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ANALYSIS OF MICROBIOLOGY QUALITY OF SURGICAL ROOM AIR BASED ON HOSPITAL TYPE AND ITS IMPACT ON THE ENVIRONMENT AND HEALTH IN EAST JAVA ON 2019

[1]Dianori Rositasari, [2]*R. Azizah, [3]Soedjajadi Keman, [4]Mahmudah, [5]IzmiDwiraEriani, [6]Sri Rochana

ABSTRACT--*Hospitals as a means of health care, as well as a gathering place for sick and healthy people so that it has the potential to become a place of disease transmission and enables environmental pollution and health problems. One problem that often occurs is nosocomial infection. In Indonesia, nosocomial infections are quite high at 6-16% with an average of 9.8%. Environmental factor that influence nosocomial infections is air microbiology quality . Toanalyze microbiological quality of air in surgical room by hospital type and its impact on the environment and health in East Java on 2019.: This type of research was quantitative with cross sectional design, using secondary data from the laboratory testCenter for Environmental Health Engineering and Disease Control Surabaya which consisting of hospital surgical room air germs number data in East Java on 2019. Data were processed using statistical techniques, analyzed descriptively andwith cross tabulation (crosstab). Air germs number in surgical room both high and low can be found in all types of hospitals were Type A, B, C, and D. However, the highest germs number was found in type B hospitals. The highest surgicalroom air germ number was 1885 CFU/m^3 . The highest average surgical room air germs number (144 CFU/m^3) was found in the type A hospital group. The maximum limit of surgical room air germs is based on Regulation of Health Minister Number 7 Year 2019 which is 35 CFU/m^3. There was a weak correlation between the surgical room air germs numberand type of hospital (coefficient contingency = 0.287). Microbiological quality of air in hospital surgical room in East Java with the air germs number, which wasnot qualify exceed 50%,are hospitals with types A, C, and D. Disciplined monitoring and supervision is needed, because the Surgical room is a very high risk zone so the airborne germs count needs to be controlled properly so it does not exceed quality standards.*

Keywords--*Germs Number, Microbiological Air, Nosocomial Infection*

I. INTRODUCTION

[1]*Departmentof Environmental Health, Faculty of Public Health, Airlangga University, Campus C Mulyorejo, Surabaya, East Java, Indonesia*
[2]**Departmentof Environmental Health, Faculty of Public Health, Airlangga University, Campus C Mulyorejo, Surabaya, East Java, Indonesia* ***Corresponding Author: R. Azizah****E-mail:azizah@fkm.unair.ac.id*
[3]*Departmentof Environmental Health, Faculty of Public Health, Airlangga University, Campus C Mulyorejo, Surabaya, East Java, Indonesia*
[4]*Department Biostatistics dan Population, Faculty of Public Health, Airlangga University, Campus C Mulyorejo, Surabaya, East Java, Indonesia*
[5]*Department of Bussiness, Faculty of Vocational Studies, Airlangga University, Campus B Surabaya, Indonesia*
[6]*Center for Environmental Health Engineeringand Disease Control, East Java Province*

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Hospital is a comprehensive, integrated part of organization and medical, which serves to provide complete health services to the community both curative and rehabilitative, where the service output reaches family and environmental services, the hospital is also a center for training of health workers and for biosocial research (1). In addition to functioning as a health service facility, hospitals are also a gathering place for sick and healthy people, so that it has the potential to become a place of disease transmission and enables environmental pollution and health problems (2).

One problem of disease transmission that often happens in hospitals is nosocomial infection. Nosocomial infection according to the *World Health Organization* (WHO) is an infection that is seen in patients while in a hospital or other health facility, where the infection was not visible at the time the patient is received at the hospital. Nosocomial infections will show new symptoms after 48 hours the patient is admitted to the hospital (3). A study conducted by WHO in 2006 shows that around 8.7% of 55 hospitals in 14 countries in Europe, the Middle East, and Southeast Asia and the Pacific have had nosocomial infections, particularly in Southeast Asia as much as 10%(4).Nosocomial infections continue to increase from 1.0% in several European and American countries, to more than 40.0% in Asia, Latin America and Africa .

