



Research Article

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Characterization of Infections Associated with Health Care in Pediatrics Bogotá 2017



Maria C Mejía^{1*}, Luis G Piñeros², Anibal A Teherán³ and Luis M Pombo⁴

¹Physician, Epidemiologist, COMPLEXUS Research Group. Corpas University, Colombia

²Physician, Family Medicine Specialist, GIFVTA Research Group. Research Group. Corpas University, Colombia

³Physician, Epidemiologist, COMPLEXUS Research Group. Corpas University, Colombia

⁴CI GIFVTA Research Group. Corpas University, Colombia

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***Corresponding author:** Maria C Mejía, Physician, Epidemiologist, COMPLEXUS Research Group. Corpas University, Bogotá, Colombia,
Tel: +5716622222; Email: maria-mejia@juanncorpas.edu.co

Abstract

Background: Infections associated with health care (iahc) are all infections contracted by a patient during treatment in a hospital or other health center, and that said patient was not and was not incubating at the time of admission. In the world, 1 in 20 inpatients are affected, and in Colombia the incidence is 5.9% of all hospitalized patients.

Objective: To describe the characteristics of HAI in pediatrics and to characterize the terms used during the care of pediatric patients with HAI.

Methods: Descriptive study divided into three phases; phase 1: a systematic search was performed on HAI in pediatrics in ebsco, pubmed and lilacs; phase 2: clinical cases of infections were designed, which were delivered to health professionals who had contact with the pediatric population, requesting that they make a brief analysis of the cases to make a theoretical model of predictive or present factors at the time of diagnosis, phase 3: the records of patients diagnosed with HAI during the period between 2014-2016 were reviewed and the demographic, social and clinical characteristics of these patients were identified. Frequencies were calculated, and the qualitative data were analyzed atlas ti 8.0.

Results: In the systematic search, predictive terms of common HAI were identified in the three databases as neonates, male sex, surgery among others, terms used by health professionals were obtained that coincided with those found in the scientific literature and finally were identified and analyzed the HAI cases of a third level clinic, finding an HAI rate of 0.46 per 100 hospital discharges.

Conclusion: There are terms that can be interpreted as predictive factors contributing to the early diagnosis of a HAI.

Keywords: Cross infection; Pediatrics; Forecasting

Background

The world health organization (who) defines as an infection associated with health care (HAI) "any infection contracted by a patient during his treatment in a hospital or other health center, and that said patient did not have nor was incubating at the time of your entry." the HAI can affect patients in any type of environment in which they receive health care, they are the most frequent adverse event during the provision of health services, and no institution or country can claim to have solved the problem [1]. A study conducted by the who showed that more than 1.4 million people around the world suffer complications from infections acquired in the hospital; the most frequent infections being: those related to surgical wounds, urinary tract and lower respiratory tract, with higher prevalence in the surgical, orthopedic and intensive care unit (icu) services [2]. This phenomenon increases

the morbidity and mortality of the users of the health system, increases the costs of the system, constitutes a biological risk for professionals, involves legal medical situations and also influences the quality aspects of the health service provider [3]. According to the who, an average of 8.7% of hospitalized patients have HAI, of which 4384 are children [4]; the pan american health organization (PAHO) estimates that HAI affect one in every 20 hospitalized patients, which corresponds to a total of 4.1 million patients per year, of which around 37,000 die [5]. In Canada, some 220,000 hospital infections per year contract, resulting in 8,000 deaths related to this cause; in Latin America, the prevalence of HAI is between 5% and 12% of hospitalized patients [6]. In Chile, there are about 70,000 cases of HAI and this has a cost of approximately USD 700,000. In Colombia, the incidence of HAI is 5.9% of the total

number of hospitalized patients and in bogotá it is 2.4 per 1,000 hospital discharges. In the pediatric population, the incidence of mortality from hais is 1.7 deaths per 1000 live children [7,8].

