



Research Article

MICROBIOLOGICAL QUALITY BASSINET AIR, SECOND LEVEL HOSPITAL

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ABSTRACT

Environmental surveillance in secondary hospitals is not found or is rarely identified because there are no standardized national parameters that support air quality for inpatients. The objective to study this is to determine the existence of environmental monitoring strategies in hospital units for the control of nosocomial infections from the query in information sources, and indexed information databases. A critical analysis of the subject in magazines detected in sources of information such as Thomson Reuters, and CrossRef PubMed indexed and Mexican Official Standards was conducted. 26 items were analyzed, of which 34 % were discarded due to the performing validation of the literature, 47 % were validated through Pub Med and only 6 % by Thomson Reuters; Analysis of air into hospital units show agents that can cause nosocomial infections such as *Acinetobacter baumannii*, *Citrobacter freundii* and *Klebsiella*. The international literature has shown well supported studies on the existence of nosocomial pathogens in the air. In Mexico there are few reports of the microbiological quality of air in their hospital units because the Mexican Official Standards for the prevention of nosocomial infections have not been standardized for evaluating these risks. The presence of epidemiological emergencies such as influenza or SARS created the need for updating regulations to allow constant monitoring of air quality for inpatients and thus face new threats to the health of nations.

Keywords: bassinets, environmental monitoring, environmental epidemiology, epidemiological surveillance

INTRODUCTION

The hospital infection control is a challenge for all health services globally, Mexico has implemented multiple actions to reduce these, the creation of Mexican Official Norms which disclosed the minimum activities highlighted to play by the Epidemiological Surveillance Unit hospital, the hospital infrastructure in developing countries is limited so that exposure of health personnel and patients to pathogens is favored.¹ Ignaz Philipp Semmelweis (1847) carried out observations of the frequency of cases of puerperal infections where epidemiological measurements showed that nosocomial infections are a major clinical and epidemiological problem.² Subsequently Louis Pasteur discovered that microorganisms in organic matter appeared from air pollution phenomena. The microorganisms in the air are accidental pollutants and air is not a microbial habitat, however this may transport pathogenic bacteria.³

CDC Centers for Disease Control and Prevention made recommendations for the control of nosocomial infections by monitoring hospital environments; they suggest the isolates from patients with use of negative and positive pressure, and air changes with the use of high efficiency filters, HEPA.⁴ In Mexico, the Ministry of Health created the Mexican Official Norm 045 SSA2 2005 for the prevention and control of nosocomial infections, which takes up the isolation of patients suggested by the CDC, but makes no mention of the microbial air monitoring units hospital.^{5,15,16} Airborne transmission is performed by bioaerosols which are airborne particles, including bacteria, viruses and fungi; their presences in air are a result of the dispersion of a site of

colonization or growth and sometimes originate from living organisms. These particles have an indirect effect on respiratory apparatus,⁷ patients with immunological immaturity as infants are the most susceptible.⁶ Particles smaller than 10 microns have an indirect effect on the respiratory system, for microbiological agents adsorbed on the surface and transported to the lung. The health hazard is the concentration, exposure time and their physical characteristics quintessential susceptible individuals are those who are carriers of a chronic respiratory disease that has led mainly to damage the mucociliary system.⁷ Air borne transmission refers to that which occurs at a distance of several meters from the source (infected patient) and the new host. Together, agent host transmission mechanism and represent the links of the chain of infection, the modification of these links can cut the string and consequently nosocomial infections.⁸

The environment health units are rare time involved in the transmission of the disease, except in patients who are immunosuppressed. However, accidental exposures to environmental pathogens (eg, *Aspergillus* spp. *Legionella* spp) or airborne pathogens (eg, *Mycobacterium tuberculosis* and *Varicella-zoster*) may result in nosocomial infections and cause disease in health workers. Strategies for Environmental Infection Control and engineering controls can effectively prevent these infections.⁹ It has been shown that a concentration of 1x10³ negative bacteria/m³ in the environment, cause mucosal inflammatory effects, which represents a concentration of 0.1 mg/m³ of endotoxin.¹⁰⁻¹⁴ Achieving lower health risks is essential to break the chain of

infection, which is why the World Health Organization (WHO) has implemented worldwide multiple programs from safe surgery, strengthening clinical hand washing, control of the hospital environment, where instead of finding guilty people it is necessary to find solutions, analyzing each case of error in health care.¹¹ A surveillance of nosocomial infections should be conducted through environmental epidemiological surveillance methodology and research and monitoring standardized allowing enforcement of sanitary measures.¹¹⁻¹⁴

MATERIAL AND METHODS

A comprehensive analysis of the topic in journals and information sources as CossRef, Thomson Reuters and PubMed, indexed and Official Mexican Standards in order to identify current perspectives in environmental monitoring for the control of nosocomial infections for information search were conducted using keywords such as environmental monitoring, nosocomial infections and microbiological level. Each article was critically analyzed and subsequently these articles were validated in sources of information in order to improve the quality of the literature review.

