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MONITORING OF THE HOSPITAL ENVIRONMENT AND COSTS ATTRIBUTABLE TO HEALTH CARE-ASSOCIATED INFECTIONS A SYSTEMATIC REVIEW

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Abstract: Health Care Associated Infections (HAI), according to the WHO, are defined as infections contracted by a patient during treatment in a hospital or other health center and where said patient was not in the incubation period at the time of admission. Currently, they represent a highly relevant problem in Public Health, they entail high hospital mortality and morbidity rates, in addition to presenting great economic and social significance since they affect the years of life potentially lost in the population. Neonates are susceptible to IAAS and represent a greater care burden compared to other populations. The hospital environment constitutes a reservoir and a source of infection for the hospitalized patient, microorganisms that contaminate a surface can survive for days, so environmental microbiological monitoring provides retrospective information on the effectiveness of safety barriers, cleaning and disinfection processes of areas and could even evaluate people before the appearance of a series of microorganisms that increase the risk of IAAS.
Keywords: Health Care-Associated Infections, Costs, Hospital Environment.

INTRODUCTION

According to the World Health Organization (WHO), Healthcare Associated Infections (HCAI), formerly known as nosocomial infections, are defined as infections contracted by a patient during treatment in a hospital or other health center and that said patient "He was not incubating at the time of his admission in any type of environment in which he receives health care."(Alvarez L, 2020)Nosocomial infections, as they were previously known, are acquired during a stay in a hospital and were not present in the incubation period or at the time of admission of the patient.(Pujol & Limón, 2013)

Infections Associated with Health Care currently represent a problem of great relevance in Public Health, firstly, they represent an adverse event in terms of patient safety, they entail high rates of mortality and hospital morbidity, in addition to presenting great significance. economic and social since they affect the potentially lost years of life of the population.(Alvarez L, 2020)

At the hospital level, neonates are susceptible to HAIs and represent a greater care burden compared to other populations, both in environments with limited resources and in environments with sufficient resources, reporting infection rates in premature infants that are 10 to 20 times higher compared to other populations. with rates reported by neonatal intensive care units (NICU).(García et al., 2010)

Environmental factors are extrinsic factors that affect the infectious agent in a person who is likely to be exposed to that agent. Environmental factors related to IAAS include the animate and inanimate environment of patients. The lively atmosphere extends to healthcare staff, other patients in the same unit, family and visitors.

The inanimate environment refers to medical instruments and equipment, as well as environmental surfaces. Risk factors associated with the hospital environment include sanitation, unit cleanliness, temperature and humidity, and diagnostic and therapeutic maneuvers.(CONAMED, 2020)

The hospital environment constitutes a reservoir and source of infection for the admitted patient. There are several areas that surround the patient: the air, the sanitary water that comes into contact with the patient himself, with the staff and with the medical devices, food, surfaces, instruments that contact the patient's skin and mucous membranes, and the sterile solutions that are administered by inoculation. There are pathogens classically associated with each mode of transmission and environmental reservoir, but also multiresistant microorganisms that have recently been associated with environmental acquisition.(López, 2014)

Any surface in the hospital environment is susceptible to being colonized by microorganisms, including pathogens; This means that they can be cross-transmitted, through the hands of health personnel, to other surfaces, both animate and inanimate. Nosocomial infectious outbreaks can occur if the source is not eliminated; These can occur through solutions, liquids or medications contaminated by microorganisms adapted to survival in these environments.(Zúñiga & Caro, 2017)

Microorganisms that contaminate a surface can survive for days, weeks and even months, with the probability of transmission being greater the longer they persist in said place. The role played by hospital cleanliness in the transmission of healthcare-associated infections (HAI), however, there are still no exact scientific standards worldwide that evaluate environmental cleanliness.(Plasencia et al., 2022)

Environmental microbiological monitoring is a set of procedures that provide retrospective information on the effectiveness of safety barriers, cleaning and disinfection processes of areas and can even evaluate people, in the event of the appearance of a series of microorganisms that are indicators of recognized environmental acquisition. The Centers for Disease Control and Prevention (CDC) guidelines recommend performing environmental microbiological controls when cases of surgical infection due to opportunistic fungi appear, outbreaks due to parenteral preparations or milk bank products, outbreaks in critical areas of the hospital, for example burn units, isolation rooms, neonatology and others; works in the adjacent area or in

the surgical block, areas of the human milk bank and parenteral preparations; humidity detected; anomalies or breakdowns in the air conditioning system; and before the commissioning of a new critical installation. They also recommend that it must be used for quality assurance purposes, such as biological monitoring of sterilization processes, monthly cultures in dialysis units; and the short-term evaluation of the impact of control measures on HAIs or changes in established protocols that may affect patient safety.(Mena et al., 2017)

METHODOLOGY

A systematic review was carried out by searching the databases of PubMed, mediagraphic, Elsevier and SciELO, articles published on topics of costs attributed to Infections Associated with Health Care in Hospitals, as well as the environmental factors that contribute in its appearance. This way, the search was carried out by dividing on the one hand articles that refer to the direct costs of antimicrobials, cultures and medications used during the hospital stay of patients. The second search was carried out with the topic of microbiological monitoring environment in the hospital environment, which refers to the monitoring of intra-hospital surfaces for the detection of microorganisms that are a latent risk for the appearance of some HAIs.

