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## **Microbial Risk and Health Care Associated Infections Diseases at Dok II Hospital Jayapura**

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### **Abstract**

One of the best parameter to evaluate the quality of indoor environment is the air microorganisms. It has been found various types of microorganisms such as fungi, bacteria, viruses, and amoebae. Bacteria that cause healthcare associated infections can live and thrive in a hospital environment either in air, water, floor, food and medical or non-medical objects. The general objective of this study was to analyze the relationship between quality airborne bacteria in the treatment room with the incidence of healthcare-associated infections at the General Hospital of DOK II Jayapura. This study was an observational analytic with cross sectional study, observation directly performed to determine the state of the environment and the maintenance room operating room, equipment used by doctors and nurses to treat patients and see whether the services carried out hygienically. Results indicated that a type of bacteria commonly found were Bacillus sp group and Staphylococcus sp are almost found in every treatment room. There are several bacterial pathogens were identified in the treatment room include Staphylococcus sp. Furthermore, respondents who potentially Related Infections Health Services more than that is not potentially; 27 patients (25.0%) and that no potential 81 patients (75.0%). Chi Square test results demonstrate the value of research p-value of 0.000 (0.000 < 0.05) means that H<sub>0</sub> is rejected; it means that there is a relationship between the presence of bacteria in the air with the potential Health Care Associated Infections.

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Likewise, the temperature shows the p-value research 0.000 ( $0.000 > 0.05$ ). However, there is no relationship between the presences of bacteria in the air with light intensity.

**Keywords:** Environmental Risk; Health Care; Infections Diseases; Bacterial in Air.

## **1. Introduction**

The spread of microorganisms in the air can be sourced from dust particles into the room through the shoes, clothing, and for opening doors and windows. Droplets in the air formed during human activity going in and distributed through the air flow, which can cause a risk of transmission of dangerous infections [1]. One of the best parameter to evaluate the quality of indoor environment that is bad is the air of microorganisms. It has been found various types of microorganisms such as fungi, bacteria, viruses, and amoebae are found in indoor environments [2]. The hospital is a place of ill people who require intensive care in order to be healed. But the hospital in addition to getting a cure, it can also be a place for various kinds of diseases originating from other patients as well as from well-wishers as a potential carrier of various diseases. On the other hand the bacteria that cause healthcare-associated infections can live and thrive in a hospital environment, such as air, water, floor, food and objects of medical or non-medical. The state of the bacteria in the room greatly influenced the conditions that occur in the room [3,4].

Health care-associated infection was first recognized in 1847 by Semmelweis and to this day remains a problem which is quite a matter of concern and needs serious treatment. Since 1950 health care-associated infections began to study in earnest in many countries, especially in the United States and Europe. The incidence of infections related to health care are different from hospital to hospital. Health care associated infection rates were recorded in several countries range between 3.3% -9.2%, which means that a percentage of patients who were treated contracting healthcare-associated infections and can be acute or chronic [5]. According to [1] healthcare-associated infections cause 1.4 million deaths every day worldwide.

The current health care-associated infection is one cause of increased morbidity (morbidity) and mortality (mortality) in the hospital, so that it can be a health problem today, both in developing countries and in developed countries [5].

Bacteria are commonly the cause of health care-associated infections are Staphylococci, Escherichia coli, and Pseudomonas. gram-positive bacteria are categorized as a major cause of health care-associated infections. Staphylococci are opportunistic pathogens that can invade the human body and cause serious infections. There are various types of these organisms but the most common types infect humans to cause serious illness to death is Staphylococcus aureus [6].

Staphylococcus aureus is the most common pathogen in patients with a history of neurosurgery, causing 10 of the 32 episodes (31%). Patients with a focus of infection, such as otitis, sinusitis or pneumonia were more likely to have meningitis due to Streptococcus [7].

