Relation between temperature and wards humidity with air germs number in inpatient unit of RS PKU Muhammadiyah Jogjakarta

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Original Article

ABSTRACT

Background: The prevalence of nosocomial infections in Yogyakarta is quiet high, which is around 5,9%. Hospitalize patients are more prone to nosocomial infections. One of the non medical factor of nosocomial infections is environmental factor, such as temperatures and humidity, which enhance bacterial growth.

Objective: The purpose of this study is to determine the correlation between temperature and wards humidity with air germs number in inpatients unit class I, II, and III of RS PKU Muhammadiyah Jogjakarta .

Methods: This study was conducted as analitical study, in which laboratory tests and cross sectional approach was used. The sampling technique used was saturated sampling. The samples were 30 wards in inpatient unit of RS PKU Muhammadiyah Jogjakarta. VIP wards were excluded. Data were analyzed by chi-square test.

Results: Bivariate analysis found that there is a significant correlation between temperature and wards humidity with air germs number in inpatients unit class I, II, and III of RS PKU Muhammadiyah Jogjakarta; with p=0.007, which is less than alpha (α=0.05), RP=2.25, CI=1.039-4.874 for temperature; and p=0.028, which is less than alpha (α=0.05), RP=1.968, CI=1.039-4.874 for humidity.

Conclusion: There is a significant correlation between temperature and wards humidity with air germs number in inpatient units class I, II, and III of RS PKU Muhammadiyah Jogjakarta.

Latar Belakang: Prevalensi infeksi nosokomial di Jogjakarta cukup tinggi sebesar 5,9%. Pasien rawat inap mempunyai risiko lebih tinggi mengalami infeksi nosokomial. Faktor yang menyebabkan salah satunya lingkungan yaitu suhu dan kelembaban ruangan bangsal rumah sakit, dimana hal ini mempengaruhi pertumbuhan bakteri.

Tujuan: Tujuan penelitian ini adalah untuk mengetahui hubungan antara suhu dan kelembaban bangsal dengan angka kuman ruang kelas I, II, dan III RS PKU Muhammadiyah Jogjakarta.

Metode: Penelitian menggunakan desain cross sectional dengan saturated sampling. Sampel adalah 30 ruang bangsal RS PKU Muhammadiyah Jogjakarta. Kriteria ekslusi adalah kelas VIP. Data dianalisis dengan uji Kai Kuadrat.

Hasil: *Analisis bivariat menunjukkan terdapat hubungan antara suhu dan kelembaban dengan angka kuman di unit bangsal kelas I, II dan III RS PKU Muhammadiyah Jogjakarta dengan berturut turut p=0,007; α=0,05; RP=2,25; CI=1,039-4,874 untuk suhu dan p=0,028; α=0,05; RP=1,96;, CI=1,039-4,874 untuk kelembaban.*

Kesimpulan: *Terdapat hubungan antara suhu dan kelembaban ruang bangsal dengan jumlah angka kuman di unit kelas I, II, III RS PKU Muhammadiyah Jogjakarta.*

INTRODUCTION

Hospital is a health-care public facilities where healthy and unhealthy individuals intermingled with each other. The complexity of process that occur in a hospital is not only in terms of many types and kinds of diseases, that need particular attention from the doctors (medical providers) to confirm in terms of diagnosis and to determine the treatment (curative), but also in the use of medical equipment ranging from simple to the most modern and sophisticated.[1] A large number of microorganisms are responsible for hospital infections, and, among them, any microbe may have the capacity/ability to cause infections in hospitalized patients. Ninety percent of the nosocomial infections is caused by bacteria, whereas mycobacterial, viral, fungal or protozoal agents are less commonly involved.[2]

Nosocomial infections, also named healthcare-associated infections (HAI), are a global problem in every hospital around the world. HAI value quantification is needed to help allocate the necessary resources dedicated for infection control.[3] Health care associated (or nosocomial) infections is a major problem in hospitals worldwide and the prevalence is two or threefold higher in developing countries. Nosocomial infections is associated with an increase in crude mortality, length of stay in ICU, and hospital costs.[4] In developing countries, in which less than 5% of the gross national income is spent on health care, and where workforce density is less than 5 per 1000 population, nosocomial infections emerge and could possibly be a serious issue.

The epidemiological gap leading to the absence of reliable estimates of the global burden is mainly because surveillance of health-care-associated infection consumes time and resources, and requires expertise in study design, data collection, analysis, and interpretation. Very few countries of low and middle income have national surveillance systems for health-care-associated infections[5].

In Intensive Care Unit, nosocomial infections are more common than in the regular inpatient ward. Worldwide, 5-10 % of all hospitalized patients acquired nosocomial infections. Approximately 20-30% of them were patients undergoing treatment in the intensive care unit (ICU).[6] Environmental quality in hospitals is a matter that must be considered, because some of the ways of transmission of germs that cause the infection can occur by droplet, air borne, or direct contact. Moreover, the causes of the disease can be found in the air, floors, walls and medical equipment.[7] Contaminated environment has a considerable role as transmission of the disease that can cause nosocomial infections.[8] Supporting environmental conditions can spur the growth of bacteria. Environmental factors that affect the growth of bacteria, among others, are temperature and humidity.