Article quality evaluation:

Regarding the quality of the bibliographic review, the level of evidence and degree of recommendation was taken into account, considering the following aspects:

Introduction: contain the central topic addressed clearly and relevant.

Methodology: the study population and data collection instrument are mentioned in detail.

Results: that they were consistent with the objectives and methodology used.

Discussion: description of possible biases, limitations, and support with other scientific articles that support or reject the theory.

RESULTS

From the review, the following results were found, which are described in Table 1. Firstly, reference 1 mentions the main accepted classification worldwide, which is: Pneumonia Associated with Mechanical Ventilation, Bloodstream Infections, Surgical Site and Catheter Infections. urinary. Likewise, reference 3,4,5,6 describes the types of HAIs and their specific characteristics, all of which include the concept of HAIs with onset of 48 and 72 hours. In reference 3, reference is made to sepsis, which represents between 79 and 87% of all infections, with an average hospital stay of 7 to 21 days and an increase in hospital costs. In relation to costs, references 7 and 8 conceptualize costs, and their classification for health study purposes, such as direct and indirect. The economic impact represented by the costs associated with HAIs is reflected in different studies from 2002, to some more recent ones from 2020, directly related to the days of hospital stay, the type of antimicrobial used, laboratory studies specifically requesting blood cultures. (9,10,11, 12, 13). Among the areas with the most susceptibility to the acquisition of infections is the Neonatal Intensive Care Unit (9), associated with prolonged hospital stay, vulnerability of neonates, which leads to the use of more resources such as equipment, and especially human resources. (15,17,19). The type of microorganism will depend on the aggressiveness of the infection, as well as the resistance to the different medications for its treatment, so investigation of the hospital environment is essential for prevention (16,18,20).

The results of the review regarding hospital environment monitoring are described

Findings	Bibliographic reference	Reference number
Health Care-Associated Infections affect any type of patient, in any type of environment in which they receive health care. Among the HAIs, bloodstream infections (STIs), Ventilator-Associated Pneumonia (VAP), stand out. Urinary tract infection (UTI), and surgical site infections (SSI), associated with high morbidity and mortality.(Secretariat of Health, 2019)	Ministry of Health, DR ©. (2019). Manual for the Implementation of Action Packages to Prevent and Monitor Infections Associated with Health Care (HAI).	1
The most common type of infection is sepsis, which represents between 79 and 87% of all infections, prolonging hospital stays by an average of 7-21 days and consequently increasing care costs. Neonatal sepsis is defined as a patient less than or equal to 28 days old who, after 72 hours of hospitalization, presents at least one of the following signs and symptoms: Fever (>38°C), hypothermia (less than 37°C), apnea or bradycardia and at least one of the following: two or more positive blood cultures and the physician has instituted appropriate antimicrobial treatment or clinical diagnosis and treatment installed.(Vargas, 2008)	Vargas, R. A. (2008). Excess costs due to In-hospital Sepsis in two Neonatology services in Trujillo, Peru 2003-2005. Rev Peru Med Exp Salud Publica, 25(2), 185–189.	2
In the case of ventilator-associated pneumonia (VAP), they are those that occur between 48 and 72 hours after endotracheal intubation, and whose diagnosis can be early or late. (10) Mechanical ventilation has been one of the great advances in the care and survival of critically ill patients. (Secretariat of Health, 2019)	Ministry of Health, DR ©. (2019). Manual for the Implementation of Action Packages to Prevent and Monitor Infections Associated with Health Care (HAI).	3
Urinary tract infections associated with bladder catheterization, it was established that the presence of symptoms (fever >38.0°C, suprapubic tenderness, pain or tenderness in the costovertebral angle, urinary urgency, urinary frequency and dysuria) positive urine culture with more than two species of identified organisms, at least one of which is a bacteria of > 105 CFU/ml in the presence of a urinary catheter for > 2 days, are the criteria for making a confirmatory diagnosis.(Castillo et al., 2020)	Castillo, M., Moranchel, L., & Ruiz, A. (2020). Prevalence of urinary tract infections associated with urinary catheter in a private tertiary hospital. Med Int Méx., 36(3), 301–311. https://doi.org/10.24245/mim	4
Surgical site infections (SSI), defined by the Center for Disease Control and Prevention (CDC), is an infection that occurs after surgery in the part of the body where the surgery took place, describing three levels of SSI, incisional superficial, deep incisional and organ-space infection. It is also important to mention that, in the absence of clinical signs, the finding of positive cultures does not necessarily indicate SSI.(Cebrián & Ottolino, 2017)	Cebrián, J., & Ottolino, P. (2017). Epidemiology and Definitions in Surgical Infections. Rev Venez Cir, 70(1), 7–11.	5
Defined as that infection "less than or equal to 28 days of birth that after 72 hours of hospitalization presents at least one of the following signs and symptoms: fever (>38°C), hypothermia (<37°C), apnea or bradycardia and at least one of the following: two or more blood cultures positive for common skin contaminants, drawn on different occasions, at least one blood culture positive for a common skin contaminant from a patient with an intravascular line (all classes of catheters)(Moreno & Miliar, 2019)	Moreno, MM, & Miliar, R. (2019). Pneumonia Associated with Mechanical Ventilation: An area of opportunity in intensive care units. Rev Enferm Infecc Pediatr, 32(131), 1626–1630. www.eipediatria.com	6
The determination of health costs is complex, however, it is necessary to start from an understanding of the concepts in order to have defined limits and scope. The cost or cost is the economic expense represented by the manufacturing of a product or the provision of a service. Health costs are the expenses linked to the production of the service, including the payment of benefits and supplies.(Barreiro, 2019)	Barreiro, S. (2019). Health Cost Management. monograph.	7
The cost or cost can be classified according to the framework in which it is analyzed as direct costs which are associated with the resources of the health systems and indirect costs are what are related to the value of the time that has to be invested. the patient in an intervention (transfer, waiting, recovery) associated with salary and productivity. (14) The other type of costs are indirect costs, which are related to the loss of production or productive time associated with the presence of an illness, and may imply short-term or long-term temporary absence depending on the total or partial disability that occurs. correspond.(Ripari et al., 2017)	Ripari, NV, Elorza, ME, & Moscoso, NS (2017). Disease costs: classification and analysis perspectives. Health Sciences Magazine, 15(1), 49–58.	8

