwent the antibiotic susceptibility testing. Microbiological documentation was available only for 75% of infected patients. This was comparable to that reported in the literature (41-86%).[16] Surveillance of clinical HAIs without microbiological documentation of bacterial growth may lead to overestimation of the infection rate, overuse of broad spectrum antibiotics and increased mortality when the prescribed antibiotics are inadequate.[,17]

There are two main factors that may explain the low number of cultures in our study: (1) limited health care resources; and (2) uncommon practice to obtain cultures when an infection is clinically suspected. Conventionally in the Philippine General Hospital, cultures are often only taken when empiric antibiotic therapy fails and the patient shows clinical deterioration.

The top microbial isolates in the different areas almost remained the same and remain sensitive to empiric treatment being given.

SCOPE AND LIMITATIONS

Data on HAI were limited to those reported and recorded in the logbook and database of the INTROP Section of the Department of Pediatrics, University of the Philippines–Philippine General Hospital (UP-PGH) from 2011-2014. Missing data on results of cultures were retrieved from laboratory records.

CONCLUSIONS:

The overall HAI prevalence during the 4-year study period was 11.37% (9.14% - 13.65%). There was decreasing annual trends that coincided with the infection control programs implemented and hiring of a part-time infection control nurse. The microbial isolates obtained vary per area but overall, the same organisms were isolated during the study period which was susceptible to empiric treatment given.

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