Nosocomial infections can originate from the process of transmission in health services, both patients, health workers, visitors, or other sources. Intermediaries that can cause nosocomial infections in hospitals are microorganism factors, treatment factors, or environmental factors (5). These infectious germs can live and thrive in a hospital environment, such as the air media, floors, walls, food, even medical equipment (6).

Environmental factor that influence the transmission of nosocomial infectious diseases in hospitals is microbiology quality of air due to the transmission of microorganisms to humans occur with certain mechanisms, for example by wind, water droplets or droplets, coughing or sneezing, conversations and contact with ground surface. In hospitals, this mechanism of transmission has the potential to cause nosocomial infections that lead to the possibility of endemic and epidemic infections (7). Microbiology quality of air in room is a problem that needs attention because it will affect human health (4).

East Java is the second largest province in Indonesia and has many public and private hospitals. In Indonesia, nosocomial infection is quite high at 6-16% with an average of 9.8% in 2010(8). By restructuring the building and yard space through monitoring the quality of air microbiology in room, it is expected that appropriate control measures can be determined (9). The microbiological quality of the air in Surgicalroom is a significant parameter to control healthcare associated infections, and regular microbial monitoring can represent an useful tool to assess environmental quality and to identify critical situations which require corrective intervention(10).

II. RESEARCH METHODS

The type of research used in this research was quantitative research. Quantitative research was done by collecting quantitative data and processed using statistical techniques. The research design used was a *cross sectional* approach using secondary data from Center for Environmental Health Engineering and Disease ControlSurabaya laboratory results consisting of room air microbiology data, namely air germs in hospital surgical room in East Java on 2019. The location of data collection was carried out at hospitals in East Java . The population and sample size in this study were all hospitals in East Java that had carried out microbiological quality of air germs number inSurgical roomtest, as many as 59 hospitals. The data analyzing in this research was

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done descriptively and cross tabulation *(crosstab)* then read the value of *contingency coefficient* to find out how strong the relationship between the surgical room air germs number and hospital type in East Java on 2019.

III. RESULTS AND DISCUSSION

Overview of Hospitals in East Java that Conducted Quality Microbiology Tests in Surgical Room Air on 2019

Based on the Minister of Health Regulation Number 30 Year 2019 concerning Hospital Classification and Licensing, types of hospitals in Indonesia are divided into 4 classes (11), namely:

1. Type A hospital is a general hospital that has the facilities and capabilities of medical services at least 4 (four) basic specialists, 5 (five) medical support specialist, 12 (twelve) other specialists in addition to basic specialist, and 13 (thirteen) subspesialist.
2. Type B hospitalis a hospital that has the facilities and capabilities of medical services at least 4 (four) basic specialists, 4 (four) medical support specialist, 8 (eight) other specialists in addition to basic specialist, and 2 (two) basic subspesialist.
3. Type C hospital is a general hospital that has the facilities and capabilities of medical services at least 4 (four) basic specialists, 4 (four) medical support specialist.
4. Type D hospital is a general hospital that has the facilities and capabilities of medical services at least 2 (two) basic specialists.

Frequency distribution of hospitals type/class of that have carried out microbiological quality test of hospital surgical room airin East Java on 2019 is shown in the following table:

Table 1: Frequency Distribution of Hospital Types that Examined the Microbiology Quality of Air in Surgical Room in East Java on 2019

No	Hospital Type	Frequency	Percentage
1	A	2	3.4%
2	B	36	61.1%
3	C	16	27.1%
4	D	5	8.4%
Total		59	100%

From the table above it can be seen that the majority of hospitals that conduct microbiology quality tests of air in surgical roomwere hospitals that have a class B type of 61.1%. According to Tsutsui and Suzuki, the prevalence of pathogens in small hospitals is higher than in large hospitals (9.37% vs 6.50%, respectively). Therefore, the same prevalence may be interpreted differently when the hospital type is taken into account (12).