It is estimated that 1 in 10 hospitalized patients will acquire an infection during their hospital stay, which will lead to an increase in hospital stay, additional diagnostic and therapeutic interventions. In this article it is estimated that the "cost of these infections, in 2002 prices, suggests that the Annual economic burden is $6.7 billion a year in the United States and £1.06 billion (approximately $1.7 billion) in the United Kingdom. (Graves, 2004)	Graves, N. (2004). Economics and Preventing Hospital-acquired Infection. Emerging Infectious Diseases, 10(4), 561–566.	9
Figures are presented in Chile for the notification of in-hospital infections around 70,000 per year, with an average number of days of hospital stay of 10, which would mean 700,000 bed days used for the aforementioned cause and a cost for that country of US$ 70,000,000. (16), in this same article the complexity of measuring costs is mentioned due to the multiple factors that involve the etiological agent, antimicrobial resistance, making it easier to obtain direct costs.(Brenner et al., 2003)	Brenner, P., Nercelles, P., Pohlenz, M., & Otaíza, F. (2003). Cost of hospital-acquired infections in Chilean hospitals of high and medium complexity. Rev Chil Infect, 20(4), 285–290.	10
In an article published in a Peruvian Regional Hospital, with the purpose of estimating costs in the care of "nosocomial pneumonia", the total health costs in the group with nosocomial pneumonia amounted to $/340,000 new soles and in the group without pathology approximately $/105,0000 new soles. This represented higher costs in pneumonia acquired in the hospital by up to three times compared to those that did not present this pathology.(Dámaso et al., 2016)	Dámaso, B., Chirinos, J., & Menacho, L. (2016). Estimation of Economic Costs in the Care of Nosocomial Pneumonia in a Peruvian Regional Hospital, 2009 to 2011. Revista Peruana de Medicina Experimental y Salud Publica, 33(2), 233–240. https://doi.org/10.17843/rpmesp.2016.332.2202	eleven
In other cases, it may be necessary to occupy isolation rooms to avoid superinfections, generating high costs during the hospital stay.(Hansen et al., 2007)	Hansen, S., Stamm-Balderjahn, S., Zuschneid, I., Behnke, M., Rüden, H., Vonberg, R.P., & Gastmeier, P. (2007). Closure of medical departments during nosocomial outbreaks: data from a systematic analysis of the literature. Journal of Hospital Infection, 65(4), 348–353. https://doi.org/10.1016/j.jhin.2006.12.018	12
Next, Nercelles and Bremmer (2008) analyzed the cost of in-hospital infections in Chilean hospitals of high and medium complexity, they included cost studies in the years 2003 and 2005, selecting the cost indicator the excess days of stay in the Hospital. between patients with nosocomial infection and patients without IIH with a control for each case. The results indicated that IHH prolongs hospital stay and increases the use of antimicrobials by two to four times compared to patients with similar characteristics, but without nosocomial infection.(Brenner et al., 2003)	Brenner, P., Nercelles, P., Pohlenz, M., & Otaíza, F. (2003). Cost of hospital-acquired infections in Chilean hospitals of high and medium complexity. Rev Chil Infect, 20(4), 285–290.	13
Likewise, Peru carried out a research study from 2003 to 2005, with the purpose of quantifying the excess costs of in-hospital sepsis in the neonatology services of two Hospitals, using the methodology of the protocol proposed by PAHO, where the indicators of The costs used were days of stay since admission, administration of antimicrobials in pharmacological presentation units and number of blood cultures recorded in the medical records, obtaining as results in total costs an excess cost was evident, in cases of sepsis that amounts to US $ 7,580 in the Regional Teaching Hospital and US$ 15,997 in the Belén Hospital, in both hospitals it is observed that the highest cost among the evaluated indicators is found in bed days in more than 80% of the total excess cost. (Vargas, 2008)	Vargas, R. A. (2008). Excess costs due to In-hospital Sepsis in two Neonatology services in Trujillo, Peru 2003-2005. Rev Peru Med Exp Salud Publica, 25(2), 185–189.	14
It is estimated that around 2 million patients acquire IAAS annually in the US, which in addition to contributing to the death of around 88,000 people, has generated additional costs of 5 billion dollars, used in hospitality, health human resources, use of antimicrobials and other direct and indirect costs,(Alvarez L, 2020)	Álvarez L. (2020). Prevalence and factors associated with healthcare-associated infections in patients admitted to an intensive care unit. Neiva 2016-2017. Bioscience, 15(2), 75–78.	fifteen

