Meta Analysis: Relationship of Tuberculosis Patient Contact, Density And Ventilation Area With Tuberculosis Events

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ABSTRACT

Tuberculosis is one of 10 causes of death in the world. In 2018 TB sufferers in Indonesia reached 840 thousand people, the third-highest figure in the world after India and China. The purpose of this study was to analyze the relationship between contact with tuberculosis patients, occupancy density and ventilation area with tuberculosis' incidence. This study used meta-analysis, the articles' sources were from Google Scholar, PubMed and DOAJ published from 2011-2020. There were 12 articles that met the conditions for contact-free variables with tuberculosis patients, 12 articles of occupancy density, and 10 articles of ventilation area variable. The results were contacting with tuberculosis patients had 5.93 times more of getting tuberculosis compared to people who had no contact with tuberculosis patients, people who lived in densely populated areas were 2.41 times more getting tuberculosis compared to people living in occupancy that is not crowded, people who live in dwellings with a non-standard ventilation area were 2.14 times more getting tuberculosis when compared to people who live in an area where the ventilation area meets the standard. The conclusion of this study is tuberculosis patient contact, occupancy density, and ventilation area with the incidence of tuberculosis have a significant relationship.

Keywords: Tuberculosis, tuberculosis patient contact, occupancy density, ventilation

INTRODUCTION

Tuberculosis is still a major global health problem and is one of the top 10 causes of death in the world. About a quarter of the world's population infected by Mycobacterium Tuberculosis is at risk of developing the disease. According to the WHO (World Health Organization) report, it is estimated that people affected by Tuberculosis are estimated to be 10 million people (around 9.0-11.1 million) in 2018.[1]

In 2018, Indonesia occupied the third position in the world with TB sufferers reaching 840 thousand people, after India with 2.7 million people and China with 889 thousand people. Based on data from the Global Tuberculosis Report (WHO, 2018) in Indonesia, the tuberculosis mortality rate is 42 per 100,000 population. One of the causes of the tuberculosis problem that has not been resolved until now is due to risk factors that have not been well controlled, one of which is household contact. People with tuberculosis are most likely to transmit the tuberculosis germs to people who spend all day with them, in this case including family members, friends and colleagues, or school friends.[2]

Based on the research of Darmin et al (2020), it was concluded that if someone had contact with a patient with pulmonary tuberculosis AFB + at home/living together continuously, there would be the transmission. Because often inhaling air that contains these bacteria causes a large number of germs to enter the lungs so that you have the risk of suffering from tuberculosis. Home contact with tuberculosis sufferers will be more and more exposed to tuberculosis germs, which will lead to the risk of tuberculosis transmission.[3]

Meanwhile, another study conducted by Lusiani in 2019 stated that the history of contact with tuberculosis in respondents with Diabetes Mellitus accompanied by pulmonary tuberculosis showed that there was no relationship between tuberculosis and a history of contact with tuberculosis patients[4]. Shetty et al (2004) in Guterres et al (2014) stated that contact with tuberculosis patients was not a risk factor for pulmonary tuberculosis.[5]

Budi et al's research in 2018 concluded that statistically environmental factors in the house were significantly related to the incidence of tuberculosis, one of which was occupancy density.[6] Other research also states that the occupancy density factor shows a negative effect, meaning that if the density of the occupancy meets the requirements it can further reduce the risk of tuberculosis.[7] Meanwhile, Alnur's research in 2018 explained that the results of the statistical test analysis conducted showed that there was no significant relationship between the occupancy density variable and the incidence of tuberculosis.[2]

Furthermore, based on research of Muslih et al (2018) explained that people who live in a house with a ventilation area that does not meet the requirements have a 4.2 times greater risk of suffering from pulmonary tuberculosis compared to people who live in a house with an adequate ventilation area.[8] Then Mudiyono et al's research stated that the area of ventilation is the dominant risk factor for pulmonary tuberculosis.[9] Meanwhile, Izzati et al. Examined the risk factors associated with the incidence of pulmonary tuberculosis in the work area of Puskesmas Andalas found that the area of home ventilation had no significant relationship with the incidence of tuberculosis.[10] Currently, there is still a statistical gap between several studies related to the relationship between tuberculosis and patient contact history, occupancy density and the area of house ventilation. So this study was conducted to analyze the relationship between contact with tuberculosis patients, occupancy density and area of ventilation with the incidence of tuberculosis.