\Overview of GermsNumber in Hospital Surgical Room Conducting Microbiology Quality Test of Air in East Java

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Test of germ numberaimed to determine the microbiology quality ofsurgical room air. In the table below were the results of test of air germ rates at hospitals in East Java that have conducted microbiological quality test of surgical roomair on 2019 at the Center for Environmental Health Engineering and Disease Control Surabaya Laboratory in Surabaya, as follows:

Table 2: Microbiology Quality Test Resultsof Hospital Surgical Room Air in East Java on 2019

Hospital Code	Hospital Type	Microbiology Quality Test Results (Germs Figures)	Explanation (35 CFU / m^3) Regulation of Health Ministry Number7 Year 2019
RS 1	A	43 CFU / m^3	Unqualified
RS 2	A	244 CFU / m^3	Unqualified
RS 3	B	183 CFU / m^3	Unqualified
RS 4	B	29 CFU / m^3	Qualified
RS 5	B	48 CFU / m^3	Unqualified
RS 6	B	26 CFU / m^3	Qualified
RS 7	B	26 CFU / m^3	Qualified
RS 8	B	19 CFU / m^3	Qualified
RS 9	B	15 CFU / m^3	Qualified
RS 10	B	7 CFU / m^3	Qualified
RS 11	B	4 CFU / m^3	Qualified
RS 12	B	672 CFU / m^3	Unqualified
RS 13	B	37 CFU / m^3	Unqualified
RS 14	B	25 CFU / m^3	Qualified
RS 15	B	74 CFU / m^3	Unqualified
RS 16	B	45 CFU / m^3	Unqualified
RS 17	B	3 CFU / m^3	Qualified
RS 18	B	0 CFU / m^3	Qualified
RS 19	B	211 CFU / m^3	Unqualified
RS 20	B	200 CFU / m^3	Unqualified
RS 21	B	496 CFU / m^3	Unqualified
RS 22	B	17 CFU / m^3	Qualified
RS 23	B	5 CFU / m^3	Qualified
RS 24	B	76 CFU / m^3	Unqualified
RS 25	B	2 CFU / m^3	Qualified
RS 26	B	2 CFU / m^3	Qualified
RS 27	B	2 CFU / m^3	Qualified
RS 28	B	92 CFU / m^3	Unqualified
RS 29	B	6 CFU / m^3	Qualified

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Hospital Code	Hospital Type	Microbiology Quality Test Results (Germs Figures)	Explanation (35 CFU / m^3) Regulation of Health Ministry Number7 Year 2019
RS 30	B	7 CFU / m^3	Qualified
RS 31	B	43 CFU / m^3	Unqualified
RS 32	B	1 CFU / m^3	Qualified
RS 33	B	7 CFU / m^3	Qualified
RS 34	B	4 CFU / m^3	Qualified
RS 35	B	1885 CFU / m^3	Unqualified
RS 36	B	167 CFU / m^3	Unqualified
RS 37	B	1 CFU / m^3	Qualified
RS 38	B	87 CFU / m^3	Unqualified
RS 39	B	1 CFU / m^3	Qualified
RS 40	C	55 CFU / m^3	Unqualified
RS 41	C	83 CFU / m^3	Unqualified
RS 42	C	246 CFU / m^3	Unqualified
RS 43	C	150 CFU / m^3	Unqualified
RS 44	C	161 CFU / m^3	Unqualified
RS 45	C	5 CFU / m^3	Qualified
RS 46	C	2 CFU / m^3	Qualified
RS 47	C	57 CFU / m^3	Unqualified
RS 48	C	0 CFU / m^3	Qualified
RS 49	C	121 CFU / m^3	Unqualified
RS 50	C	10 CFU / m^3	Qualified
RS 51	C	1 CFU / m^3	Qualified
RS 52	C	87 CFU / m^3	Unqualified
RS 53	C	62 CFU / m^3	Unqualified
RS 54	C	25 CFU / m^3	Unqualified
RS 55	D	134 CFU / m^3	Unqualified
RS 56	D	41 CFU / m^3	Unqualified
RS 57	D	134 CFU / m^3	Unqualified
RS 58	D	22 CFU / m^3	Qualified
RS 59	D	2 CFU / m^3	Qualified

Source: Installation Data of Environmental Media Biology Laboratory and Biomarkers,Center for Environmental Health Engineering and Disease Control Surabaya on 2019