The study carried out by Judith L. Ortiz-Mayorga, 2019, in Colombia, which used a case-control study in patients over 18 years of age, hospitalized in a period from 2011 to 2015, identifying the main factors related to the high cost of the management of HAIs to the causal agents of the infection, indicating that when it is caused by fungi the cost increases, as well as their hospital stay, as well as the nature of the condition of each patient, for example oncological conditions. She conclusively estimated a median cost of treatment and management of IAAS at COP $1,190,879, where 41% of the total value represented the use of antibiotics, and 13.5% laboratory studies.(Ortiz et al., 2019)	Ortiz, J., Pineda, IG, Dennis, RJ, & Porras, A. (2019). Costs attributed to infections associated with health care in a hospital in Colombia, 2011-2015. Biomedica, 39(1), 102–112. https://doi.org/10.7705/biomedica.v39i1.4061	16
There is the publication of the article by Navarrete-Navarro (1999), carried out at the National Medical Center Siglo XXI, on the analysis of secondary costs due to nosocomial infections in two pediatric intensive care units (NICU/PICU), the costs investigated were diagnostic tests and therapeutic resources used, as well as excess costs such as hospital stay, reflecting the results of 102 episodes presented, was 9,353,255 pesos, according to the age group, neonates consumed 56.7% of the resources, infants 27.2 %, schoolchildren 14.7% and finally preschoolers 1.4%. concluding that the average cost of caring for an infected neonate in the NICU was higher than that of caring for an older child in the PICU. (Navarrete & Armengol, 1999)	Navarrete-Navarro S, Gerardo AS. Secondary costs due to nosocomial infections in two pediatric intensive care units. Public Health of Mexico. 199; 41(1)	17
Another investigation led by Juárez-Muñoz & Cols. was carried out in this same medical establishment. (1999) with the purpose of knowing the costs generated by in-hospital infections (IIH) through a descriptive, analytical and observational study, which included all patients who were admitted to the Hospital in a quarter who presented IIH, as a result The report of 159 cases was found, analyzing only 131 files, the relevant data resulted in an overstay of 970 total days, an average of 7.4 days per infection, with a total cost of $3,516,421.00, this figure calculated over one year, It corresponded to 16.2% of the annual budget assigned to the Hospital.(Juárez et al., 1999)	Juárez, IE, Vázquez, A., Games, J., Sciandra, M., Mercado, JA, & Solórzano, F. (1999). Costs of hospital-acquired infections of a group of patients in a tertiary care hospital. Gac Méd Méx, 135(5), 457–462.	18
Another aspect to consider is the impact of infections associated with health care directly to the health system, and the indirect costs are added, as referred to by the latter as expenses and losses of future income for the patient who is hospitalized for an IAAS and for society. It is well known that, in patients with immunosuppressed situations, with long-stay hospitalization, the presence of infections with multi-resistant microorganisms is highly probable, representing an economic cost per patient between 5,000 and 25,000 euros, a figure that increases if the stay of The patients must be in an intensive care service, since to this are added the use of highly complex medical devices, greater frequency of patient monitoring as well as the permanent use of the health professional, these figures can increase by up to 50,000 euros,(Olaechea et al., 2010)	Olaechea, PM, Insausti, J., Blanco, A., & Luque, P. (2010). Epidemiology and impact of nosocomial infections. In Intensive Medicine (Vol. 34, Issue 4, pp. 256–267). https://doi.org/10.1016/j.medin.2009.11.013	19
For García in 2015, he refers to the incidence of "Nosocomial Infections" of an average of 4 and 15.4 per 1000 live births, and compared to hospital discharges of 8.8 to 41.1 per 100 discharges, the third comparison is with respect to the days patient, in this case the incidence rate shown in a Hospital with social security showed an average of 25.6 cases per 1000 patient-days.(PAHO, 2019)	OPS. (2019). WHO/PAHO. Https://Www3.Paho.Org/Hq/Index.Php?Option=com_content&view=article&id=2973:Health-Financing&Itemid=0&lang=es#gsc.Tab=0.	20

