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ANALYSIS OF ENVIRONMENTAL SANITATION FACTORS AFFECTING NOSOCOMIAL INFECTIONS INCIDENCE IN HOSPITALS: LITERATURE REVIEW

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ABSTRACT

Hospital environmental sanitation is an attempt to control various physical, chemical and biological environmental factors in the hospital that inflict or may cause adverse effects. Poor sanitation in the hospital can cause negative impacts, one of them is nosocomial infection. This article was written by using literature studies and looked for databases from Scienceirect, Google Schoolar and other related journals from 2011 to 2021 with keyword syntax for each database. 6 articles eere reviewed in this article. The results of the literature study showed that poor environmental sanitation in the hospital was not in accordance with the standards could affect the incidence of nosocomial infections in the hospital. Evidence from the review resulted in a theme : Environmental Sanitation Affecting the Incidence of Nosocomial Infections in the Hospital. The following subtheme came from this main theme: biological aspects, physical aspects, chemical aspects and the impact of sanitation mismanagement from these various aspects. Poor control, supervision and governance related to sanitation of the hospital environment will increase nosocomial infections.

Index Terms- Hospital environmental sanitation, impact, nosocomial infection.

I. INTRODUCTION

The environment is one of the variables that often gets particular concern when assessing the health condition of the community (Theodora, 2014). Construction of houses and environments that is not accordance with the health requirements become a risk factor for the various types of diseases transmission, especially environmentally based diseases.[1] Hospital environment is a public place with its parts can be a breeding ground for vectors. Considering the hospital as a health service facility and a gathering place for sick and healthy people, the hospital environment must be vector free so that there is no contact between humans and vectors or food and vectors so that nosocomial infectious diseases which are transmitted by vector can be suppressed as low as possible and the people can not be infected by other vector-borne diseases.[2]

Hospital (in Bahasa shorted as RS) as a health service facility, a gathering place for both sick and healthy people, also become a place for disease transmission and the environmental pollution and health problems may be happened.[3] The interaction of various components in a hospital, such as buildings, equipment, people (staff, patients and visitors) and health service activities, can have a good or bad impact. On the other hand, the existence of a hospital can give a negative impact in the form of bad effects on humans, such as its garbage and waste which can cause environmental pollution, a source of disease transmission. Therefore, to anticipate the negative impacts of this health service institution, the concept of environmental sanitation was formulated with the purpose of controlling the factors which can be dangerous to human health.[4] According to JCI, 2011 Hospital sanitation is one of the ways to prevent nosocomial infection spreading by breaking the chain from various sources in the hospital environment.

According to WHO, hospital sanitation is an attempt to control all factors of the human physical environment that may cause some things harmful for physical, health development and human survival. Poor sanitation of the hospital environment can cause disease. Poor waste

management will give rise to various problems, one of which is nosocomial infection.[5] The quality of hospital services can be measured by one of the nosocomial infections incidence indicators.[6] Nosocomial infection is an infection that occurs in a hospital, where the patient did not previously suffer from infection and was not in the incubation period of the infection.[7] People who receive health services, health workers and visitors to the hospital are faced with the risk of infection or nosocomial infection, it is about about 20% due to treatment or visit to hospital. According to the Infection Prevention and Control team at the Hospital[8], the hospitals Control of infections requires environmental health efforts that play an important role in supporting the success of public health development. In accordance with *the provisions of Law Number 36 Year 2009 concerns about Health* stated that environmental health efforts are aimed to create a healthy environmental quality, physically, chemically, biologically, and socially, allow everyone to gain the highest degree of health. This is strengthened through the regulation as stated in Government Regulation Number 66 of 2014 concerns about Environmental Health, which is the main reference in the environmental health implementation in various activities throughout Indonesia. Environmental health efforts are efforts to prevent diseases and / or health problems from environmental risk factors in order to create a healthy environmental quality in the terms of physical, chemical, biological, and social aspects. The implementation of environmental health is carried out through efforts to make health, safeguarding and controlling, which are established on occupancy environments, workplaces, recreation areas, as well as public places and facilities. One of these public places and facilities is a hospital. In carrying out its function, the hospital uses various materials and facilities or equipment that may contain hazardous and toxic materials. Hospital interactions with humans and the environment in the hospital can cause environmental health problems which are indicated by indicators of decreasing environmental health media quality in the hospital, such as water, air, food, facilities, and buildings as well as vectors and animals carrying disease. As a result, the quality of the hospital environment was not in accordance with the environmental health quality standards and health requirements that have been determined. Sanitation of the home environment is one of the important components in creating a good healthy environment to reduce the chain of disease transmission.[9]

Based on the description above, the purpose of this paper was to study and analyze environmental sanitation factors that affect the incidence of nosocomial infections in hospitals. This article was a literature review of various research journal literatures. This article was compiled because the authors wanted to make a comprehensive review to develop informed knowledge from previous studies on environmental sanitation factors that influence the incidence of nosocomial infections in hospitals. According to the author's point of view, the topic needs to be compiled because of the lack of articles that showed further and more comprehensive review related to the topic.

