

Analysis of Physical Environmental Quality on Number Germ Air in the Care Room, Hospital of Bhayangkara H.S. Samsoreri Mertojoso Surabaya

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Abstract-The physical environment quality in the hospital especially in the care room, such as ventilation, lighting, temperature and humidity have an important role to the presence of number germ air. The purpose of this study was to analyze the influence of the physical environment on number germ air in the care room, Hospital of Bhayangkara H.S. Samsoreri Mertojoso Surabaya. Type of research is an analytic observational study with cross sectional design. The population is all the care room, Hospital of Bhayangkara H.S. Samsoreri Mertojoso Surabaya with a sample size of 24 care rooms with simple random sample. The independent variable was the physical environment (ventilation, lighting, temperature and humidity) and the dependent variable is the number germ air. The results showed that the quality of the physical environment that includes ventilation, lighting, temperature and humidity largely not meet health requirements in accordance with Health Minister Decree Number 1204/HealthMinister/SK/X/2004. Based on the results of multiple linear regression showed physical environment that influence the number germ air in care room, Hospital of Bhayangkara H.S. Samsoreri Mertojoso Surabaya include temperature ($p = 0.001$) and humidity ($p = 0.033$). The conclusion is that temperature and humidity have a very important role to the existence number germ air in the care room. Necessary monitoring physical environmental conditions the care room with a good arrangement of the room, controlling the use of air conditioning and the provision of exhaust fans in every room so that the air conditions meet the health requirement

Index Terms: Number Germ, Physical Environment, Hospital

1. INTRODUCTION

Hospital as a health care facility, a gathering place for sick people or healthy people, can be a place of disease transmission and allow the environmental pollution and health problems. People who receive health services, health workers and visitors in hospitals faced with the risk of nosocomial infections, is infections acquired in hospital, either for treatment or to come to the hospital^[1].

The care room in hospital is a place that has a high risk of the transmission of the disease because of several factors including the patient's own normal flora, linens, bedding, clothing employees, visitors and plants. In addition, patient activities such as sneezing, coughing, talking and yawning as well as the number of patients per room is also a source of hospital infections. When the air quality is not maintained then the indoor air will be a means of transmission of the disease is closely related to the respiratory tract^[2].

According Pelczar of microorganisms that contaminate the air is also determined by the source of pollution in the environment, for example, of the human respiratory tract that is sprayed through coughing, sneezing, and dust particles^[3]. Organisms that enters the air can be transported several meters or several kilometers partly soon die within a few seconds, while others can survive. From some who

survive there in the air, some have fallen and are on the floor, causing micro-organisms on the floor more.

The mechanism of transmission of microorganisms potentially cause nosocomial infection that led to the possibility of infection is endemic or epidemic. For example, of the 285 types of infections in Special Hospital of Infectious Diseases Jakarta, nosocomial urinary tract infections top the list (15.9%), followed by bacteremia (10.8%), lower respiratory tract (4.7%), gastrointestinal tract (2.6%), skin (2.4%), mucous membranes of the mouth (1.4%), and upper respiratory tract (0.6%)^[4].

Sanitary room in the infirmary should receive special attention, so as not to endanger the health of others and meet health requirements based Health Minister Decree Number 1204 in 2004 about Hospital Healthy Environment Regulation. To prevent transmission of the disease, the Health Ministry requires that the air inside the patient room should be free of pathogens with the total number of germs no more than 500 colonies/m³ of air^[5].

In Hospital of Bhayangkara H.S. Samsoreri Mertojoso Surabaya, the number of patients hospitalized in the last 3 years increased from 3,700 people in 2013 to 3,962 people in 2014 and 4,052 people in 2015. In line with the increasing number of patients, the frequency of use of beds in a given period Bed Occupancy Rate (BOR) fluctuated from 37.11 %

in 2013 to 39.14% in 2014 and 52.9% in 2015. The number of patients is increasing and the ratio of the number of patients on the floor area of the room that did not meet health requirements can degrade air quality inpatient ward. Results of a preliminary study indoor air quality checks in the care room Teratai in March 2016 the total number of germs was 480 CPU/m³. Although the number of germs are still eligible does not mean it can be stated safely, because its value is almost approaching the limits of the terms are allowed. Based Health Minister Decree Number 1204 in 2004 number of bacteria that are allowed between 200-500 m³ CPU. Air condition with a high number germ air if not kept clean to be dangerous and certainly can at any time become ineligible (number of bacteria exceeded the limit requirement). For that it is necessary to monitor air quality regularly to the hospital to be safe, comfortable and healthy.