Table 1. Characterization of the IAAS

Findings	Bibliographic reference	Number of reference
In Colombia, a hospital environmental monitoring study was carried out which reported 62 sampled surfaces, a total of 177 isolates, of which 173 (97.74%) were positive and 4 (2.26%) were negative. A total of 2.79 microorganisms were reported per sampled surface, with UCEMIN being the service with the highest ratio of positive isolates with 2.92 germs for each surface studied and UTIC the service with the lowest ratio with 1.45. Of the total microorganisms, 50.87% were made up of gram-negative bacilli, the most isolated microorganism being Acinetobacter baumannii with 17 reports, followed in frequency by Rhizobium radiobacter with 16 and Sphingomonas paucimobilis with 13. The hospital environment is highly contaminated, being the majority pathogenic microorganisms. (Plasencia et al., 2022)	Plasencia, N., Zegarra, C., Failco, V., & Díaz, C. (2022). Microbiological isolation of inanimate surfaces in contact with patients in a Peruvian hospital. Colombian Association of Infectology, 26, 67–72.	1
Alonso, G in his study Analysis and distribution of antibiotic resistance in bacterial strains of hospital origin, carried out six environmental sampling in the ICU of the HUC, a total of 1,072 colonies with morphology of Gram-negative bacteria were isolated, of which only 189 were actually Gram negative bacteria. When identifying these microorganisms, 42 A. baumannii organisms were obtained distributed throughout the service, on inanimate surfaces near and far from the patients, including the cleaning and work areas. Five P. aeruginosa organisms were also obtained from 2 cure cars in the third shot.(Alonso, 2017)	Alonso, G. (2017). Analysis and distribution of antibiotic resistance in bacterial strains of hospital origin. VITAE Digital Biomedical Academy, 72, 1–6.	2
Meanwhile, in a study carried out in Mexico, two hospitals in the city of León, Guanajuato, were selected to evaluate air quality. In hospital 1, the highest concentration of bacteria was found in the children's intensive care area (232 CFU/m3), while the lowest concentration was in the transplant area (40 CFU/m3. In hospital 2, the highest concentration of bacteria was in the adult intensive care area (448 CFU/m3) and the lowest concentration in the intensive pediatric area (32 CFU/m3. It was shown that the air quality is poor and that essential measures to control these. The identification of pathogens such as Kluyvera cryocrescens and Enterobacter cancerogenus found in hospital 1 and Alcaligenes faecalis, Kluyvera ascorbata, Klebsiella pneumoniae and Pandoraea pulmonicola present in hospital 2, are considered of clinical importance with the possibility of incidence for hospital users.(Maldonado et al., 2014)	Maldonado, M., Peña, J., De los Santos, S., Castellanos, A., Camarena, D., Arévalo, B., Valdés L, Hernández, L., & Guzmán, D. (2014). Bioaerosols and evaluation of air quality in two Hospital Centers located in León, Guanajuato, Mexico. Rev. Int. Contam. Ambie, 30(4), 351–363.	3
In the study Microbiological quality of the air in a Community Family Health Center in Talcahuano, Biobío Region, Chile, the presence of bacteria and fungi with importance in human health was evident, in contrast to what is recommended by the WHO for the air of closed spaces., in which these health centers are included, among the microorganisms present in the environment, 11 genera were detected, where the majority corresponded to gram-positive bacteria. It is important to highlight that, although with very low frequency, pathogenic gram-positive bacteria such as Staphylococcus aureus (2%) and Kocuria rhizophila (5%) were detected. In the case of gram-negative bacteria, these were detected at a very low frequency (4%), and corresponded to the species Pseudomonas oryzihabitans (3%) and Acinetobacter lwoffii (1%). On the other hand, for fungi a smaller number of species was identified, 71% belonging to the genus Aspergillus. (Parra et al., 2021)	Parra, M., Valdebenito, E., Maldonado, N., Domínguez, M., Sanhueza, F., Salvo, C., López, M., Bournas, P., & Bello, H. (2021). Microbiological air quality in a Community Family Health Center in Talcahuano, Biobío Region, Chile. Chilean Journal of Infectology, 38(3), 324–332. www.revinf.cl	4
Chávez et al., in their study, carried out 78 samples that were obtained from the surfaces of hospital rooms: 24 samples were taken in the ICU, 16 samples in the NICU and 38 samples in the surgery room. In the hospital environment, S. aureus was detected in 12.2% (20/167) of cases, with the presence of this bacteria being significant in the ICU (6.1%, P=0.031). In this room the presence of S. aureus represented a higher risk (OR) of 3.143. The results of the antibiotic susceptibility test show that in the hospital environment there was resistance to tetracycline (31.4%), ampicillin (28.6%) and ciprofloxacin (22.9%).(Chávez et al., 2017)	Chávez, M., Martínez, A., & Esparza, M. (2017). Characterization of Staphylococcus aureus obtained from the hospital environment and health personnel in a hospital in the city of Cali. Biosalud Magazine, 16(2), 22–33. https://doi.org/10.17151/biosa.2017.16.2.3	5