Until now Staphylococcus aureus causes infections related to health care has been widespread throughout the

world. These germs of infection since the beginning of history, has become a major part causes of morbidity and mortality of patients [8]. Meanwhile, based on the results of research by [9] of the total inspection germ air and *Staphylococcus aureus* in inpatient hospital X Semarang obtained results of the study that found bacteria type air *Staphylococcus aureus* for 50% of total rooms in class III inpatient disease in and the average - average total germ air in the inpatient unit of disease after surgery was 281 CFU / M3 for class II and 717 CFU / M3 for the third class, and the average total germ air in inpatient medicine is 1,095 CFU / M3 for class II and 1,522 CFU / M3 for class III.

Growth in air bakeries can be influenced by physical environmental factors such as room temperature, humidity and lighting intensity. In addition the number of visitors and the number of patients because they influence the growth of germs visitors and patients carry the bacteria and spread into the air through sneezing, coughing, talking or laughing.

Results of research conducted at the Regional General Hospital (Hospital) Abepura, Jayapura City found that health care-associated infection at the surgery caused by aerobic bacteria. Aerobic bacteria were identified, namely: gram-positive cocci: *Staphylococcus epidermidis*, *Stap. aureus*, *Stap. saprophyticus*, *Streptococcus sp* ;; gram-positive rod: *Listeria monocytogenes*, *Diphtheroid sp*, *Lactobacillus sp* and gram-negative bacteria: *providence rettgeri*, *Pseudomonas putrefaciens*, *Klebsiela ozaena*, *Pseudomonas malthophyla*, *Morganela morganii*, *Serratia sp*, *Klebsiela oxytoca*, and *Klebsiela pneumonia*. Therefore, the authors noticed that the physical environment, extrinsic factors, and factors in nursing to be important for further analysis of the presence of pathogenic bacteria especially those types of *Staphylococcus* and *Pseudomonas* in the air in the treatment room and the operating room Dok II hospital. Jayapura Kota Jayapura potentially causing health care-associated infections.

## **2. Materials and Methods**

This type of research is observational analytic with cross sectional study, observation directly performed to determine the state of the environment and the maintenance room operating room, equipment used by doctors and nurses to treat patients and see whether the services carried out hygienically.

Cross sectional study also seeks to find the relationship between the independent variables (independent) and dependent variable (dependent) to perform measurements simultaneously between environmental conditions, equipment and services to the incidence of health care-associated infections.

## **3. Results and Discussion**

### ***3.1 Univariate analysis***

#### ***3.1.1 The presence of pathogenic bacteria***

The results of the identification of bacteria found in the treatment room DOK II Hospital in Jayapura in 2016 can be seen in Table 1, namely the treatment of eligible.

**Table 1:** This type of bacteria identified in indoor air treatment DOK II Hospital in Jayapura in 2016

Room	Bacterial
1 Super VIP	Bacillus sp, Alkaligenes sp, Staphylococcus sp, pseudomonas sp.
2 VIP Trikora	Bacillus sp, Serratia sp, Staphylococcus sp, pseudomonas sp.
3 Class I	Bacillus sp, Staphylococcus sp, pseudomonas sp.
4 Class II	Bacillus sp, Alkaligenes sp, Staphylococcus sp, Acinetobacter sp, pseudomonas sp..
5 Class III	Bacillus sp, Staphylococcus sp, pseudomonas sp.
6 ICU	Bacillus sp, Staphylococcus sp, pseudomonas sp.
7 ICCU	Bacillus sp, Staphylococcus sp, pseudomonas sp.

According to the table 1. it can be seen that the type of bacteria that is commonly found bacteria of the Bacillus group Staphylococcus sp and sp are almost found in every treatment room. The tables also can be seen that there are some pathogenic bacteria were identified in the treatment room include Staphylococcus sp.

### 3.1.2. Potential Health Care Associated Infections

Related Potential Health Services as defined in this study is a new infection that arises at - least within 3 x 24 hours after infection began to be treated and not a continuation of previous treatments. Distribution of Health Care Related potential can be seen in Table 2.