In colombia, the national institute of health (ins) together with the national system of surveillance in public health (sivigila), responsible for providing information on events that affect the health of the colombian population in a systematic and timely manner [9], has two tools for the notification of cases the first corresponds to epidemiological prevention guidelines and control of HAI [10] and diagnostic criteria for infections associated with health care to be used for notification to the subsystem of epidemiological surveillance of iacs [11]; the second tool is a web application of the national subsystem for surveillance of infections associated with health care - HAI designed for the mandatory notification of infections associated with medical devices, antimicrobial resistance and antibiotic consumption by primary generating units of data (upgd); these tools facilitate the analysis of epidemiological indicators and the generation of reports [12,13]. Despite the implementation of the aforementioned tools, in the first quarter of 2017 there was a decrease in the reporting of HAI cases associated with the use of devices in 52.77% compared to the same period of 2016, a situation that can be related to weaknesses in the surveillance processes of the upgd and the difficulties in the handling of the notification tool, this may correspond to the absence of an opportune diagnosis, since the mandatory notification to sivigila is made immediately after having a confirmed diagnosis of HAI, that is, after identifying an infectious process, in order to initiate antibiotic management; therefore, it is a late notification that does not lead to the prevention of the event and yes, to the increase of the bacterial resistance [14].

There are multiple options for an early diagnosis of HAI, which are divided into two groups; a clinical one, corresponding to signs and symptoms, which must be evaluated by medical personnel and a paraclinical one that includes laboratory tests [15]. In the last group, the blood culture stands out as the “gold standard” for the diagnosis of HAI and biomarkers such as simple pcr and pcr with modified dna, the latter generates an almost immediate report of the presence of an infection; procalcitonin, which has become a useful tool, both for diagnosis and for monitoring medical treatment; interleukin 6, definitive to define the treatment of HAI; endotracheal aspirate and catheter culture, among others [16-21].

Additionally, different diagnostic or predictive scales are available to evaluate infections in pediatrics, which relate clinical variables with laboratory parameters and apply to hais, among which are nosep i / ii and newborn scale of sepsis (sos), among the most used [22]; there are even systematized tools that emit alerts when detecting a possible HAI, achieving an opportunity in the diagnosis and treatment of the infection, however this type of tools are barely in the early phase of implementation and there are still no clear results in the hospital community [23]; taking into account that colombia is a developing country, there are limitations to the use of certain paraclinical exams, mainly due to the cost that they generate for the health system; what conditions a diagnosis of HAI based on the clinical examination and laboratory tests, such as simple pcr, the blood count; and the blood culture that can take about 48 hours to identify definitive results that allow clinical behaviors to be taken. For this reason, the initial treatment is empirical and this contributes to the increase of the bacterial resistance (24). The objective of this research is to describe the demographic and social characteristics, as well as the clinical characteristics of the patients and the HAI in pediatrics and to characterize the terms used during the care of pediatric patients with HAI.

Methods

A descriptive study composed of three phases was carried out.

First phase

A systematic search was carried out in the databases ebco, pubmed and lilacs, on articles that address the topic of medical terms related to HAI using the starlite strategy (Table 1) [25]. 626 articles were obtained in the period between June 2014 and June 2017 articles of which, after applying the selection criteria explained in table 1, 116 were selected to be analyzed and it was found that there are common terms in the three databases, that is, they are frequent in more than 75% of the selected articles, such as: neonates, male sex, prematurity, low weight, icu, prolonged hospital stay, cyanotic heart disease, venous catheter, nasogastric tube, corticosteroids, cannula orotracheal, mechanical ventilation, parenteral nutrition, pleural tube, bladder catheter, toys, immunosuppression, surgery, enteral nutrition, neutropenia, neoplasia, gastrointestinal disease, respiratory disease, tracheostomy, hiv (Table 2).

Table 1: Metodología STARLITE

Sampling strategy	Selective
Type of studies	Qualitative and quantitative studies
Approaches	Book: Nelson, Treaty of Pediatrics, Internet search
Range of years	Last 5 years, recent information
Limits	Human, full texts, English and Spanish, age (<18 years)
Inclusion and exclusions	Included: infections associated with health care, pediatrics Excluded: Incomplete, not recent, articles in animals, other infections
Terms used	Nosocomial infections and Pediatrics Healthcare associated infections and pediatrics Hospital acquired infections and children
Electronic sources	PubMed, LILACS y EBSCO

Table 2: Characteristics and findings of the systematic search.