The care room in the hospital is a place that has a high risk of the transmission of the disease because of the many staff and visitors on activity there. If the air quality is not maintained then the indoor air will be a means of transmission of the disease is closely related to the respiratory tract. Besides inpatient unit serves as a second home for patients who are undergoing a period of recovery so it is important to note sanitation compared to other facilities in hospitals are also a source of nosocomial infections. The officers both nurses and janitors also very instrumental for maintaining sanitation in the care room. Therefore, sanitary room in the infirmary should receive special attention so as not to endanger the health of others and meet health requirements based Health Minister Decree Number 1204 in 2004 about Requirements for Environmental Health.

2. MEASUREMENTS

Type of research including analytic observational research with cross sectional approach. The population of this research is all the care room at Police Hospitals H.S. Samssoeri Mertojoso Surabaya number of 25 rooms. The sample size was calculated formula selected Slovin 24 care rooms. The sampling technique respondents in this study using a simple randomize sampling is a sample of a number of randomly selected elements. Sampling the physical environment and the number germ air carried by BBTKLPP team of Surabaya.

The independent variables in this study is the physical environment (ventilation, lighting, temperature and humidity) and the dependent variable is the number germ air. Measurement ventilation using meter, lighting using a lux meter and the temperature and humidity using a thermohygrometer. Analysis of data using multiple linear regression to see the influence of the physical environment (ventilation, lighting, temperature and humidity) of the germ air in

the care room, Hospital of Bhayangkara H.S. Samssoeri Mertojoso Surabaya.

3. RESULTS

The maximum concentration of microorganisms per m³ of air in the care room, Hospital of Bhayangkara H.S. Samssoeri Mertojoso Surabaya are as follows:

Table 1. Distribution of Number Germ Air in the Care Room, of Bhayangkara H.S. Samssoeri Mertojoso Surabaya in 2016

Number Germ	Frequency	%
Meet Requirement (200-500CPU/m ³)	19	79.2
Not Meet Requirement (> 500CPU/m ³)	5	20.8
Total	24	100.0

According to the table 1 obtained number germ air in the care room is still in the category qualify as many as 19 rooms (79.2%) as well as 5 rooms (20.8%) do not qualify. Value of microorganisms in the air are allowed in the room by Health Minister Decree Number 1204 in 2004 is an index of 200-500 CPU/m³. The measurement results of the physical environment in the treatment room by ventilation, lighting, temperature and humidity are presented in Table 2.

Based on Table 2 shows that the ventilation, lighting and temperature of the majority does not meet health requirements hospital environment by Health Minister Decree Number 1204 in 2004 so as to increase the number germ air in the care room. This mutual influence, where ventilation has a function as an air exchange as well as the entry of sunlight in the room as well as the influence of temperature and moisture in the room in addition to the use of air conditioning in the room. To see how much influence some of the physical environment variable to the number germ air in the care room, Hospital of Bhayangkara H.S. Samssoeri Mertojoso Surabaya performed multiple linear regression with the results as shown in Table 3.

Table 2. Characteristics of Physical Environment (ventilation, lighting, temperature and humidity) based on the Numbers Germ Air in the Care Room, Hospital of Bhayangkara H.S. Samsoreri Mertojoso Surabaya in 2016

Physical Environment	Number Germ				Total	
	Meet Requirement (200-500CPU/m ³)		Not Meet Requirement (>500CPU/m)			
	n	%	n	%	n	%
Ventilation						
Meet Requirement (≥15% floor area)	0	0.0	1	100	1	100
Not Meet Requirement (<15% floor area)	19	82.6	4	17.4	23	100
Lighting						
Meet Requirement (100-200 lux)	8	80	2	20	10	100
Not Meet Requirement (≤100 or ≥200 lux)	11	78.6	3	21.4	14	100
Temperature						
Meet Requirement (24°C-26°C)	2	100	0	0.0	2	100
Not Meet Requirement (≤24°C or ≥26°C)	17	77.3	5	22.7	22	100
Humidity						
Meet Requirement (45-60%)	13	100	0	0,0	13	100
Not Meet Requirement (≤45% or ≥60%)	6	54.5	5	45.5	11	100

Table 3 shows that the lighting, temperature and humidity affect the existence number germ air in the care room, Hospital of Bhayangkara H.S. Samsoreri Mertojoso Surabaya with p= 0.001 and 0.033 where p <0.05. B is positive value indicates that the higher the temperature and humidity of the room will increase the rate of growth of number germ air in the care room.