From the table above, it's known that there was 59 sample hospitals that conducted microbiology qualitytest of surgical room air test. The test results were determined from total germs number found in the

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surgical room air which were then compared with the Minister of Health Regulation Number 7 Year 2019 on Hospital Environmental Health, whether it meets the quality standard requirements or does not meet the quality standard requirements, that is, for the surgical room air number has a maximum quality standard of 35 CFU/m^3. The highest germs number is 1885 CFU/m^3 which was found in the surgical room of RS35 hospital. This is in line with research by Stauning et al (2018), the results stated 52 of 102 samples (51%) exceeded 35 CFU/m ^{3}(13).

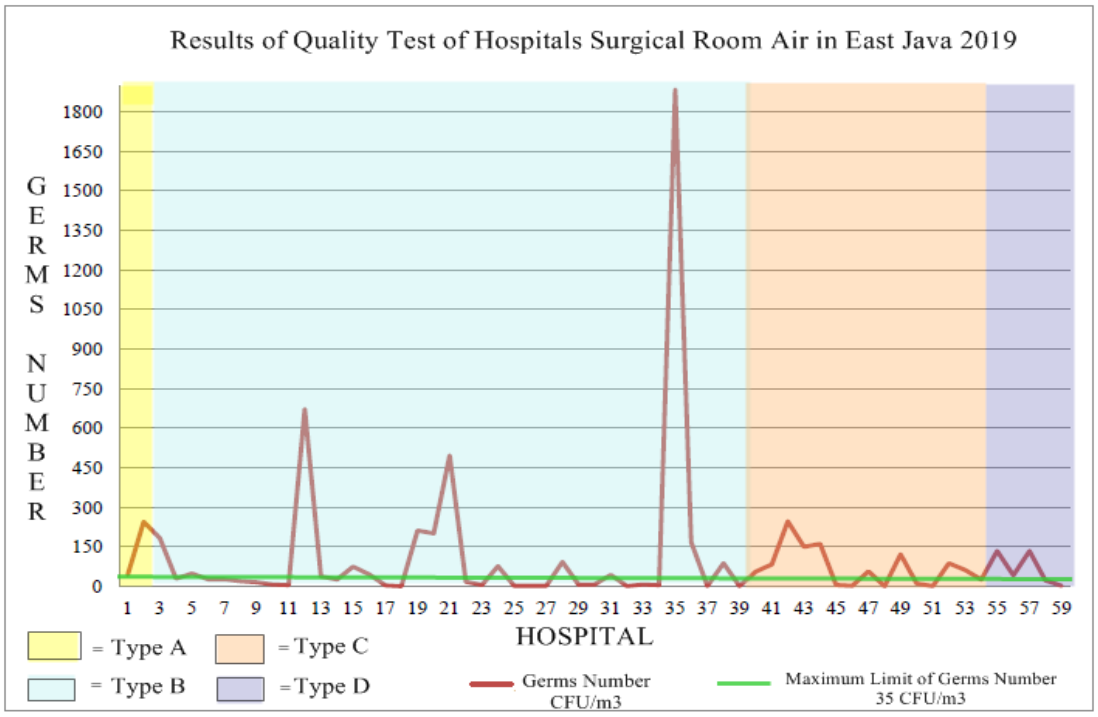

Figure 1: Results of Microbiology Quality Test (Germs Number) of Surgical Room Air Based on Group Type Hospital in East Java 2019

From Figure 1. it can be seen that the Surgical room air germs number both high and low can be found in all types of hospitals, namely in hospitals type A, B, C, or D. However, for the highest germs number were found in hospitals with type B. The highest surgical room air germs number reached 1885 CFU/m^3.