In a study entitled Environmental contamination by multiresistant microorganisms and the effect of cleaning and disinfection in an intensive care unit, environmental samples were obtained from the rooms, 48 h after the detection of colonization and after cleaning. The results showed that after both cleaning procedures, contamination by Acinetobacter spp was reduced from 28.2% to 2.6%. multiresistant (AMR). Also, samples of commonly used equipment were taken, finding between 1.8 and 5.4% contamination by MMR. Cleaning and disinfection significantly reduce environmental pollution. However, colonization of equipment by MMR and failure to follow universal precautions represent a possibility of cross-transmission.(Masó et al., 2020)	Masó, M., Sesma, A., Pintado, S., Santolin, C., Luna, T., & Mangiaterra, S. (2020). Environmental contamination by multiresistant microorganisms and the effect of cleaning and disinfection in an intensive care unit. Latin American Clinical Biochemical Act, 54(2), 145–150.	6
In a hospital of the Mexican Institute of Social Security in the State of Quintana Roo, sampling was carried out in the services of Internal Medicine, pediatrics, gynecology, surgery, operating rooms and CEyE, it was observed that the prevalent agent was coagulase-negative staphylococcus, and therefore importance due to its pathogenicity, Pseudomonas aeruginosa, Citrobacter freundii, Acinetobacter iwoffi and Staphylococcus haemolyticus. Coagulase-negative staphylococcus was found on various surfaces (beds, walls, chairs and dressing cart). Pseudomonas aeruginosa and Citrobacter freundii were found on moist surfaces such as sinks. Acinetobacter iwoffi i and Staphylococcus haemolyticus were common on mattress and bed surfaces.(Zúñiga & Caro, 2017)	Zúñiga, I., & Caro, L. (2017). Environmental and surface cultures: a strategy for timely detection of nosocomial infections. Latin American Journal of Pediatric Infectology, 30, 147–150. www.medigraphic.org.mxFinancing:None. Conflict of interest:None.This article can be consulted in full version athttp://www.medigraphic.com/rlip	7
In a study carried out in a Neonatology Area of a Hospital located in the South of Ecuador, it was found that the microorganisms identified in the present study were 25 bacterial colonies, where the agents that presented the highest frequency index were Staphylococcus epidermidis (20 colonies), S. saprophyticus (3 colonies), E. coli (1 colony), and Serratia marcescens (1 colony), the results showed that the germs identified in the different units of the neonatology area do not pose a risk to the health of newborns. nor for the personnel who work in the different units, because the bacterial counts are within the permissible range according to the UNE-EN-ISO 14698-1-2:2006 standard, considering it as a VERY CLEAN ENVIRONMENT, so it was concluded that The presence of microorganisms in the Hospital studied was minimal.(Cabrera & Silverio, 2019)	Cabrera, C., & Silverio, C. (2019). Determination of Microorganisms in the Environment of the Neonatology Area of a Hospital located in the South of Ecuador. Knowledge Pole, 4(6), 96. https://doi.org/10.23857/pc.v4i6.1001	8
At the National Institute of Perinatology of Mexico, a total of 21 surfaces from different areas were sampled, which included emergencies, tocosurgical unit, intermediate care unit for newborns, neonatal intensive care unit, adult intensive care unit, operating rooms, of maternal fetal medicine and area of urogynecology. Of the total areas subjected to disinfection with the 2 antiseptic agents, the results were the following: on the surfaces disinfected with sanitizing solution and sodium hypochlorite, various microorganisms grew on 13/21 and 9/21 surfaces respectively before the disinfection process. After applying the disinfectant, the growth of microorganisms was 0/21 and 2/21 respectively, so it was concluded that there is no significance in both products.(Galván et al., 2016)	Galván, R., Ruiz, R., Segura, E., & Cortés, R. (2016). Comparative study on the effectiveness of 6% sodium hypochlorite vs. the bromo-chloro-dimethyl-hydantoin solution for disinfection in hospital environments. Perinatology and Human Reproduction, 30(4), 145–150. https://doi.org/10.1016/j.rprh.2017.06.001	9
Izzeddin et al., in their study, took samples of air, temperature and relative humidity, the sampling was carried out at the door of the operating room (point 1) and in front of the air conditioning outlet (point 2). A total of 46 samples were collected. Among the main microorganisms found are: Coagulase negative Staphylococcus Staphylococcus aureus, Bacillus spp., Pseudomonas luteola, Pseudomonas oryzihabitans and Aspergillus niger, the analysis of this research indicates that the quality of the operating room environment does not meet the criteria established by the NTP-409 and 243 that establish a microbial count of less than 10 CFU/m3 of air, a temperature less than 18ºC and humidity of 50% to 60%.(Izzeddin et al., 2017)	Izzeddin, N., Rodríguez, G., Medina, l, & González, L. (2017). Microbiological evaluation of air and surfaces in the operating room of a public health center. No. 3 Rev. Salus, 21(3), 18–23.	10