METHOD

This research uses a meta-analysis study. This research protocol uses the concept of Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA). Data search refers to database sources such as Google Scholar, PubMed, Directory of Open Access Journals (DOAJ) adjusted to the research title.

The population in this study are national and international journals related to the title of this research. The sample in this study amounted to a minimum of 10 national and international research articles (each independent variable) that met the inclusion criteria and were related to the research title of the contact relationship with TB patients, occupancy density and ventilation area with the incidence of tuberculosis.

The sampling technique in this study is using purposive sampling technique, which is a sample determination technique by selecting a sample among the population according to what the researcher wants (objectives and problems in the study) so that the sample can represent the characteristics of the population that have been previously known. Based on the known population characteristics, selection criteria were made.

The quality or feasibility assessment is based on data (research articles) by fulfilling predetermined inclusion criteria, namely the

type of study is quantitative, the design of the Case-Control study, the type of journal used is the original research article, the articles to be analyzed consist of international journals and national journals, reputable international journals (indexed by Scopus and/or Web of Science), accredited national journals (indexed Sinta 1 to Sinta 4), latest articles (5 - 10 years earlier), research articles with full text and having value Odds Ratio (OR) and maximum-minimum value. The statistical test used is the Effect Measure Odds Ratio by using a statistical application, namely the Review Manager (RevMan).

RESULTS AND DISCUSSIONS

Based on the research protocol that was made previously using the concept of Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA), the first step is to search for data or articles on sources such as Google Scholar, PubMed, Directory of Open Access Journals (DOAJ). The number of articles for the independent variable contact with tuberculosis patients was 211 articles, for the independent variable the occupancy density was 469 articles, while for the independent variable the area of ventilation was 205 articles.

After searching for data or articles, then screening and assessing the quality (feasibility) of data or articles that have been obtained regarding duplicate or the same articles, not journals, cannot be downloaded and do not meet the inclusion criteria with each independent variable, namely contact with TB patient was 199 articles excluded, the occupancy density was 457 articles excluded and the area of ventilation was 195 articles excluded. So that data or articles that meet the requirements for meta-analysis are obtained for the independent variable, namely contact with tuberculosis patients totaling 12 articles, for the independent variable is the occupancy density of 12 articles and for the independent variable the area of ventilation is 10 articles.

Articles that meet these conditions are then carried out meta-analysis using the Statistical Review Manager (RevMan) 5.3 application for each independent variable as follows:

Contact with tuberculosis patients

The results of statistical tests using the Review Manager (RevMan) 5.3 application for 12 articles that met the inclusion criteria for the independent variable were contacting with tuberculosis patients, which can be seen in Figure 1 below:

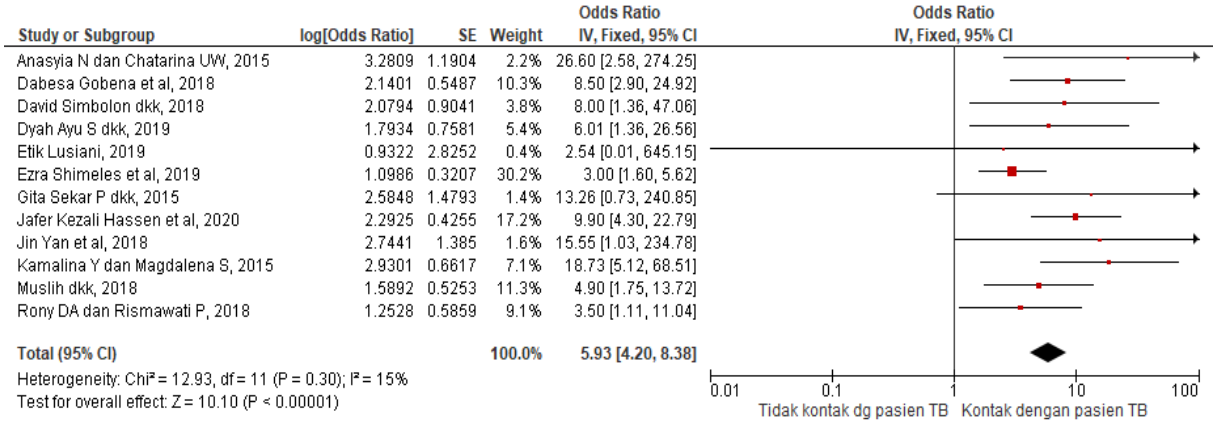

Figure 1. The results of statistical tests using the RevMan 5.3 application for independent variables of contact with tuberculosis patients

