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MICROBIOLOGY INDOOR AIR QUALITY AT HOSPITAL DURING THE COVID19 PANDEMIC

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Abstract

Introduction: *Covid19 was an acute respiratory disease with fever, cough, and out of breath as the symptoms. WHO reported that until June 21st 2020, there were 8,708,008 cases were confirmed with 461,715 number of death (CFR 5.3%). In Indonesia, there were 45,891 cases were confirmed with 2,465 number of death (CFR 37%). People who were most at risk were people who physically close contact with the Covid19 patient, including health workers. The purpose of this study was to know the microbiology indoor air quality of Covid19 patient at Hospital before and during the pandemic.* ***Method:*** *The study design of this research was observational cross sectional. The study was done at a Hospital in East Java on December 2019 – June 2020. The sample of this research was a ward's air in a Hospital. The research variable was the number of microbiology, temperature, and humidity of the ward of Covid19 patient that was measured 3 different points of measurement each rooms.* ***Result and Discussion:*** *The result showed that the average of the number of microbiology before the pandemic was about 46.31 CFU/m3 with the average of the temperature was 27.64°C and the humidity was 44.58%, while during the pandemic the number of microbiology in the air increased to 64 CFU/m3 with the average of the temperature was 27.77°C and the humidity was about 42.46%. Based on the statistic analysis, there were differences between the numbers of the microbiology before and during the pandemic in the ward of Covid19 patients (p value 0.00).* ***Conclusion:*** *The result showed that the number of the microbiology was increased before and during the pandemic although it was still under the quality standard. Increasing of Covid19 patient was the probably reason of the increasing the number of the indoor air microbiology. It was recommended the hospital requires to control the air quality of the treatment room by regulating air ventilation.*

INTRODUCTION

Covid19 was a brand new disease was detected for the first time in Wuhan, China on January 7th, 2019. World Health Organization (WHO) stated that the Covid19 case was an Emergency of the Public Health that was Public Emergency Emergency International Concern on January 30th, 2020 (1). People who were taking care of the Covid19 patient had more risks than people who were not (2). WHO reported that up to June 21, 2020, the amount of confirmed Covid19 cases in 216 regions and countries is 8,708,008 with 461,715 deaths (CFR 5.3%). In Indonesia, Covid19 cases were first reported on March 2nd, 2020, with a total of 2 positive cases. From the tracking results, it was found that the Covid19 confirmed patient in Indonesia originated from the city of Jakarta, the amount of positive Covid19 confirmed cases in Indonesia reached 45,891 with 2,465 fatalities (Case fatality rate 5.37%) spread across 34 provinces and 439 districts/cities (3).The number of positive confirmed patients of Covid19 is getting higher in Indonesia, causing the government to provide an adequate number of health care facilities. Based on the Decree of Minister of Health of the Republic of Indonesia No. HK.01.07/MENKES/169/2020 about Determination of Referral Hospital for Handling Certain Emerging Infection Disease, 132 referral hospitals for handling Covid19 cases had been appointed in Indonesia (4).

Health workers at the hospital were at high risk of contracting Covid19 because they had direct contact with sufferers.The hospital as a health service facility that handled positive patients from Covid19 spearheading the control of this case. With the increasing number of positive sufferers of Covid19, the burden of hospitals to handle these cases was also higher. Several case reports stated that medical personnel in Indonesia contracted Covid19 after treating positive patients with Covid19.

Covid19 was transmitted through respiratory sparks and indirect contact. Viruses from contaminated hands might carry over into the mucosal ducts in the person's mouth, nose, and eyes and make them infected with Covid19 (5). Covid19 transmission was easier if it occurs indoors, especially in a hospital setting, because the hospital was a gathering place for sufferers to get treatment. Covid19 transmission was easier if it occurs indoors as much as 79% rather than outdoors (6). This confirms that the risk of Covid19 transmission indoors was higher than the outdoors.

Poor air quality in hospital rooms could cause nosocomial infections. About 10-20% of nosocomial infections could be caused by poor air quality in hospital rooms (7). The number of medical workers infected with Covid19 in East Java was 109 people as of May 28th, 2020 (8). Another case was reported from Aceh that as many as 4 hospital medical personnel were infected after treating positive patients Covid19 (9).

There was no exact data on the total number of medical personnel who contracted Covid19 in hospitals. But many case reports from various hospitals in Indonesia about their medical personnel who contracted after treating positive patients Covid19. For this reason, hospitals needed to control the quality of airespecially for the quality of air microbiologyin the hospital so that the transmission of Covid19 could be minimized.

Hospitals must control indoor air quality and carried out regular monitoring. The parameters that must be monitored to determine the quality of air quality in hospital rooms were physical, chemical, and microbiological parameters. Based on the background above, the authors wish to describe the microbiological quality of hospital air before and after the Covid19 pandemic.