In a Hospital in the city of Cuenca, 50 samples of instrumental materials, medical equipment and surfaces from the operating room and ICU area were collected. In this study, a frequency of 6% of S. aureus was demonstrated contaminating the surfaces of the hospital environments analyzed. In relation to the detection of resistance genes, they have the genes blaZ and mecA, which code for resistance to penicillin and methicillin, respectively. Given that the majority of the S. aureus isolates obtained carried resistance genes to penicillin and methicillin, it is advisable to maintain epidemiological surveillance measures of the resistance of the isolated strains, both from patients and from environmental surfaces, in order to control the dissemination of multiresistant strains.(Andrade & Orellana, 2019)	Andrade, T., & Orellana, P. (2019). Frequency and susceptibility to penicillin and methicillin of environmental isolates of Staphylococcus aureus in a hospital in Cuenca. KASMERA, 47(2), 123–130.	eleven
Failoc et al., make an analysis of a study previously carried out in a hospital in Chiclayo, Peru, in which they report that asepsis, which includes disinfection and sterilization, is a process of vital importance to prevent these phenomena from making the patient's situation more difficult. patient, for this it is important to have a microbiological surveillance system that periodically monitors each environment of the health facility, in order to prevent microorganisms found on inanimate surfaces from being transported to susceptible people and causing an HAI.(Failoc et al., 2015)	Failoc, V., Molina, C., & Díaz, C. (2015). Importance of hospital cleaning for the control of hospital-acquired infections: microbiological evaluation of a hospital in Chiclayo, Peru. In ELSEVIER (Vol. 19, Issue 4, pp. 183–184). Elsevier Doyma. https://doi.org/10.1016/j.infect.2015.03.004	12
Mena et al., in their study Microbiological Monitoring of Infections Associated with Health Care (IASS): A Proposal for Quality Care and Patient Safety, mentions the importance of environmental microbiological monitoring since it is one of the tools of field research most used for monitoring IAAS, mentions the different types of monitoring, in conclusion microbiological monitoring is a broad topic and it is necessary to standardize an institutional protocol based on the needs and available resources, which can provide information useful and relevant for decision making not only in the control of outbreaks, but also in the search for reservoirs and improvements in the application of standardized cleaning and disinfection methods.(Mena et al., 2017)	Mena, K., Elizondo, D., & Delgado, ME (2017). Microbiological monitoring in infections associated with health care (IASS): A proposal for quality care and patient safety. Medical Journal of Costa Rica and Central America, 74(624), 129–135.	13
In a study carried out in a second level hospital in Hidalgo, microbiological monitoring was carried out in the nursery area, the sampling was by open box, highlighting that the microbiological volume detected was less than 1X103 microorganisms per m3 of air, which means that There is no risk in this environment for neonates, although air monitoring indicates that they are aerobic mesophiles. It was not possible to determine if there is a risk derived from the resistance profiles of the microorganisms detected since neither typing nor determination of said profiles was carried out.(Monroy et al., 2011)	Monroy, S., Reynoso, J., Becerril, M., Flores, M., Paz, J., Muñoz, B., Martínez, J., Corona, H., Cortés, S., & Ruvalcaba, J. (2011). In-hospital environmental monitoring: the need for standardization in nurseries. UAEH Scientific Bulletin.	14
In a study called Evaluation of the risk due to transmission of intra-hospital respiratory infections mediated by bioaerosols present in the Suba Hospital (II NIVELESE), monitoring of the microbiological quality of the air was developed in the emergency area of the Suba II hospital, finding that, Of the 19 strains identified, it was found that the environment of the hospital's emergency area represents a medium risk to the population due to the characteristics evidenced. In addition, it was established that the causal agents Kytococcus spp and Cladosporium spp present a high risk to people's health, since they can cause diseases such as rhinitis, asthma and pneumonia, which in immunosuppressed patients can lead to death.(Guzmán & Pachón, 2016)	Guzmán, L., & Pachón, J. (2016). Risk assessment for transmission of hospital-acquired respiratory infections mediated by bioaerosols present in the Suba hospital (II LEVEL ESE).	fifteen

In another study carried out in a Hospital in Quito, it was determined that the main bacteria that were identified were coagulase negative Staphylococcus with 78.26%, followed by the genus Micrococci which corresponds to 15.94% and finally with 5.79%. the genus Bacillus spp; The fungal genera found are: Penicillium and Aspergillus spp. in equal percentage with 50%. Of the total samples and microorganisms identified, the genus Aspergillus spp. It is the most pathogenic since it causes health problems. The contamination of this hospital environment may be due to the patients, the medical staff in the area and the air conditioning system, the latter being capable of introducing infectious particles directly from the outside environment, in addition to the hygienic care that must be taken when entering the hospital. this critical area such as proper hand washing.(Montalusia, 2018)	Montalusia, M. (2018). Analysis of the air microbiota in intensive care at the Fuerzas Armadas N°1 specialty hospital in Quito, 2018.	16
In 2012, a study called Germicidal Ultraviolet Light and Control of Environmental Microorganisms in Hospitals was carried out. Environmental concentrations of total aerobic flora that were not acceptable for an Intensive Care Unit were found in rooms 1 and 3. The effect of the germicidal ultraviolet light lamp It was absolute on fungi and not on bacteria, but significantly improving the air quality of the rooms, bringing them to clean environmental values.(Sánchez et al., 2012)	Sánchez, J., Echandi, M., Armenta, J., & Salas, D. (2012). Germicidal ultraviolet light and control of environmental microorganisms in hospitals. Costa Rican Public Health Magazine, 21(1), 19–22.	17
Silverio and Cabrera in their research entitled Control of asepsis measures in the neonatological area of a Hospital in the south of Ecuador obtained that in the neonatology area <5 Colony Forming Units for each positive sample analyzed and S. epidermidis as the most frequent agent for showing it on 4 occasions and the Basic Care Unit was identified as the unit with the greatest continuity of colonies for presenting a growth of 11 bacterial colonies; concluding that the presence of microorganisms in the Hospital studied was minimal, which implies that there is no risk for the neonates.(Silverio & Cabrera, 2019)	Silverio, C., & Cabrera, C. (2019). Control of asepsis measures in the neonatological area of a Hospital in southern Ecuador. Interdisciplinary Refereed Journal of Health Sciences. Health and Life, 3(6), 95–107. https://doi.org/10.35381/svv3i6.309	18