II. IDENTIFY, RESEARCH AND COLLECT IDEA

This article was a systematic literature review study used the PRISMA statement. The PRISMA statement helps ensure clarity and transparency of systematic review reporting. The method of analysis and inclusion criteria in this study were determined. Literature sources were reviewed when they met the following criteria: the maximum year of the source is 10 years, published in English and Indonesian, the abstract and article are openly accessible. This inclusion criteria allowed the study to measure only those variables related to Environmental Sanitation that gave impact to the incidence of nosocomial infections in the hospital. Articles were excluded if the reportage and literature were unclear. The searching strategy was carried out by 5 reviewers independently by doing electronic databases searching: Google Scholar and Science direct. Investigation was carried out by using the following terms: "Hospital sanitation", "Hospital sanitation problems", "Hospital Environmental Conditions", "Hospital Environmental Sanitation Impacts", "Hospital Sanitation Condition Factors" were used to obtain relevant articles.

2.1. Defines the hospital sanitation concept

According to JCI in 2011 Hospital sanitation is a way to prevent the nosocomial infection spreading by breaking the chain from various sources in the hospital environment, breaking the chain of disease transmission include complex activities and require requirements to be able to support the establishment of healthy hospital environmental, while according to WHO, environmental sanitation is an effort to control all factors of the human physical environment that may cause negative impacts for physical, health, and human survival development. Hospital sanitation environment is an effort to control various physical, chemical and biological environmental factors in the hospital that cause or may have a negative impact on the health of staff, patients and visitors as well as the community around the hospital, the impact or problem of hospital sanitation needs attention because of the hospital role in performing health services for the community.

Hospital environmental sanitation is an effort to control various physical, chemical and biological environmental factors in the hospital that cause or may have a negative impact on the health of staff, patients and visitors as well as the community around the hospital, the impact or problem of hospital sanitation needs attention because seeing the large role of hospitals in public health services and sanitation as a way to prevent the nosocomial infection spreading.

3. Data extraction

Data collection for systematic review was carried out by extracting data from relevant research studies as the sample study. The researcher could determine which data was the most important in answering the review questions. The author selected the study articles that have been found which were described in the prism of the flowchart. The extraction element which was the basis of the analysis of the study included characteristics such as: the purpose of the study, study about the design of data collection methods and instruments which were used for data collection and the results. Articles with unclear designs were excluded from the review.

Table 1: The summaries of the journals that used in this literature review.

NNo	Title	Authors	Methods	Results
11	The number of germs in the inpatient rooms of Dr. M. Haulussy Ambo Regional Public hospital, Maluku Province	1.Tina Amnah Ningsih 2. Susi Iravati 3. Titik Nuryastuti	Observational	Temperature has a significant correlation with the number of germs in the morning air. Lighting had a significant correlation with the number of germs in the air in the afternoon and during the day
22	Physical Environment and Room Air Germ Numbers at Haji General Hospital in Makassar, South Sulawesi	1. M. Tahir Abdullah 2. Buraerah Abdul Hakim	Cross sectional	Based on 4 physical environmental factors, only humidity contributed directly to the germ number, while lighting, temperature, and occupancy density did not have a direct contribution to the germ count.
33	Description of Biological Contaminant Risk Factors in Environmental Test at "Y" General Hospital Surabaya	1. mochamad rizal maulana 2. khuliyah chandraning Diyanah' 3. Fransisca susilastuti	Cross Sectional	Pollution occured in all environmental biological tests of the Y hospital in Surabaya. Room air quality was in poor condition, especially in high risk zones. Microbiological quality of food / beverage and eating / drinking utensils were not in accordance with the requirements. The microbiological quality of medical devices, linens, AC swabs and clean water were not in accordance with the requirements. Only the microbiological quality of the wall and floor swabs were in good condition and meet the requirements. It is necessary to carry out a comprehensive evaluation to improve the quality of microbiology in environmental contaminant tests at Y hospital Surabaya, especially in high risk areas such as operating rooms and ICUs. The quality of clean water also needs to be improved by thoroughly disinfecting the plumbing using the backwash method or other effective methods.
4.4	The Effect of Alcohol Swab Use on the Level of Laryngoscope Blade Bacterial Contamination in the Central Operating Room of Dr. Saiful Anwar Hospital	1. Buyung Hartiyo Laksono 2. Isngadi 3. Muhammad Rizqan Khalidi	Experimental	The highly disinfected laryngoscope blade was still contaminated with bacteria. Alcohol swab 70% can be used to maximize the disinfection process of the laryngoscope by reducing the level of bacterial contamination.
5	Analysis of Sustainable Solid Medical Waste Management System at Raden Mattaher General Hospital of Jambi	Zuhriyani	Qualitative descriptive	Storage of solid medical waste for infectious waste in TPS LB3 for more than 24 hours, has the risk of becoming a link in the chain of disease transmission in the hospital environment. Collection and transportation, for washing waste containers and troly had not used disinfectants. The behavior of officers involved in solid medical waste management, the Asymp.Sig value was 0.06
66	The Effectiveness of Hospital Medical Waste Management on Environmental Impact	Anggreany Haryani Putri	Descriptive	Most of the hospital medical waste management was still below environmental standards because it was generally disposed of in an open dumping system or dumped elsewhere. If waste management was not carried out in a sanitary manner, it would cause disruption to the community around the hospital and medical waste users.