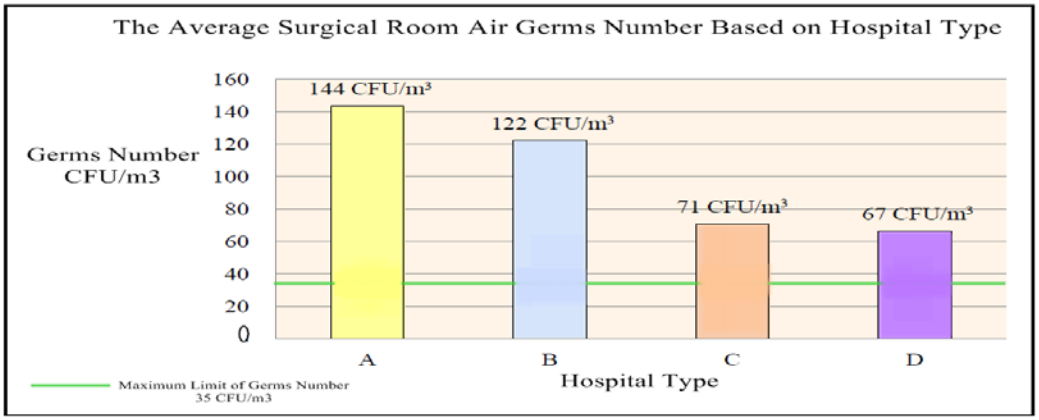

Figure2: The Average Surgical Room Air Germs Number Based on Group Type of Hospital in East Java 2019

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From Figure 2., for the average surgical room air germs number, the highest was in the hospital group with type A, and the lowest was in the hospital group with type D. The samples number for hospitals with type A were only 2, hospitals type B were 36 samples, type C were 16 samples, and type D were 5 samples (Table 1.).

The frequency distribution of samples that were qualified and unqualified could be seen in the followingtable:

Table 3: Frequency Distribution of Microbiology Quality of Hospital Surgical Room Air in East Java on 2019 by Category of Sample Test Results

No	Category ofSurgical Room Air Germs Test Results	Frequency	Percentage
1	Qualified	28	47,5%
2	Unqualified	31	52,5%
Total		59	100%

Based on the table above, it can be seen that the majority of the Surgical room taken by the air germs room sample for testing count of 52.5% were unqualified. In line with research conducted by Palawe et al (2015), where the results are addressing that air Surgical room Installation Central Surgery (IBS) hospital in Manado was still contaminated with microorganisms, and this showed that the level of sterilization and sanitation applicated in Installation Central Surgery (IBS) has not been good so that the quality must be improved for the realization of good health services(14).In research of Matinyi et al (2018) results showed if Surgical bed (77.8% from the total sample) , instrument trolley (28.6% from the total sample), and door handles (100% from the total sample) had the highest number of pathogens (15). Even in research of Ding *et al* (2019), a total of 334 pathogens were isolated from the ascetic fluid samples from patients with spontaneous bacterial (16). There were 178 (53.3%) strains of g -negative bacteria, 138 (41.3%) strains of g -positive bacteria, 14 strains of fungi and 4 anaerobic strains.

The germs number present in room air is generally influenced by several factors from physical environmental conditions such as lighting, humidity, temperature, occupancy density, and the layout of the room adjacent to the source of pollution(17). This is also consistent with research conducted by Darmadi, which states that the level of air pollution in a hospital room by microbes was influenced by factors such as temperature, humidity, lighting, frequency of sterilization, cleaning of trash, cleaning of linen, personal hygiene of patients, visitors number, and will affect the growth of microorganisms in installation rooms air in hospital including Surgical rooms(18). In addition, the air germs number is influenced by the density of patients, officers and visitors in the room(19). The more dense the occupants in the Surgical room the greater the degree of contamination with more microorganisms (20). This is supported by research conducted by Shaw et al (2018), which states that under the well-controlled ventilation system, the mean microbial colony counts obtained by active sampling in different working Surgical rooms were low. The staffs number and their activities critically influences the microbe concentration in the water of the Surgical room (21).

Other factors that have the potential to influence the growth of microorganisms in the air room such as personal hygiene who uses the room, cleanliness of walls/floors, and ventilation systems in the room. The ventilation system can also affect the Surgical room air contamination with particles carrying aerobic bacteria. In

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a study of comparative Surgical rooms equipped with a laminar airflow (LAF) ventilation system and one with conventional ventilation, other influencing parameters remaining the same, it was found that in the LAF-ventilated space the bacterial contamination of the Surgical room air was effectively reduced in terms of both the content of particles in the water and bacteria on the floor(22).