Table 2. The importance of in-hospital environmental monitoring.

in table 2. References 1,3,4,7,10,12,15,16 mention the importance of environmental microbiological monitoring, in which sampling taken mostly in intensive care units, operating rooms and other hospital areas considered high risk from different surfaces, show that the microorganisms found are of risk to health, the microorganisms identified are mostly Staphylococcus aureus, Acinetobacter baumannii, P aeruginosa, Klebsiella pneumoniae, Staphylococcus coagulase, Kytococcus spp and Cladosporium spp, Penicillium and Aspergillus spp, recommend continuous microbiological monitoring to identify timely cleaning and disinfection to avoid cross infections and multi-resistant strains. While references 2,5,6 and 11 are focused on verifying multi-resistance by Staphylococcus aureus isolated on the surfaces of different hospital areas, it has been demonstrated that there is resistance to tetracycline, ampicillin, ciprofloxacin, penicillin and methicillin, so measures are recommended. of epidemiological surveillance, both of patients and of environmental surfaces that prevent the increase of multi-resistant microorganisms. In references 9 a comparison is made on the effectiveness of two disinfectants, sampling is carried out before and after cleaning with these disinfectants, concluding that there is no significance in both disinfectants. Reference 17 shows how ultraviolet light is capable of identifying microorganisms and being an effective germicide. References 8, 14 and 18 mention that among the microorganisms found such as Staphylococcus epidermidis, S. saprophyticus, E. coli, Serratia, among others, there is no health risk since there are <5 Colony Forming Units per which are in the permissible range. Finally, reference 13 refers to the different types of microbiological monitoring in hospital environments, which are: sampling of the microbiological quality

of the air, monitoring of the hands of health personnel, sampling of surfaces and areas that are difficult to access, and liquid solutions.

DISCUSSION

Health Care Associated Infections (HAI), considered a major problem in Public Health, on the one hand represent an adverse event in terms of patient safety, entail high rates of mortality and hospital morbidity, in addition to presenting high costs. hospitals, which are not contemplated in the budgets for the operation (Monroy et al, 2011). The analysis of direct costs allows obtaining information regarding days of hospital stay, human resources allocated to care, prescription of broad-spectrum antimicrobials, as well as the indication of complementary studies.

The etiology of HAIs is multifactorial, associated with poor hand hygiene practices, as well as poor hospital cleaning and disinfection techniques, as described by Del Moral (2019).

Some hospitals, aware of the high cost of HAIs and mainly, in order to avoid outbreaks or consumption of high-cost antibiotics in the face of bacteria resistant to almost the entire basic hospital treatment, perform surface cultures sporadically; This process, instead of being a "useless expense", is a recommended strategy in every hospital in the health sector (Zuñiga & Caro, 2017).

Bacteria from environmental environments can be used as bioindicators and in colloquial terms as warnings of environmental conditions in hospital environments, these do not represent any threat to hospital institutions, on the contrary the information detected Aero microbiological in hospital settings, represent areas of opportunity Based on the knowledge generated by micro-environmental researchers, a hospital stay free of health risks is guaranteed, which puts life and death in a thread, since the bacteria detected in this type of environmental environments generate compatible solutes, increasing virulence. of them and make an uncertain prognosis flourish (Ruvalcaba et al, 2014).

The above denotes that it is of utmost importance that frequent studies be carried out in intra-hospital environmental settings; in no way are these carried out with the insignia of favoring or blaming any institution responsible for monitoring and maintaining an optimal state of health in the population of its patients. users.

CONCLUSIONS

As already mentioned, infections associated with health care are a great economic and social burden, not only for patients but also for health institutions, which is why prevention of these is essential, we must work together both operational health personnel, managers, patients and family members for the prevention and control of HAIs, in addition, epidemiological surveillance must be strengthened, continuous training for health personnel, hospital cleaning and disinfection that can be verified through microbiological monitoring, all this in order to reduce HAI rates.

IN MEMORY to Dr. Miguel Raygoza Anaya, Research Professor at CUCS-U de G, University of Guadalajara, Mexico Trainer of Human Resources in Scientific Research at my Alma mater, to whom I owe my professional training, hard collaborator in the construction of knowledge, motivator and example to follow, demanding in his professional work, an understanding and motivating person for research. to whom I reiterate my respect and admiration for the hard work carried out in applied environmental epidemiology, my recognition for the great friendship of him "Cuaterol", a demanding human being and friend, RELY IN PEACE.

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