**Table 2:** Distribution of respondents with Potential Health Care Associated Infections in hospitalized patients in hospitals DOKII Jayapura 2016

No	Infection potential related to health service	Number (n)	Percentage (%)
1	Potential	81	75.0
2	Not Potential	27	25.0
Total		108	100

In Table 2. it can be seen that the potential respondents Health Care Associated Infections (ITPK) more than that is not potentially; 27 patients (25.0%) and that no potential 81 patients (75.0%).

### 3.2 Bivariat analysis

In bivariate analysis are outlined results of research on the relationship between the independent variables such as temperature, light intensity, humidity, density space, ventilation, cleanliness of the room with moderate variable is the number of bacteria and is associated with the dependent variable that is related infections Health Services.

To determine the relationship between the factors - factors related to the calculation of the amount of bacteria used Chi-square. The bivariate analysis done by the cross table (crosstab) two times two.

The results of the bivariate analysis of research on factors related to the number of bacteria and the potential incidence of infection in hospitals Related Health Services DOK II Jayapura in 2016 are presented in the table - the table as follows:

**3.2.1. The relationship between the total number of airborne bacteria with the potential incidence of Health Care Associated Infections**

The results of the analysis of the relationship between the total number of airborne bacteria with the potential incidence of infection Associated Medical Services can be seen in Table 3.

Bivariate statistical analysis results in Table 3. to see the results of Chi Square test showed p-value of 0.000 research (0.000 <0.05) means that Ho is rejected, it means that there is a relationship between the presence of bacteria in the air with the potential Health Care Associated Infections in Hospital treatment room DOK II Jayapura.

**Table 3:** Relationship Between Figures Total Bacteria In The Air With Potential Event Related Infections in Health Care Lounge DOK II Jayapura Hospital Care 2016

No	Total Bakteri	Infection potential related to health service				Number	P-value
		Yes		No			
		n	%	n	%	n	%
1	Meet requirement	5	6.2	13	48.1	18	16.7
2	Not Meet requirement	76	93.8	14	51.9	90	83.3
Total		81	100	27	100	108	100

**3.2.2. The relationship between the total number of bacteria in the air with Temperature**

The results of the analysis of the relationship between the total number of airborne bacteria with the potential incidence of infection Associated Medical Services can be seen in Table 4:

**Table 4:** Relationship between Score Total bacterial On Air With at room temperature Hospital Care DOK II Jayapura Year 2016

No	Total bacterial	Temperature				Number		P-value
		Yes		No		n	%	
		n	%	n	%			
1	Meet requirement	11	64,7	7	7,7	18	16,7	0,000
2	Not Meet requirement	6	35,3	84	92,3	90	83,3	

The results of the bivariate statistical analysis in Table 4.. to see the results of Chi Square test showed p-value research 0.000 ( $0.000 > 0.05$ ) means that  $H_0$  is rejected, it means that there is a relationship between the presence of bacteria in the air with the temperature in the treatment room DOK II Jayapura General Hospital.

**3.2.3. The relationship between the total number of bacteria in the air with Light Intensity**

The results of the analysis of the relationship between the total number of airborne bacteria with the potential incidence of infection Associated Medical Services can be seen in Table 5.

**Table 5:** Score Relationship between Total bacterial On Air with Light Intensity in Space DOK II Jayapura Hospital Care 2016

No	Total bacterial	Light intensity				Number		P-value
		Yes		Not		n	%	
		n	%	n	%			
1	Meet requirement	14	19.4	4	11.1	18	16.7	0,412
2	Not Meet requirement	58	80.6	36	88.9	90	83.3	
Total		72	100	15	100	108	100	

Bivariate statistical analysis results in Table 5 to see the results of Chi Square test showed p-value research by 0.412 ( $0.412 > 0.05$ ) means that  $H_0$  is accepted, it means there is no relationship between the presence of bacteria in the air with a light intensity in the treatment room DOK II Hospital Jayapura.