METHOD

This research was observational study. Study was using a cross-sectional design. The study was done by measuring the air quality of the treatment room for patients with Covid19 in the hospital before and during the pandemic. Indoor air quality before the onset of a pandemic was obtained using secondary data from the hospital. The hospital routinely checks the quality of the indoor air every once a month, so it could be used as a baseline for research. While indoor air quality data when a pandemic occurs was measured when the research was conducted. The air quality parameters measured were the number of microbiology in air using a microbiology air sampler (MAS) MERCK type MAS 100 T sample of 12 samples, namely 3 sampling points in each treatment room for patients with Covid19 (4 rooms). In addition, temperature and humidity measurements were also performed using the Corona type GL-99 thermohygrometer at each sampling point. Temperature and humidity were also measured at three points in each room with the mean during microbiological sampling.

The variable of this study was the quality of the air microbiology room care of patients with Covid19 in the hospital before and during the pandemic. Analysis of the data in this study was a bivariable analysis to identify whether there were differences in the number of microbiology in the patient room before and during the Covid19 pandemic. The statistical test used was a paired t-test with a significance level of $p < 0.05$, with a 95% confidence interval (CI).

RESULT

Indoor Air Quality in Hospitals Before the Covid19 Pandemic

The quality of air in the hospital examined was the number of microbiology in air. Sampling was carried out in four Covid19 patient care rooms. Each room was taken three measurement points from December 2019 to February 2020. The measurement results explained that the average number ofthe quality of air microbiology at the Covid19 patient care room was 46.31 CFU / m3.

As a result, the temperature and the humidity that had been measured in the Covid19 treatment room before the pandemic was 27.64^{0}C and 44.54%. The room conditions at the time of sampling were rooms for patients with non-infectious diseases with a 60 % density of uses bed and cleaning the room in accordance with the hospital room hygiene sanitation procedures

Indoor Air Quality in Hospitals during the Covid19 Pandemic

The inpatient room used to treat Covid19 patients was an inpatient room that originally used to treat other disease patients so that the condition of the room did not change too much. The average measurement result of microbiology in air number for Covid19 patient care room was 64.00 CFU/m^3.The average temperature and humidity in the ward before the pandemic was 27.77°C and 41.33%. The rooms condition at the time of sampling were rooms for patients with non-infectious diseases with 90 % of density usage bed and cleaning the room in accordance with the hospital room hygiene sanitation procedures, same procedure before pandemic happened.

Analysis of Room Air Quality Differences in Hospitals Before and During the Covid19 Pandemic

Differences in room air quality at the hospital before and during the Covid19 pandemic were statistically analyzed using paired t-test analysis. The analysis shows that the p-value is 0.00, which means that there were significant differences in the number of microbiology in indoor air before and during the pandemic.

DISCUSSION

The increase in the number of microbiology before and during the pandemic was due to the increasing activity of Covid19 patient care in the room, and some patients did not wear masks during treatment. Patients who do not wear masks were a source of pollution in the treatment room, such as from the respiratory tract, which was sprayed through clean and coughing. This is in line with the amount of patients influences the amount of microbiology in the treatment room in the hospital (14). The another study showed that personal density and occupants activities contributed for microbiological concentrations (15).

An increasing in the number of microbiology before and during the pandemic was possible because of an increase in activity in the treatment room. Physical environmental indicators (temperature and humidity) associated with the concentrations of microorganism (10). Temperature and humidity were variables that could encourage the transmission of Covid19 in sustainable manner (11-12). Based on the observations at the hospital, it concluded that some of the patients treated were not pleased to use appropriate personal protective equipment. When the patient coughed, he would spread the droplet and pollute the room air. This was the cause of an increasing number of air microbiology in the Covid19 patient's ward. The airborne transmission of SARS-Cov-2 is possible happened (13).

WHO had published guidelines to regulate and manage treatment centers for severe acute respiratory infections so that they could be used as a basis for hospitals to control room air quality in hospitals that was by setting good ventilation (16). The various types of ways to control room air quality in hospitals during the pandemic Covid19, for example, optimized airflow patterns, directional airflow, zone pressurization, dilution ventilation, in-room air-cleaning systems, general exhaust ventilation, personalized ventilation, local exhaust ventilation at the source, avoiding air recirculation and overcrowding, central system filtration, Supplement general ventilation with germicidal ultraviolet lights, and controlling indoor temperature and relative humidity (17-23). Another recommendation for reducing microbiological contamination was by monitoring the effectiveness of ventilating and air conditioning (HVAC) system (24).

CONCLUSION

The number of microbiology-room air gases for Covid19 patients during the pandemic had increased compared to the condition before the Covid19 pandemic. This happened due to increased maintenance activities. Patients who did not wear masks were a source of pollution in the treatment room, for example, from the respiratory tract, which was sprayed through clean and coughing. Therefore, the hospital required to control the air quality of the treatment room by regulating air ventilationfor exampleoptimized airflow patterns, directional airflow, zone pressurization, dilution ventilation, in-room air-cleaning systems, general exhaust ventilation, personalized ventilation, local exhaust ventilation at the

source, central system filtration, UVGI, and controlling indoor temperature and relative humidity.

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