Measure	EBSCO	LILACS	PUBMED
Terms	Hospital acquired Infection, health care associated infections, nosocomial infections, pediatrics, risk factor, predictors	Cross infection, healthcare associated, pediatric, risk factors	healthcare associated infections, cross infection, risk factors, child, preschool infant, newborn
STARLITE	See Table 1		
Query	(hospital acquired infections OR health care associated infections OR nosocomial infections) AND (pediatrics OR children) AND (risk factors OR predictors)	"CROSS INFECTION" or "HEALTHCARE-ASSOCIATED" [Palabras] and "PEDIATRIC" [Palabras] and "RISK FACTORS" [Palabras]	(Healthcare Associated Infections[mh] AND ("Cross Infection/epidemiology"[Majr] OR "Cross Infection/statistics and numerical data"[Majr]) AND "Risk Factors"[tiab]) AND ((child, preschool[MeSH] OR infant, newborn[MeSH] OR infant[MeSH] OR infant[MeSH:noexp] OR child[MeSH:noexp]))
Limits	Date of publication: last 5 years, Age: birth - 18 years, human, full texts, English and Spanish.		
Number of articles	34	22	115
Risk factors	Newborns [26,29], male [27,29,35,36,40,45], premature [27,29,34,41,42,47], low weight [27,29,34, 41,44], UCI [26, 30, 34,42,46], length hospital stancy [32,33,38,40,46], cardiopathy [28,38], catheter (27,31-36, 38), nasogastric tube [28,31,38,46], corticosteroids [34, 35], orotracheal cannula [28,38], mechanical ventilation [28,29,31-34,36,44,46,47], malnutrition (28,34,38,40), parenteral nutrition (31,34,41,42,44), pleural tube [28,38], bladder catheter [31,33,34], toys [30], immunosuppression [30,36,30], surgery [31,33,34,30,42,44,45,47], enteral nutrition [32,34,36], neutropenia [32,34], neoplasia [33, 34], gastrointestinal disease [34,44], respiratory disease, tracheostomy [33,40,43], HIV [34,47].	Mechanical ventilation [48,57-58], prolonged hospital stay [50, 55, 58, 60-62, 64], prematurity [64], previous use of antimicrobials (48-52,55,56,58,61-62), parenteral nutrition (57-58,62), nasogastric tube (48,54-55), ICU (51, 59, 61), immunosuppression [48,41,56,58,59], neutropenia [50], venous catheter [55, 59, 61], co morbidities [48,52,55,56,61], surgery [43,57,60], neoplasms [49], low weight [53], neonates [53], tracheostomy [54], bladder catheter [58], malnutrition [58-60], incomplete or absent breastfeeding, recent hospital discharge, low socioeconomic status, poor grade of family members, poor quality of medical care and poor access to health services [58], cyanogenic heart disease [59]	Previous use of antibiotics [64,68,71,76,79,86,97,92,105,114,119,120,122,123,128,130,132,146], comorbidities [64,74,76,80,101,120], male [65,67,85,89,92], prolonged hospital stay [83,85,88,94,96,100,109,110,112,114,115,117,125-128,132,134,136], uci [65, 71, 75, 77, 83, 85, 92, 108, 109, 112], bladder catheter [65, 66, 68, 69, 71, 74, 89, 90, 92, 95, 135, 140], central venous catheter [66, 70, 73, 77, 79, 83, 107, 110, 111, 117, 121, 122, 126, 132, 136, 140], mechanical ventilation [65,67, 71-77, 80, 84,85,92, 93,97,101,102, 107, 110,111,129,131,135,140], tracheostomy [65, 106,102], immunosuppression [67,76-80,93], surgery [68-70,84,95,97,98,103], transfusion [71,73,102,103,114,139], nasogastric tube [71,72,82,96,132], neutropenia [71,100]), corticosteroids [71,119,130], cyanogenic cardiopathy [96], malnutrition [96,97,116], parenteral nutrition [70,79,81,83,104,110,113,117,119,130,134,138], neonates [73,86], prematurity [73,79,98,101,103,111,115,128,137], gastrointestinal disease [75,84,113,137], low weight [84,86,88,101,107,111,115,124,129,137], intubation [84,89,92,101], cardiopulmonary bypass [105], enteral nutrition [112], colonization pressure [114], burns [133- 141],

Second phase

Subsequently, in order to identify the terms used by health personnel (paediatricians, neonatologists, general practitioners, residents, nurses) within the clinical histories during the phase of suspicion or diagnosis of a patient with HAI, they were designed four clinical cases, one contained signs and symptoms suggestive of the start of an infection, another contained paraclinicos confirmatory of infection, another was an HAI and a

last was the negative control which did not suggest infection (see supplementary material 1). The clinical cases were included in a questionnaire that requested to write to the health professional an evolution of the clinical case. The questionnaire was applied in three health institutions of the city of bogotá and additionally, it inquired about the health area in which the professional practiced, the time of experience and the place where he worked. The data were analyzed with the atlas ti program, .8.1 taking into account that they were qualitative data (Table 3 & 4).