The necessity for limiting airborne bacteria in the Surgical room (OR), to establish a safer environment. It is mainly achieved by a combination of qualified hygienic standards, good ventilation and staff of Surgical rooms wearing clothing that reduces the emission of skin scales (23)

The regularity and compliance of officers in conducting room sterilization methods can be one of the risk factors for room air contamination. To avoid these risk factors for microbiological contamination, more intensive monitoring and supervision efforts are needed to improve the health and safety of the hospital community to reduce the risk of transmission and spread of secondary infectious diseases or commonly referred to as nosocomial infections (24).

Room temperature can affect the high and low surgical room air germs number. Unqualified temperature conditions can cause high air germs number because the optimum temperature for bacterial breeding is around 37 ^{0} C which is also the temperature of the human body (25). Therefore human body temperature is a good temperature for the growth of some pathogenic bacteria, destructive and pathogenic noodles generally can grow in the temperature range of 4^{0}C-66^{0}C (9). Temperature has an important role in the growth of microbes in air which will affect both directly and indirectly on human life(26). The temperature in the Surgical room must be kept in compliance (25). The temperature for the Surgical room based on Health Ministry Regulation Number 7 Year 2019 is around 22-27 (2). In the *5th International Conference on Prevention & Infection Control* (ICPIC 2019) states that, an increase of 1°C in mean temperatures resulted in a 0.7% higher overall microbial growth surgical and wound infection risk(27).

According to Irianto in Wismana (2016) microbial flora or germs in the air are temporary and various (4). Air is not a medium in which microorganisms grow, but is a carrier of particulate matter of dust and liquid droplets, all of which make it possible to carry microbes (8). The level of air pollution in the room by microbes is affected by factors of ventilation rate, density of people and activities of people who occupy the room (28). Medical staffs and medical tools become one of the factors of development of bacteria or germs in the room (29).

Extreme air humidity can be related to poor air quality. Low humidity can cause SBS (Sick Building Sydrome) symptoms such as eye irritation, throat irritation and cough (20). In addition, low humidity can also increase susceptibility to infectious diseases, as well as asthma (14). Humidity is also one of the factors that affect the survival of microorganisms or germs in the Surgical room. Room air that is too humid can cause the growth of various molds and spores (30).The survival of viruses and other infectious agents depends partially on levels of humidity (31).

Cross Tabulation of Hospital Surgical Room Air Germs Number in East Java with Hospital Type on 2019

From secondary data that has been obtained, cross tabulation was carried out to find out the overview of Surgical room air germs number based on the hospital type that had conducted microbiology quality test of room air, the results were as follows:

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Table 4: Cross Tabulation of Hospital Surgical Room Air Germs Number in East Java with Hospital Type on 2019

Hospital Type	Categories of Germs Number Test Results				Total Sample	
	Qualified		Unqualified			
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
A	0	0%	2	100%	2	100%
B	21	58,30%	15	41,70%	36	100%
C	5	31,25%	11	68,75%	16	100%
D	2	40%	3	60%	5	100%

From Table 4. Type A hospitals samples that were tested for microbiological tests of the Surgical room air had 100% unqualified results. Type C (68.75%) and D hospitals (60%) majority of the samples tested, the results did not meet the requirements (68.75%). So it could be concluded that the Surgical room air samples that did not meet the highest requirements were found in type A hospitals.