Base on Decree of the Minister of Health in the Republic of Indonesia No. 1204/Menkes/SK/X/2004 on health requirements, the condition of hospital environment must be clean, as measured by room air germs number, especially for rooms with high and very high risk. Maximum permissible concentration of air germs number is 200-500 Colony Forming Units (CFU/m3) of air. The requirements for room temperature is 24-26°C, and the requirements for room humidity is 45-60 percent.

RS PKU Muhammadiyah Jogjakarta is located strategically on the side of a highway, it makes the number of visitors who visit hospitalized patient become more numerous. This can increased the growth of air germs number in inpatient ward. RS PKU Muhammadiyah Jogjakarta has several types of room, which are VIP class, class I, class II, and class III. VIP class consists of rooms called Zam-zam, Sakinah, Marwa, Ibnu Sina, and Sofa. Class I consists of rooms called Muzdalifah, Sakinah, and Ibnu Sina. Class II consists of rooms called Raudhah, Multazam, Sakinah, and Ibnu Sina. Whereas Class III consists of rooms called Arofah, Marwah, Sakinah, and Ibnu Sina. The overall capacity of beds are 160 beds.

The source of bacteria that occur in this

hospital are not only coming from patients and nurses, but also can come from visitors, as well as the activities of cleaning the room, unwell window management, or poor ventilation unit, which can cause dust particles or biological materials to infiltrate the patient rooms. Based on the preliminary study in Multazam ward, It was found that room temperature range at 28°C and humidity at 71%. In Raudah ward, room temperature range at 33.4°C and humidity 56%. In Marwah ward, room temperature range at 67°C and humidity 30.8 %. In Arofah ward, room temperature range at 31.6°C and humidity 57.5%. From the result of this preliminary study, it was known that the temperature and humidity of the room is not in accordance with the standards of KEPMENKES No.1204/Menkes/SK/X/2004. This study aims to determine the correlation between temperature and humidity with air germs number in inpatient unit class I, II, and III of RS PKU Muhammadiyah Jogjakarta.

METHODS

This study was conducted as an observational analytic laboratory tested, by comparing the temperature and humidity measurement results with the results of laboratory air germs number in inpatient unit class I, II, and III, using cross-sectional study design approach. The sampling technique used in this study are saturated sampling, in which the entire study population was used as samples. Exlusion criteria: VIP class at RS PKU Muhammadiyah Jogjakarta. The number of rooms that meet these criterias were 30 rooms. Data were analyzed by univariate and bivariate analysis with chi-square test.

Temperature is the value of the dispersion of heat and cold in the inpatient unit class I, II, and III at RS PKU Muhammadiyah Jogjakarta. Humidity is the percentage ratio of the amount of water vapor in the air in the inpatient unit class I, II, and III at RS PKU Muhammadiyah Jogjakarta. The measurement of temperature and humidity of the inpatient unit class I, II, and III at PRS PKU Muhammadiyah Jogjakarta used a Hygrometer by putting it on the walls of the room.

Air germs number is the total number of germs contained in the air of ward class I, II, and III at RS PKU Muhammadiyah Jogjakarta. Samples were taken with Midget impinger and water pump, and then were checked in the laboratory with a pour plate method and compared with the standard. The results were categorize as Not good if the index of air germs number > 500 CFU/M3; and Good if the index of air germs number ≤ 500 CFU/M3. The examination of the air germs number were performed at Laboratory of Biology, Faculty of Science University of Ahmad Dahlan Yogyakarta.

RESULTS

Sixty six point seven percent of all samples taken in the inpatient unit class I, II, and III at RS PKU Muhammadiyah Jogjakarta were categorized as "Not Appropriate" in terms of indoor temperature and humidity. While 22 of the 30 rooms that were sampled showed "Not Appropriate" air germs number. (Table 1).

Chi-square test did not qualify because the requirements were not meet, wherefore the expected count <5 ought to be less than 20%, however the results of expected count value <5 in bivariate analysis was 25%. Then an alternative test was used, which was Fisher's exact test. The results obtained are significant at p value of 0.007 which was less than α (0.05). Ho was rejected, which means that there is correlation between room temperature and air germs number in inpatient ward of RS PKU Muhammadiyah Jogjakarta(Table 2).

The test used was Fisher's Exact test because expected count values <5 should be less than 20%, however bivariate analysis result showed expected count value <5 was 25%. The Fisher's exact test results obtained significance value of 0.028 which was less than α (0.05). Ho was rejected, and the value of Confidence Interval (CI) was 1.012 to 3.829, which was not include a figure in it, which means there is correlation between air germs number and room humidity in inpatient unit of RS PKU Muhammadiyah Jogjakarta(Table 3).