RESULTS

A review of 26 articles was conducted to understand current perspectives in environmental monitoring of hospital-acquired infections, of which 34 % were discarded because there was no bibliographic validation in databases such as CossRef, Thomson Reuters and PubMed, and at the same time did not focus on environmental monitoring for the prevention of nosocomial infections which is the main objective in this study. In order to validate the literature in some databases the following results were found: 47 % of the data was validated through Pub Med and only 6 % by Thomson Reuters, the rest of the literature is based on manuals and Mexican Official Standards for prevention and control of nosocomial infections. Thus, it is essential to publish the overview of the situation in the prevention of nosocomial infections in Mexico. Among the findings detected Solar-Pérez (1966) mentions that airborne microorganisms are accidental pollutant and air is not a microbial habitat, however air can transport pathogenic bacteria. The Mexican Official Norm 025 1993 Environmental Health SSA1 refers that particles smaller than 10 microns have an indirect effect on the respiratory system, patients with immunological immaturity as infants are the most susceptible.⁸ Analysis of air into hospital units found agents that can cause nosocomial infections such as *Acinetobacter baumannii*, *Citrobacter freundii*, and *Klebsiella*, which are resistant to multiple drugs, and can cause urinary tract infections, wound infections, sepsis, meningitis, infections of skin and soft tissues.¹ CDC Centers for Disease Control and Prevention have made recommendations for the control of nosocomial infections by monitoring hospital environment. They suggest the isolation of patients by using negative and positive pressure and air changes with the use of high efficiency filters, HEPA.

DISCUSSION

Moreover, microbiological monitoring of air quality in hospital units is not found or is rarely identified and it depends on several factors such as coordinating actions along with the State Public Health Laboratories (LESP) and the management of financial resources for its implementation. As mentioned by Ruvalcaba *et al.*, 2013¹¹ in a study conducted in

a tertiary hospital unit "surveillance of nosocomial infections should be performed through environmental microbiological monitoring, methodology and research, with standardized monitoring allowing execution of sanitary-hygienic measures". In order to consider the environmental quality, bio sprays can contain particles between 0.5-30 μm diameter, the concentration of microorganisms located in bioaerosols varies depending on the dissipation and deposition, they are associated with particles depending of the size, density, humidity and temperature; when they are extreme they intervene as environmental factors and favor the variety of microorganisms, fungus, bacteria, virus, amoeba cysts among other agents.^{11,13,20} During their transportation, microorganisms get stressed and die, but the ones that survive generate adverse damages in human health; the agents get installed in the human body through exposition mechanisms and entrances as indigestion, inhalation and contact through the skin, are the main roots of exposition for the human.^{11,13,14,17-20} Human beings inhale approximately 10 m³ of air per day and can give room in their alveoli for particles of 1 to 2 μm diameter; as a result of this they will present adverse health status, such as, severe infections, asthma, hypersensitiveness, pneumonia and other associated with the exposition to bioaerosols,^{19,21} as Ruvalcaba and Cortés (2013) state in their proposal "The proposal to reduce the impact of nosocomial infections". The proposal is to conduct research projects from the epidemiology point of view starting from a longitudinal descriptive study, which through sampling of air in cultivating boxes added with TSA Trypticase soy agar, which will be exposed for 15 minutes in an open box, Surveillance of the environmental aero microbiological quality, standardizing sampling methods, as well as proposing sampling of the air of the hospital rooms by means of a sampler that simulates the functioning of the respiratory system of humans denominated as sampler Andersen (MA) and in another sampler of air, as the air sampler known as IDEAL TM, in order to analyze the collected information concerning nosocomial infections, microbial viability, invasive treatments, whose characteristics are related to the etiologic agent: the microbial recovery, frequency of nosocomial infection, as well as etiological agent and resistance and sensitiveness to antimicrobial, resistance profiles to heavy metals, as well as diagnosing the personnel's health and the incidence of respiratory infections. It is fundamental to execute the environmental epidemiology in all the hospitals, obviously in order to provide the best quality of inter hospital attention; thus, reduce the experience of suffering a nosocomial infections. Every hospital requires the intervention of a Division or Department of Epidemiology, not only clinical epidemiology but environmental inter hospital epidemiology. Inter hospital environmental epidemiological surveillance intervenes in diminishing the nosocomial infections. It implies and means that epidemiological surveillance requires taking samples and conducting environmental monitoring to describe and identify the risks of inter hospital aerosols.²⁰ Nowadays, there have been other microbiological samplers which would have to be considered for environmental epidemiological surveillance and standardization of sampling methods. The presence of epidemiological emergencies such as influenza or SARS created the need for updating regulations to allow constant monitoring of inpatient air quality and thus face new threats to the health of nations.

CONCLUSION

Environmental monitoring for infection control is essential to reduce the transmission of airway infections; currently the use of evidence-based medicine emphasizes the need for research regarding inpatient air quality in order to reduce pillar health risks for patients. The international literature has shown well supported studies on the existence of nosocomial pathogens in the air. In Mexico, there are few reports of the microbiological quality of air in hospital units because the Mexican Official Standards for the prevention of nosocomial infections have no established standards for evaluating these risks.

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