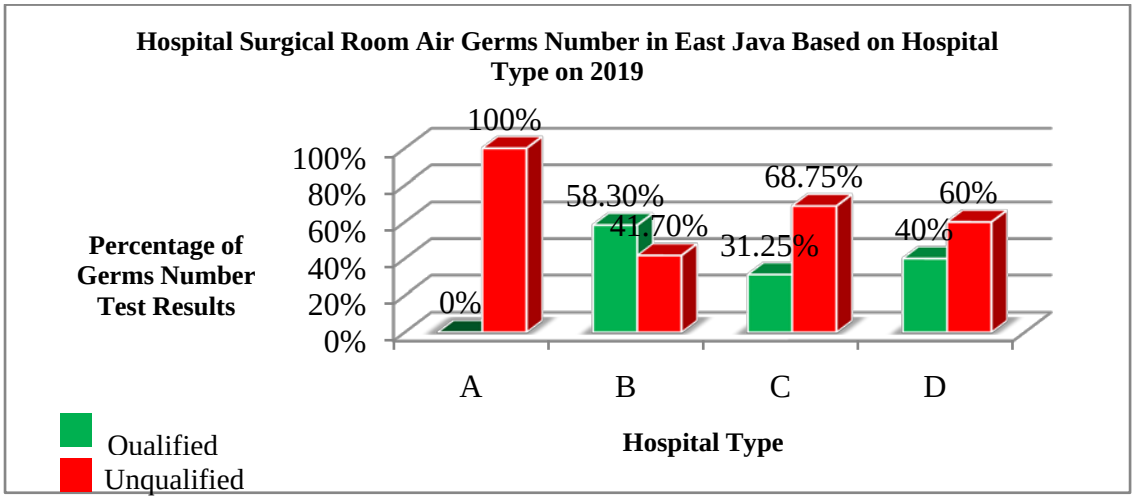

Figure 3: Hospital Surgical Room Air Germs Number in East Java Based on Hospital Type on 2019

From Figure 3. it could be concluded that the microbiological quality of hospital Surgical room in East Java as indicated by the air germs number above showed that the samples number that did not meet the requirements exceeding 50% are from Type A, C, and D. Hospitals.

Then from the results of the cross tabulation analysis obtained the results of the relationship between the Surgical room air germs number with the hospital type with a coefficient contingency value of 0.287 which meat the strength relationship level between these variables was included in the weak category.

Surgical rooms require air that is free of contamination, must be relatively positive pressure on the next room or corridor to prevent the flow of incoming air from a relatively high contaminated area (8). An air pressure difference can be maintained only in a fully enclosed room. Therefore it is important to prevent air leakage from all doors or barriers between adjacent areas (32). This is best done using a weather barrier and a lid on the door. Opening or closing the door between the two areas quickly reduces the pressure difference between the areas. If there is an opening, a natural air exchange takes place due to thermal currents arising from temperature differences between the two areas (30,32).

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High rates of Surgical room air germs in hospitals can have an impact on the hospital environment (33). Moreover, bacterial growth can also be increased after surgery. Medical tools will certainly also become contaminated with germs or bacteria contained in the room air. If the air in the Surgical room has been contaminated with germs or bacteria, of course the floor, walls, even the air conditioner, ventilation, or other air filtering systems are not good. Poor air quality can cause the growth of fungi and viruses in the hospital environment (34).

Quality of Surgical room air that does not meet the quality standards in addition to having an impact on the hospital environment, of course, can have a health impact on hospital residents as well. In Indonesia, nosocomial infection is quite high at 6-16% with an average of 9.8% in 2010 (8). The most common nosocomial infection is surgical wound infection (ILO). The results of previous researches indicate that the incidence of ILO in hospitals in Indonesia varies between 2-18% of all surgical procedures (35).

The incidence of nosocomial infections in hospital types varies. Research conducted by the Indonesian Ministry of Health in 2004 obtained data on the proportion of nosocomial infections in government hospitals with 1,527 patients out of 160,417 patients (55.1%), while for private hospitals with 991 patients out of 130,047 at-risk patients (35.7%). For military hospitals with 254 patients out of 1,672 at-risk patients (9.1%) (36)

Nosocomial infection is an infection that is acquired by a patient while being treated in a hospital or other health care places (35). Transmission of hospital infections, same with infections in general, is affected by three main factors, the transmission source of the causative microorganism, the susceptible host, and the transmission mode of microorganisms (37). According to Septiari in Sinaga (2014), transmission of infection can be through the air (through the respiratory tract), direct contact through skin contact, or through the gastrointestinal tract (38). Air is absolutely necessary for everyone, but the presence of air contaminated by pathogenic microbes is very difficult to detect so that it can cause nosocomial infections.