**3.2.4. The relationship between the total number of bacteria in the air with humidity**

The results of the analysis of the relationship between the total number of airborne bacteria with the potential incidence of infection Associated Medical Services can be seen in Table 6:

**Table 6:** Score Total Relationship between Bacteria in the Air With the humidity in the room DOK II Jayapura Hospital Care 2016

No	Total bacterial	Humidity				Number		P-value 0,000
		Yes		Not		n	%	
		n	%	n	%			
1	Meet requirement	11	61.1	7	7.8	18	16.7	
2	Not Meet requirement	7	38.9	83	92.2	90	83.3	
Total		18	100	90	100	108	100	

The results of the bivariate statistical analysis in the table 6 to see the results of Chi Square test showed p-value of 0.000 research ( $0.000 < 0.05$ ) means that  $H_0$  is rejected, it means that there is a relationship between the presence of pathogenic bacteria in the air with the humidity in the room care hospitals DOK II Jayapura ,

**3.2 5. The relationship between the total number of bacteria in the air with a density of room**

The results of the analysis of the relationship between the total number of airborne bacteria with potential Related Health Care incidence of infection can be seen in Table 7.

**Table 7:** Score Relationship between Total bacterial On Air With density at room DOK II Jayapura Hospital Care 2016

No	Total bacterial	Density				Number		P-value 0,000
		Yes		Not		n	%	
		n	%	n	%			
1	Meet requirement	11	61.1	7	7.8	18	16.7	
2	Not Meet requirement	7	38.9	83	92.2	90	83.3	
Total		18	100	90	100	108	100	

The results of the bivariate statistical analysis in the table 7to see the results of Chi Square test showed p-value of 0.000 research ( $0.000 < 0.05$ ) means that  $H_0$  is rejected, it means that there is a relationship between the presence of pathogenic bacteria in the air with a density of hospital treatment rooms DOK II Jayapura.

**4. Discussion**

**4.1 The relationship between the total number of bacteria in the air with Genesis Potential Health Care Associated Infections**

In this study, the statistical test showed that there is a relationship between the number of bacteria with the potential of Genesis Health Care Associated Infections in Hospital treatment room DOK II Jayapura. Statistical test results there is a significant correlation between the number of airborne bacteria colonies in the treatment room with Potential Genesis Health Care Associated Infections, where the value of the bivariate statistical analysis using chi-square test p-value research shows 0.000 ( $0.000 < 0.05$ ), which means  $H_0$  refused meaning that there is a relationship between the total number of bacteria in the air with Genesis Potential Health Care Associated infections in Hospital inpatient wards DOK II Jayapura.

By the standards contained in Kepmenkes No. 1204 / Menkes / SK / X / 2004, that the maximum total number of bacteria in a treatment chamber is 500 CFU / m<sup>3</sup> of air. Results of research on the wards showed that there are only two rooms that have a total number of bacteria under standard and 7 rooms that exceed the standard.

The research also shows that there is a room that has a value of the total number of bacteria  $> 500\text{CFU} / \text{m}^3$  that, of 43 respondents (81.1%) there were 16 respondents (30.2%) were potentially Genesis Health Care Associated Infection and 27 respondents (50, 9%) which is not potentially Genesis Health Care Associated infections. While in the room that has the total number of bacteria under standard  $< 500\text{CFU} / \text{m}^3$ , 10 respondents (18.9%) there were 8 respondents (15.1%) were potentially Genesis Health Care Associated Infection and 2 respondents (3.8%) were no potential Genesis Health Care Associated infections.

According to research conducted by Vincenzo [10], that the bacteria in the air, especially in the ICU has the potential to transmit disease through cross transmission means medical equipment in intensive care unit may be contaminated by bacteria. Cross transmission of bacteria present on medical devices can lead to infection, contamination can also be through the hands - the hands of staff in the ICU.