III. FINDINGS

This review showed that environmental sanitation in the hospital that was not in accordance with the standards would give impact to the nosocomial infections incidence in the hospital. Evidence from the review resulted in a theme : Environmental Sanitation Affecting the Incidence of Nosocomial Infections in the Hospital. The following subtheme came from this main theme: biological aspects, physical aspects, chemical aspects and the impact of mismanagement of sanitation from these various aspects.

IV. DISCUSSION

The environment is one of the variables that often gets special attention in assessing the health condition of the community.[10] Construction of houses and environments that do not meet health requirements is a risk factor for the transmission of various types of diseases, especially environmentally based diseases.[1] Hospital (RS) is a health service facility, a gathering place for both sick and healthy people, the hospital can also be a place for disease transmission and allows environmental pollution and health problems.[11] The interaction of various components in a hospital, such as buildings, equipment, people (staff, patients and visitors) and health service activities, can have a good or bad impact. On the other hand, the existence of a hospital can have a negative impact in the form of bad effects on humans, such as garbage and hospital waste which can cause environmental pollution, a source of disease transmission. Therefore, to anticipate the unwanted negative impacts of these health care institutions, the concept of environmental sanitation is formulated which aims to control the factors that can endanger human health. According to WHO, environmental sanitation (environmental sanitation) is an effort to control all factors of the human physical environment that may cause or can cause detrimental things for physical development, health, and human survival. Environment Hospital sanitation is an effort to control various physical, chemical and biological environmental factors in the hospital that cause or may cause adverse effects.

Physical Environment

Based on several studies that described the physical environment conditions for nosocomial infections in hospitals, where the percentage of the physical environment quality that did not meet the requirements was proportional to the increase in the germ numbers percentage, which showed that the higher the proportion of environmental quality that was not in accordance to the requirements, the higher the germs number that did not meet requirements. The biggest contribution of physical environmental factors to germ numbers was the density of the occupancy, followed by humidity, lighting, and room temperature.[12] The results of this study indicated that humidity is the largest physical environmental factor that is directly responsible for the presence of germs in the ward. Other physical environmental factors (lighting, temperature, and occupancy density) were not directly correlated with germ numbers but are related to humidity. Occupancy density affects temperature with a value of $p = 0.000$. Theoretically, temperature can affect humidity. So, indirectly the temperature and occupancy density also affect the number of germs.[12] This is in line with further research conducted by Tina, et al. (2016). The results showed that the number of germs on the floor in the afternoon has a significant positive correlation with lighting, this was because sunlight may kill microbes by its ultra violet content (295 to 400 nm).

The number of germs was influenced by the condition of the hospital building. Poor room sanitation, poor circulation, and unqualified building construction tend to be factors for the germs growth in the air. Although the presence of microbes in the air is actually only temporary, not as a natural habitat because air does not contain important nutritional components for bacteria. Microbes in the air may be carried by dust, dry water vapor droplets, or blown by wind.[13]

Biological Environment

The hospital has a very high level of bacterial contamination, so the level of control is regulated in the Republic of Indonesia Minister of Health Decree No. 1204 of 2014. in addition to high contamination. This control is also targeted for several other microorganisms such as spores on clean linen and control of clean water contamination.

In a research conducted by Mochamad rizal maulana in 2020 which raised the topic of bacterial contamination at the "Y" general hospital in Surabaya by doing swabs in several places, namely: food and drinks and the equipment used, then besides medical devices, air conditioning, clean water as well as walls and floors from the Administration, Pharmacy, Forensic, CSSD, Nutrition, HD, ICCU, Isolation, IGD, Laboratory, NICU, Operation units. From this swab, the result is that in addition to swabs that are carried out on the walls and floors, the results are still less than the requirements determined by the Ministry of Health. so that it needs to be improved in controlling the level of contamination. this also indicates that other hospitals need to also pay attention to the level of contamination from micro-organisms and exercise proper control.