Table 3: General data of the survey applied to health professionals.

Measure	n	%
Health Area		
Audit or Administration in Health	6	25
Bacteriology	2	8.3
Nursery	5	20.83
General Medicine	5	20.83
Pediatrías	3	12.5
Neonatology	2	8.03
Radiology	1	4.16
Experience Time		
1 a 3 years	13	54.16
3 a 5 years	3	12.5
>5 years	8	23.3
Lugar de Trabajo		
CJNC	10	41.6
Hospital de Kennedy	7	29.16
Hospital San Ignacio	4	16.66
Hospital Santa Clara	1	4.16
Clínica La Colina	1	4.16
Hospital Militar Central	1	4.16

CJNC: Clínica Juan N. Corpas

Table 4: Qualitative findings of the survey applied to professionals in the health area.

Term	Frequency			
	Case 1	Case 2	Case 3	Case 4
Terms related to clinical findings				
Rales	10	-	-	-
Leukocytosis	12	-	-	-
Neutrophilia	10	-	-	-
Saturation	10	-	-	-
Proper evolution	-	17	-	-
Phlebitis	-	-	9	-
Terms related to medications				
Antibiotic	11	-	11	11
Antipyretic	12	-	12	-
Endovenous	11	-	8	-
Spread spectrum	8	-	-	-
Liquids	8	-	-	-
Oxygen	7	-	-	-
Terms related to HAI				
Complication	12	-	12	-
Length hospital stay	25	-	8	12
Respiratory infection	9	-	-	-
Pneumonia	16	-	-	-
Nosocomial	10	-	10	10
Catheter-associated infection	-	-	18	-
Cellulitis	-	-	15	-

Neurological infection	-	-	-	12
Meningitis	-	-	-	10
Terms related to the conduct to be followed				
Request paraclinics	16	-	14	25
Monitor vital signs	22	-	-	17
Departure	-	6	-	-
Request blood cultures	-	-	12	-
Start antibiotic management	-	-	11	-
Continue antibiotic management	-	-	-	17
Isolation by contact	-	-	-	9

Case 1: signs and symptoms suggestive of the onset of an infection, **Case 2:** negative control, **Case 3:** Confirmatory paraclinics of infection, **Case 4:** HAI confirmed.

Third phase: once the terms used in the scientific literature and in the clinical cases analyzed by health professionals in contact with the pediatric population were identified, the records of patients diagnosed with HAI in a third-level clinic during the study period were reviewed. Time between august 2014 and august 2016, the records were obtained through two sources, the first was the database obtained from the department of epidemiology of the institution and the second, from the search for cie diagnoses 10 related to HAI in the general database of the institution, the two databases were compared and a total of 96 cases of HAI were obtained, of which 12 corresponded to pediatric patients; 6 neonates and six older than 30 days of age; we found an average age of 12.3 days in neonates and 12 years in the other patients, an incidence of 75 infections per 1000 days of hospital stay was calculated. Of the total number of patients, 75% were male, all lived in urban areas; 91.6% of the population belonged to a middle stratum, however all were of the subsidized health regime. Regarding the family environment, we found that 83% of patients were cared for by their mothers who had an average age of 37 years, in terms of the academic training of caregivers 83% were high school graduates and 17% had technical studies.

In the evaluation of clinical variables of the patients, it was identified that the most frequent type of feeding during the days of hospital stay was enteral, followed by breastfeeding; the most frequent HAI was the bloodstream infection associated with the use of catheter, the most used diagnostic method was the culture of catheter tip followed by physical examination, the most frequently isolated microorganism was staphylococcus epidermidis as a producer of HAI, half of the cases of HAI was presented in the nicu and the remaining half in other hospitalization services; the most used medical devices were the venoclysis equipment that was used in all patients, followed by the central catheter in four patients, and nasal cannulas in 33.3% of the population studied; 75% of the cases had some type of isolation, with contact being the most frequent (Table 5). Finally, based on the information found in the three sources: scientific literature, surveys of health professionals and review of medical records, a triangulation of the information was carried out and, in addition to identifying the most frequently used terms, it proposes a list of terms and characteristics that could alert the triggering or the presence of an HAI in real time

which includes characteristics of the patient such as male sex or age less than 30 days of life; clinical characteristics such as the use of any invasive medical device, especially the use of venous catheter, surgical intervention, hospitalization in the icu, enteral nutrition and prolonged hospital stay, that is, more than 7 days in any hospitalization service (Table 6).