Table 1 Results univariate analysis of variables temperature, humidity, and air germs number figures in space inpatient class i, ii and iii at rs pku muhammadiyah jogjakarta

No	Variable/Category	Number	Frequency
1	Temperature -Not Appropriate -Appropriote	20 10	66,7 % 33,3 %
2	Humidity -Not Appropriate -Appropriate	20 10	66,7 % 33,3 %
3	Air germ number -Not Appropriate -Appropriate	22 8	73,3% 26,7%

Table 2 Chi-square test results for correlation between room temperature with air germs number figures inpatient rs pku muhammadiyah jogjakarta

Temperature	Air Germ Number				Total		RP	CI 95	Sig.
	Not Appropriate		Appropriate						
	N	%	N	%	N	%			
Not Appropriate	18	60	2	6,67	20	66,67			
Appropriate	4	13,33	6	20	10	33,33	2,25	1,039-4,874	0,007
Total	22	73,33	8	26,67	30	100			

Table 3 Chi-square test results of relationship humidity with air germs number figures inpatient rs pku muhammadiyah jogjakarta

Temperature	Air Germ Number				Total		RP	CI 95	Sig.
	Not Appropriate		Appropriate						
	N	%	N	%	N	%			
Not Appropriate	17	55,67	2	6,67	20	63,34			
Appropriate	5	16,66	6	20	10	36.66	1,968	1,012-3,829	0,028
Total	22	73,33	8	26,67	30	100			

DISCUSSION
Relations Between Room Temperature with Air Germs Number.

Based on the results of measurements of the room temperature in each class I, II, and III, it is found that the results in each class are different. Class II and III showed that the average results of room temperatures exceeded standards, it was probably caused by a big number of patients and carers of patients in this unit. Room temperature and air germs number have not meet the standards required by PERMENKES, which is 27°C. The magnitude of the effect of the room temperature with the air germs number in inpatient unit can be seen from the Prevalence Ratio (RP), which is 2.25. This means that the room has a temperature that has not meet the qualification yet, and that it might cause the increase of air germs number 2.25 times larger than the room that has an eligible room temperature.

One of other effects of room temperature is the speed of air flow. High velocity air flow can cause a decrease of body temperature causing the feeling of lower temperature. However, the stagnant of air flow rate (minimal water movement) can create airflow that

felt tight, causing bad air quality.[9] The quality of the physical environment of air in the room is one of the important factors that determine the presence of microbes in the air. Indoor temperature is affected by the outside air temperature, air movement, and humidity of the room. Bacteria need a supportive environment in order to grow optimally. The most important means of transmission of nosocomial infections is by contact, usually direct contact but sometimes, can also by indirect contact through secretions of bodily fluid. Air can also be a route of transmission of air borne-nosocomial pathogens (e.g., in droplet nuclei and aerosols) that infect the respiratory tract.[2]

This research is in line with previous research which said that there is a correlation between total number of bacteria with room temperature at inpatient unit of RSUH hospital Makassar. These results indicated that humidity was the biggest physical environmental factors that directly influenced the presence of bacteria in the ward.[10] Other than being caused by physical environment, the presence of bacteria in the air can also be caused by biological environment which is always associated with the living environment. Factor of transmission or spread of the germs include health care worker and patients who are able to transfer germs to one another. Unhealthy and unhygienic behaviours by hospital staffs, patients, and visitors can increase the rate of transmission of germs.

Relations Between Humidity with Air Germs Number.

Based on the results of measurements of the humidity in each class I, II, and III, it is found that the results in each class are different. Because there was no utilization of humidity regulating device called a dehumidifier chamber in the inpatient ward, the result of average room humidity exceeds the standard. According to a research by Wajdaniyah (2011)[11], one of the efforts that can be done to reduce the humidity in the room of a hospital is by installing a Dehumidifier. Dehumidifier installed on thermohigrometer in the room should exceed the standards (60 percent). It aims to increase the effectiveness of Dehumidifier usage and efficiency of the hospital program. In the room that does not use an air controller, the influence of outside air will greatly affect the humidity. The rooms that do not use traditional air controllers are required to have a good ventilation system, resulting in good air circulation.

This research is in line with previous research which said that there is a correlation between the number of Streptococcus bacteria with the humidity of apartment room of village Bandarharjo Semarang. According to a research by Slamet in Wulandari (2013),[12] a room with inappropriate ventilation, if being occupied by a person, will caused an increase of body moisture resulting from evaporation of body fluids from the skin because of breathing vapors. Generally, microbes have optimum humidity values for its growth. For the growth of yeast and bacteria high humidity above 85% is needed, while for fungi and actinomycetes low humidity below 80% is needed.[12]

According to Moerdjoko (2004)[13] in his research about the relation between building ventilation system with air microorganisms, the greatest influence on the presence of air circulation is the circulation system. Meaning, with good air circulation, microorganisms will be reduced in number. Prevention of nosocomial infections is the responsibility of all individuals and services providing health care. And everyone must work cooperatively to reduce the risk of infection for patients and staffs. Although, not all hospital infections are avoidable, a lot of infections can be prevented.[2]

CONCLUSIONS

There is a correlation between room temperature and air germs number in inpatient unit class I, II, and III of RS PKU Muhammadiyah Jogjakarta. There is a correlation between room humidity and air germs number in inpatient unit class I, II, and III of RS PKU Muhammadiyah Jogjakarta.

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