In addition, there was also a study conducted by Dr. Buyung Hartino Laksono, Sp An, KNA in 2020 which raised the topic of the Effect of Alcohol Swab Use on the Level of Laryngoscope Blade Bacterial Contamination in the Central Operating Room of Dr. Saiful Anwar Hospital. In this study, it was found that there was a significant difference in the amount of bacterial contamination in the use of alcohol swabs to the number of bacterial colonies in the laryngoscope blade that had high-level disinfection. in this study, the cause of the significant difference is due to inadequate disinfection process and less sterile storage process. In addition to

improving the contamination control process, the hospital must also establish good SOPs for the disinfection process for equipment and storage so that contamination can be suppressed.

Chemical Environment

To protect the hospital environment from all existing hazards, it is necessary to have arrangement, management and supervision related to hospital waste, one of which is chemical waste. Chemical waste is generated from the use of chemicals in medical, vetenary, laboratory, sterilization processes and research. Chemical waste also includes pharmaceutical waste and cytotoxic waste.[14] Chemical wastes are dangerous and harmless. They are called dangerous if they have toxic, corrosive, flammable, reactive, and genotoxic properties. In addition, chemical waste can also come from chemicals from cases of infectious diseases.

Hospital waste is considered as a link in the chain of spreading infectious diseases, it can be a place for disease organisms to accumulate and become a nest for insects as well as rats. In addition, hospital waste also contains various toxic chemicals and sharp objects that can cause health problems and injuries.[15]

There are also other types of chemical waste, such as waste with heavy metal content. This waste is included in the sub-category of hazardous chemical waste and is usually toxic, such as mercury waste from leaks of damaged medical equipment, for example thermometers, blood pressure measuring devices, and so on. Therefore, one of the efforts to reduce waste at the source is to replace the mercury thermometer into a digital thermometer used in the lab. This is done by the hospital to avoid the use of B3 waste in accordance with the Minister of Environment and Forestry Regulation No.56 of 2015, namely that the health service center is responsible for the various waste produced. In addition, the pharmaceutical company also contributes to monitoring the distribution of chemicals and pharmaceuticals.

This is carried out in hospitals to monitor the flow of chemicals up to their disposal as B3 waste so that B3 waste does not occur in accordance with the Minister of Environment and Forestry Regulation No. 56 of 2015. This activity is carried out because careful management can prevent the buildup of expired chemicals or pharmaceuticals.

Impact

Hospital environmental sanitation standards consist of various aspects, such as biology, physical and chemical. An environment that is not in accordance with these standards will have an impact that is not good for health. The quality of clean water that does not meet the requirements can cause diseases such as cholera and typhoid due to microbiological pollution, especially fecal bacteria, which is a common symptom that occurs in many water sources. As an illustration, in developing countries, deaths due to diarrhea including cholera in 2002 reached 1.8 million and 90% of them occurred in infants and toddlers. As many as 88% of cases of diarrhea were related to unsafe water, hygiene and sanitation that did not meet health requirements.[16]

Another impact if it does not meet the requirements can trigger the emergence of bacteria, germs or viruses that can grow so that it can cause nosocomial infections which lead to the possibility of endemic or epidemic infections. For example, out of 285 types of infections at the Jakarta Special Hospital for Infectious Diseases, urinary tract nosocomial infections were in the top rank (15.9%), followed by bacteremia (10.8%), lower respiratory tract (4.7%), digestive tract (2.6%), skin (2.4%), oral mucous membranes (1.4%), and upper respiratory tract (0.6%).[10]

Other studies on nosocomial infectious diseases in hospitals in the United States, England, and Kuwait found types of germs (bacteria) such as Escherichia coli, Klebsiella spp, Pseudomonas spp, Enterobacter spp, Proteus spp, Streptococcus spp, Acinetobacter spp, Citrobacter spp, and Staphylococcus epidermis. These microbes can cause urinary tract nosocomial infections (INSK). Another hospital study in the United States found germs that cause common lower respiratory tract nosocomial infections (INSNB), such as Klebsiella sp, Staphylococcus aureus, Pseudomonasa aeruginosa, E. coli, Enterobacter sp, Streptococcus pneumonia, anaerobic oral flora, Haemophilus influenza, Legionella sp, and Aspergillus viruses.[17]

V. CONCLUSION

Hospital environmental sanitation standards consist of various aspects, such as physical, biological, and chemical. Errors in control, supervision and poor governance from these various aspects can lead to the emergence of bacteria, germs or viruses that can grow, and finally they can cause nosocomial infections.

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