Table 3. Analysis of Physical Environment on Improvement Number Germ Air in the Care Room, Hospital of Bhayangkara H.S. Samsoreri Mertojoso Surabaya in 2016

Variable	Number Germ	
	B	p-value
Ventilation	0.056	0.730
Lighting	-0.247	0.070
Temperature	0.570	0.001
Humidity	0.289	0.033

4. DISCUSSION

Indoor air treatment using Air Conditioners and humidity must be considered and adapted to the area of the room. Air Conditioners also can be a source of infection that can spread throughout the room. Microorganisms size <5 µm can be spread throughout the room via the flow Air Conditioners pipes. Filter on the air conditioner should be replaced or cleaned often carefully without causing the source of infection. A healthy environment can be achieved by minimizing the risk of contamination through proper filtration and air distribution scheme^[6].

The temperature in the care room is not eligible in accordance with Health Minister Decree Number 1204/HealthMinister/SK/X/2004, at least 24°C-26°C. The air temperature in the room tend to be hot, even though it is installed appliance Air Conditioners but the temperature was still not make it comfortable, it could be due to lack of ventilation and air circulation is not good, other than that the number of patients or residents in the room also affects the temperature of the room, smoking in indoor air temperatures also cause exposure to cigarette smoke and the air becomes hot. Despite widespread health problems caused by microorganisms in the environment of space is difficult to be checked, but it is known that the greatest influence on health is due to the spread of microorganisms^[7].

A study showed that increasing the air flow patterns will reduce the deposition of particles on the surface including germ, but the rate of air exchange in a certain amount of impact on increasing the deposition of germ colonies (especially on the upper surface), if the air velocity exceeds the speed increase is a source of microorganisms tertentu. Dust in the air because it contains a number of microbes that can be attached to surgical tools, the surface of the skin, as well as around the room nurse^[8].

The optimal temperature for growth for microorganisms vary greatly depending on the type of microorganism itself. At the right temperature (optimum) a cell can reproduce itself and grow very fast. Whereas at lower temperatures or higher, they

can reproduce themselves, but in small quantities and not as fast when compared to growth at optimum temperature. Bacteria usually require very high humidity.

The study stated that the lighting, temperature, and density of occupancy contribute indirectly to the numbers of germs through the air humidity^[9]. Humidity interconnected with the temperature, the lower temperature is proportional to moisture. Humidity significantly to the total number germs air in the care room, β is positive value indicates that the low moisture levels can be the media in the growth of germ air (the infirmary).

Natural lighting from the sun in addition to spreading the heat rays to the earth, also emit ultraviolet rays of deadly microbes^[10]. Lack of light coming into the room, especially natural light as well as causing less comfortable sun is also a place or a good medium for living and breeding disease.

Humidity in the care room enough to qualify 45-60% according Health Minister Decree Number 1204/HealthMinister/SK/X/2004. Humidity on each isolation room should be pursued qualify, the humidity in the room operating room that is 45-60% air pressure must positif. Air excessive moisture can cause mildew and spora. Air that is too dry causes dryness of the mucosal lining and is predisposing respiratory tract infections.

5. CONCLUSION

Factors of physical environmental such as temperature and humidity affect the existence number germ air in the care room, Hospital of Bhayangkara H.S. Samsaeri Mertojoso Surabaya. While the ventilation and lighting does not affect the number germ air in the care room, Hospital of Bhayangkara H.S. Samsaeri Mertojoso Surabaya. Physical environmental factors such as lighting, temperature and humidity in the care room, Hospital of Bhayangkara H.S. Samsaeri Mertojoso Surabaya most have not qualified according to the requirements of the environmental health of the hospital which is set out in Health Minister Decree Number 1204 in 2004. Monitoring the temperature of the air in the room need to be considered. The use of Air Conditioners and the exhaust fan needs to be provided in the room. It can regulate the temperature in the room that qualifies proper room temperature.

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