Nosocomial infections that occur in hospitals are affected by external factors such as hospital environment, food, air, and objects / tools that are not sterile, while internal factors such as contaminants from the patient him/herself. The microorganisms responsible for nosocomial infection may be the patient's own microflora, present on the skin, nasopharynx, and gastrointestinal tract, or the transmission of microorganisms from visitors and caretakers (39). On that basis, it is possible in the hospital environment for contact between three components, namely patients, staffs, and the community in the hospital environment and objects or tools used for the process of healing, treatment and recovery of patients. This relationship is a continuous contact that allows cross-infection of patients with certain diseases to healthy hospital staffs and visitors (38).

In developed countries hospital-acquired infections occur with quite high Number. In the United States there are 20,000 deaths each year due to nosocomial infections (20). Around the world around 10% of inpatients in hospitals experience new infections during treatment (1.4 million infections each year). In Indonesia, research conducted in 11 hospitals in DKI Jakarta in 2004 showed that 9.8% of inpatients acquired new infections during treatment (35,37).In line with research by Kandelaki *et al* (2013), The study results clearly show that there is a considerable burden of nosocomial infections on health care system of the country in Georgia (40). Although rates of nosocomial infections have decreased in recent years, they continue to occur since present preventive measures are only partially effective. New techniques to reduce the occurrence of nosocomial infections continue

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to be required (41). Appropriate precautions are needed to deal with nosocomial infections that occur in several hospitals.

The cause of nosocomial infections that are still high can be caused by autoinfection, which is bacteria that are already present in the human body and move to other parts of the body or exogenous originating from the hospital environment such as Surgical room air, unsterile tools, and hospital staffs which less implementing aseptic and antiseptic behavior (42). According to WHO, nosocomial infections have various types, such as urinary tract infections, infections related to intravascular tools use, pneumonia, and surgical infections (surgical wounds). 1.731 patients hospitalized for 11.297 days acquired 251 Health Care Associated Infection (HAIs), an overall rate of 14.5%, and 22,22 HAIs per 1.000 ICU days. The Central Venous Catheter-Related Bloodstream Infections (CVC-BSI) rate found was 15,7 per 1000 catheter-days; The Ventilator-Associated Pneumonia (VAP) rate found was 43,2 per 1.000 ventilator-days; and The Catheter-Associated Urinary Tract Infections (CAUTI) rate found was 11,7 per 1.000 catheter-days (43). And a total of 818 children with acute respiratory tract infectionss, 320 (39.5%) positive samples were detected by using immunofluorescence assay. Out of 320 viral acute respiratory tract infections, 226 (70.6%) were positive for respiratory syncytial virus. From that 86 (38.0%) nosocomial respiratory syncytial virus was detected (44). Nosocomial pathogen can also caused blood-stream infections and pneumonia with considerable morbidity in immunocompromised patients (45).

In the Surgical room, surgical wound infections may be possible in patients. Surgical wound infection is one of the main complications of surgery that can increase morbidity, mortality, and patient care costs in hospital (46). The incidence of surgical wound infection at a health care provider institution reflects the quality of service at that institution. WHO survey shows that the incidence of surgical wound infections in the world ranges from 5% to 34% (47.48).

According to Sjamsudihajat and Nichols in Barung (2017), complications in surgical wounds often occur because of surgery which is the deliberately act of making a wound on the tissue to provide a place of entry for bacteria; this requires a maximum level of sterility (42).

Increased morbidity and mortality, duration of hospitalization, and medical care costs are all associated with microorganisms responsible for nosocomial infection (49).

Because surgical procedures expose patients to infective complications, the Surgical rooms is considered a complex habitat in which all sources of pollution have to be kept under control (50).

IV. CONCLUSION

The microbiological quality of the hospital Surgical room air in East Java as indicated by the air germs number concluded that the samples number that did not meet the requirements exceeding 50% were from hospitals Type A, C, and D. Hospitals need to pay attention to sterilization techniques, air conditioning systems applied, maintain the room physical quality (temperature, humidity, lighting) and building construction (ventilation, ceilings, walls, floors, doors). Disciplined monitoring and supervision are needed, because the Surgical rooms are very high risk zone so the air germs number needs to be controlled properly so it does not exceed quality standards.

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