Table 5: Characteristics of HAI found in a third level clinic in Bogotá.

Measure	n (%)
HAI	
Bacteremia	8 (66,6%)
OSI	2 (16,6%)
Pneumonia	1 (8,4%)
Endometritis	1 (8,4%)
Diagnostic Method	
Catheter tip culture	6 (50%)
Physical exam	3 (25%)
Blood culture	2 (16,6%)
Transvaginal ultrasound	1 (8,4%)
Isolated microorganism	
S. epidermidis	8 (66,6%)
S. viridians	1 (8,4%)
S. aureus	2 (16,6%)
H. influenzae	1 (8,4%)
Identification Service	
Emergency	1 (8,4%)
NICU	6 (50%)
Pediatrics	5 (41,6%)
Isolated	
Yes	9 (75%)
Contact	8 (88,8%)
Air	1 (12,1%)
No	3 (25%)
Treatment	
Clindamicin	1 (8,4%)
Ampicillin/Gentamicin	8 (66,6%)
Piperacillin/Tazobactam	1 (8,4%)

Oxacillin	2 (16,6%)
Change of treatment	
Yes	6 (50%)
Vancomycin/Meropenem	6 (100%)
No	6 (50%)

OSI: Operative Site Infection, NICU: Neonatal Intensive Care Unit.

Table 6: List of terms and characteristics to suspect HAI.

Measure	Yes	No
Male		
Newborn		
Use of medical device		
Surgery		
NICU		
Enteral nutrition		
Length hospital stay		

Discussion

This investigation allowed to identify the characteristics and terms related to HAI, aspects that could be considered as warning signs during the first approach in pediatric patient care; determined the HAI events in pediatrics in a third level clinic and identified the social, demographic and clinical characteristics of the population studied. The innovative aspect of this study is that it provides information from three sources of data: the scientific literature, the clinical practice of health professionals and the records in medical records; in which the terms used were found to coincide; the foregoing assumes that the theory is not far from the practice and that the identified terms can be considered to make an early and accurate diagnosis of an HAI or to alert about the probability of suffering it during medical attention [24, 26-31, 67- 89]. It has been described that the first to identify this type of infection are the nurses or the epidemiological surveillance departments of the health entities, but with the terms found in this research, this role of early identification of HAI can be attributed to any professional of the health in contact with the patient [12,23-24].

The place of selection of participants, allowed to identify individuals of different socioeconomic level, the majority belonging to medium and low stratum, aspect that has evidenced relation with the presentation of HAI in other studies carried out [24]. Contrary to some studies that identify the rural area as a risk factor for contracting an infection, in this study none of the cases lived in a non-urban area [142-143]. It was found that the majority of patients who acquired an HAI were male, a finding consistent with multiple studies, which estimated that for every two male patients, one was female [144-148]. As well as studies conducted in north america and europe, the most frequent HAI was related to bloodstream infection associated with catheter use, and the most isolated microorganism was the staphylococcus epidermis present in the catheter tip culture; this finding is consistent with what was found in this research [149-153]. The literature describes multiple

risk factors for contracting an HAI and some authors indicate that the combination of several of these factors may increase the risk of acquiring an HAI; it is also known that HAI prolong the hospital stay of hospitalized pediatric patients, increase their morbidity and mortality and cause greater economic and human expenses that affect the health system [154-160]. The authors considered as a limitation the low number of cases found during the study period.

Finally, based on the results obtained, a list of characteristics that can alert the health professional about the presence of an HAI in the first contact with the patient is proposed, for this purpose, in a future investigation it is intended to generate a probability score of risk that will allow classifying patients in those with low, medium and high risk of HAI, at different times of hospitalization, including: admission, 24-48 hours, 49-72 hours and 73-96 hours. It would be of great value, due to the importance of reducing the HAI in the institutions, giving greater weight to the prevention of them with this information.

Conclusion

Most of the patients are male, they are cared for by one of the parents only, they belong to the middle stratum and they are subsidized. The most frequent HAI was the infection associated with the use of venous catheter. There are common characteristics and terms related to HAI that can alert on the appearance or course of an infection of this type. It is important to focus on the prevention of HAI from the first contact with the patient through the use of basic tools such as epidemiological characteristics and clinical history.

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