Other studies that support this research is research done by Lisa, et al. September to December 2015 on the pattern of aerobic bacteria that could potentially cause a Potential Event Infections Related to Health Care in the maternity wards of RSAD Robert Wolter Monginsidi Manado that found six species of bacteria most potentially causing potential of Genesis Infection Related to Health Care in the delivery room that *Lactobacillus sp*, *Enterobacter sp*, *Bacillus subtilis*, *staphylococcus epidermidis*, *Serratia sp*, *Enterobacter sp*. In the study conducted at the hospital besat, Sanandaj, Iran, the bacteria causing the infection Health Care Related most common is *E. coli*, *S. aureus*, *S. epidermis*, *Streptococcus spp*, *Klebsiella spp*, *Pseudomonas spp*, *Serratia spp*, *Acinetobacter spp*, *Enterobacter spp*, *Citrobacter spp*. This is in line with research conducted by IFIC, namely, HAI takes place in both developed and developing countries. About 1.4 million patients acquire HAI every day. In the United States, the center of disease control and prevention (CDC) estimates that 1.7 million HAI contribute to 99,000 deaths each year; they were among the ten leading causes of death. The highest morbidity among patients in the room Intensive Care Unit (ICU). The number of deaths associated with HAI is the biggest that pneumonia and bloodstream infections. The infection rate per 1,000 patient-days in the ICU highest. In addition, according to IFIC, bacteria are a major cause of infection-related illnesses health care hospital that is, *Acinetobacter baumannii*, *Bordetella pertussis*, *Campylobacter jejuni*, *Clostridium difficile*, *Clostridium tetani*, Coagulase negative staphylococci (CNS), *Corynebacterium diphtheria*, *Enterococcus species*, *Enterobacter species*, *Escherichia coli*, *Helicobacter pylori*, *Klebsiella pneumoniae*,



*Legionella pneumophila*, *Listeria monocytogenes*, *Mycobacterium tuberculosis*, *Neisseria meningitidis*, *Proteus* species, *Pseudomonas aeruginosa*, *Salmonella* species, *Salmonella typhi*, *Salmonella typhimurium*, *Serratia marcescens*, *Shigella* species, *Staphylococcus aureus*, *Streptococcus agalactiae* (Group B *Streptococcus*), *Streptococcus pyogenes* (Group A streptococcus), *Vibrio cholerae*, *Yersinia enterocolitica*.

Of the many bacteria that cause infectious diseases related to health care that has been put forward by IFIC so when compared with the results of the identification of the type of bacteria in the air in general and specifically the kind of bacteria *Staphylococcus* Sp. and *Pseudomonas* Sp. known relationship to the potential incidence of infection-related diseases in the health care department of the intensive care ward. DR. Wahidin Sudirohusodo. In this study also found primary data on human samples that the research sample based on criteria which found that almost all the human samples were analyzed by looking at the history of the disease course of the patient, other investigations, and sheets integrated study patients every day by doctors and nurses are attached inside medical record status it can be concluded from 61 human samples contained 49 patients were categorized as potentially infected with disease-related health care and the remaining 12 patients who are potentially exposed to infectious disease is related to health care. As for the variables examined in this study but it may be one factor in the potential for infection related diseases health care in this case a factor extrinsic (health workers: doctors, nurses, etc., other patients and visitors / family) based on direct observation location research it can be concluded that the factors extrinsic to have a very big role against the potential infection related diseases health care in the intensive care where are closely linked to the behavior of health workers in the field before and after the action on the patient, through droplets [11] sourced from officers, family / visitors, and other patients. In addition, health care-related disease infection can be obtained by patients via the hands are not clean themselves [12].

According to [13], the high percentage of pathogenic isolates through health workers at district hospitals Korca indicates a potential higher risk of infection related diseases health care in hospitals, most common pathogen was *Staphylococcus aureus*, a higher percentage of positive isolates found in health workers nose, wash with soap and water is far less effective than hand disinfection in hygienic and the staff are not trained in infection prevention guidelines for health care-related diseases.

## **5. Conclusion**

The total number of airborne bacteria contribute to Genesis Health Care Associated Infections. Factors temperature, humidity, ventilation, and the density of the room to give a significant role to the high number of total bacteria in the air. Furthermore, the light intensity does not contribute significantly to the presence of the total number of bacteria. While the cleanliness of the room is the factor that most significantly affect the total number of airborne bacteria in the treatment room in hospitals DOK II Jayapura.

## **Conflict of Interest**

We declared that no conflict interests within this study.

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