Based on Figure 1 above with a 95% degree of confidence, it can be concluded that people who have contact with tuberculosis patients are 5.93 times more likely to develop tuberculosis when compared to people who do not have contact with tuberculosis patients. The results of this study indicate that contact with tuberculosis patients is 5.93 times more likely to get tuberculosis when compared to people who do not have contact with tuberculosis patients, this result is in line with the theory that patients with pulmonary tuberculosis are a direct source of infection.

As it is known that the mode of transmission of Tuberculosis can be through droplets, so that exposure to droplets of Tuberculosis sufferers in those who live at home will be higher than those who do not live at home.[2] Contact history is important in pulmonary tuberculosis where the etiology of tuberculosis is the M. tuberculosis bacteria are very small, aerobic, can survive a long time in dry sputum so that they can easily be excreted through inhalation of sputum grains through coughing, sneezing or talking (droplet infection). So that frequent contact with patients with

active tuberculosis may be at risk of infection in healthy people.[4]

The presence of tuberculosis AFB + patients can be a potential source of transmission to the surrounding environment. The closer the contact, the greater the risk, therefore household contact with family members and neighbors and people closest to who is infected with tuberculosis is very infectious to transmit the pulmonary tuberculosis germs.[3]

The results of this study are in line with several other studies such as research by Muslih et al (2018) showing that women in Brebes Regency who have a history of contact with adult pulmonary tuberculosis sufferers are 4.1 times more likely to suffer from pulmonary tuberculosis compared to women who have no history of contact with adult pulmonary tuberculosis. patients with pulmonary tuberculosis[8]. According to the results of research by Prihanti et al (2017) that contact with TB patients has a significant effect on the incidence rate of pulmonary tuberculosis with an OR value of 13.26.[7]

In addition, the research of Simbolon et al (2018) entitled Spatial analysis and Risk Factors of Pulmonary Tuberculosis in Sidikalang Sub-district of Dairi District - North Sumatera concluded that people who had a history of contact with patients with pulmonary tuberculosis were 8 times higher than those who had a history of contact with pulmonary tuberculosis sufferers. there is no history of contact with tuberculosis patients.[11] Furthermore, research by Gobena et al (2018) in Ethiopia said that a history of contact with tuberculosis was identified as a predictor of tuberculosis cases with an 8.5 times greater likelihood of contracting tuberculosis when compared to people who did not have a history of contact with tuberculosis patients.[12]

Research by Hassen et al (2020) entitled Determinants of Pulmonary Tuberculosis in Public Health Facilities of Dire Dawa City, Eastern Ethiopia: Unmatched Case-control Study explains that history of contact with TB patients is independently associated with tuberculosis infection with OR values amounted to 9.9.[13]

Occupancy density

The results of statistical tests using the Review Manager (RevMan) 5.3 application for 12 articles that meet the inclusion criteria for the independent variable are occupancy density can be seen in Figure 2 below:

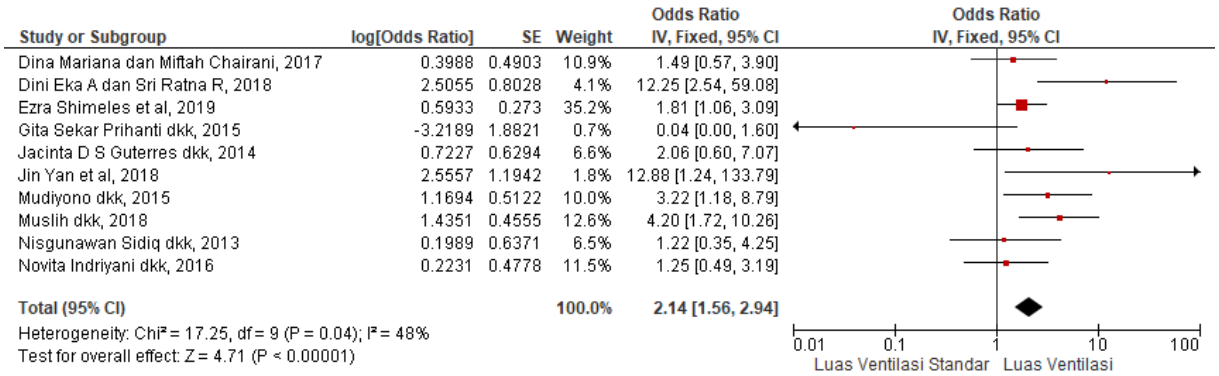

Figure 2. The results of statistical tests using the RevMan 5.3 application for the independent variable of occupancy density

Based on Figure 2 above with a degree of confidence of 95%, it can be concluded that people who live in densely populated areas are 2.41 times more likely to develop tuberculosis when compared to people who live in less crowded housing.

The results of this study indicate that people who live in densely populated areas are 2.41 times more likely to get sick with tuberculosis when compared to people who live in densely populated areas, this result is in line with the theory that density is a risk factor for incidence of tuberculosis.

The biggest factors affecting the degree of health are environmental factors and people's behavior that can harm health. Tuberculosis is an environmentally based disease. One of the risk factors for tuberculosis transmission is occupancy density[14]. The conditions of various environments that are transmitted can affect the spread of tuberculosis, one of which starts from the conditions of the residence, namely the home environment. The home environment is one of the factors related to the health status of its occupants which plays a role in the spread of pulmonary tuberculosis germs. Pulmonary tuberculosis germs can live 1-2 hours, days or even weeks depending on the presence or

absence of sunlight, ventilation, temperature, humidity, and occupancy density.[15]

The density of residents in one house will have an impact on the occupants. The size of the house which is not proportional to the number of residents will cause it to be overcrowded. This is unhealthy because in addition to causing a lack of oxygen consumption, if one of the family members has an infectious disease, especially tuberculosis, it will be easily transmitted to other family members.[15]

In theory, the physical condition of the house that meets the health requirements means that it is directly concerned with the composition of the area of residence with the number of occupants, as well as the number of rooms that are adjusted to the number of residents of the house so that the occupancy of the house is in accordance with health standards, there is no dense occupancy. Thus it will minimize the risk of transmission of airborne diseases because there is no increase in water vapor, temperature or CO_2 levels in the house which is a good medium for the growth of tuberculosis bacteria.[16]

In theory and several studies suggesting that occupancy density can have a role in pulmonary tuberculosis transmission because occupancy density can cause cross-infection by air or "droplets" originating from people with pulmonary tuberculosis in the home with a high enough density.[15]

The results of this study are in line with Kapoor et al (2016) entitled Pattern of socio-economic and health aspects among TB patients and controls which states that the number of individuals per room (as a measure of density) is a major risk factor for tuberculosis with a probability of 3 times greater than that of people. who live in less crowded housing.[17] In addition, research by Mudiyono et al (2015) in Pekalongan City reported that there was a relationship between occupancy density and the incidence of pulmonary TB in children with an OR value of 3.37.[9]

Other researchers such as Aditama et al (2019) with the research title Relationship between Physical Conditions of House Environment and the Incidence of Pulmonary Tuberculosis with a 95% degree of confidence concluded that occupancy density is a risk factor that affects the incidence of tuberculosis.[18] Research by Yustikarini (2015) also found that occupancy density is a risk factor that affects the incidence of TB disease with an OR value of 6,54.[19]

Ventilation Area

The results of statistical tests using the Review Manager (RevMan) 5.3 application for 10 articles that meet the inclusion criteria for the independent variable are the area of ventilation, which can be seen Figure 3 below in:

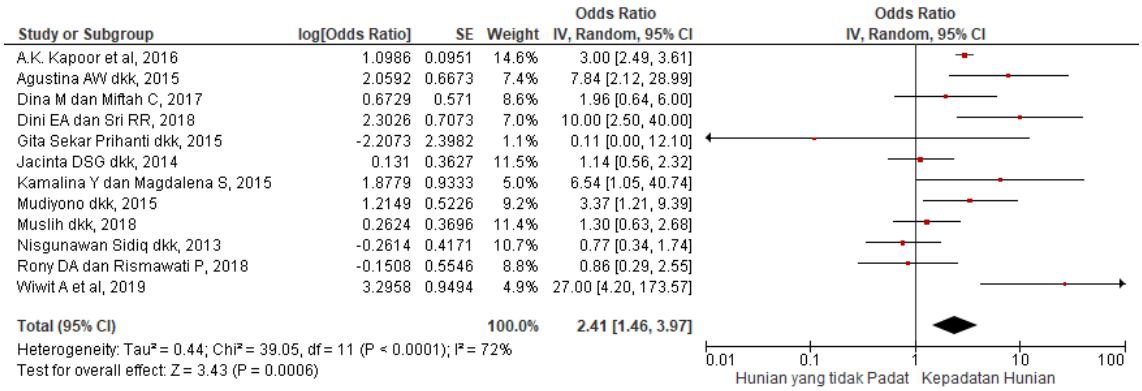

Figure 3. The results of statistical tests using the RevMan 3 application for the independent variable of ventilation area

Based on Figure 3 above with a 95% degree of confidence, it can be concluded that people who live in dwellings where the ventilation area is not standardized are 2.14 times more likely to develop tuberculosis when compared to people who live in an area where the ventilation area meets the standard.

The results in this study indicate that people who live in dwellings with non-standard ventilation areas are 2.14 times more likely to get tuberculosis when compared to people who live in occupancy areas where the ventilation area meets the standard, this result is in line with the theory that one of the factors the risk of incidence of tuberculosis is the area of the occupancy ventilation.

Ventilation is the process by which clean air from outside the room is deliberately flown into the room and bad air from inside the room is expelled. Ventilation has many functions. The first function is to keep the air flow in the house fresh. This means that the oxygen balance needed by the residents of the house is maintained. Lack of ventilation will cause a lack

of oxygen in the house, besides that lack of ventilation will cause the humidity of the air in the room to rise. This humidity is a good medium for the growth of pathogenic bacteria/bacteria that cause disease, such as tuberculosis. The second function of ventilation is to free the room air from bacteria, especially pathogenic bacteria because there is always a continuous flow of air. Another function is to keep the room in optimum humidity.[16]

Ventilation affects the process of air dilution, in other words, it can dilute the concentration of tuberculosis bacteria and other bacteria that are carried out and die because of the sun, a house that is not ventilated will result in obstruction of the process of exchanging airflow and sunlight entering the house.[20] The results of this study are in line with the research of Ezra Shimeles et al (2019) entitled Risk factors for tuberculosis: A case-control study in Addis Ababa, Ethiopia, saying that patients who live in a house without a window or one window are almost twice as likely to develop tuberculosis than with people whose houses have many windows. The research of Mudiyono et al (2015) also concluded that there was a relationship between the area of ventilation and the incidence of TB with an Odds Ratio value of 3.22, which means that people living in a dwelling with a non-standard ventilation area are 3.22 times more likely than people who live in a dwelling. whose ventilation area meets the standards.[9]

Research by Jin Yan et al (2018) in China found that poor workplace ventilation is an independent risk factor for tuberculosis (Jin yan, 2018). Muslih et al (2018) also examined the factors that influence the incidence of tuberculosis and concluded that the factor that was proven to be at risk for the incidence of pulmonary tuberculosis was the area of ventilation, with an OR value of 4.2.[22]

CONCLUSION

The conclusion from the meta-analysis of these articles is that contact with tuberculosis patients has a 5.93 times more risk of developing TB when compared to people who do not have contact with TB patients, people who live in densely populated areas are 2.41 times more likely risk of getting TB when compared with people who live in occupancy that is not crowded, and people who live in an area where the ventilation is not standardized are 2.14 times more likely to develop TB when compared with people who live in an area where the ventilation area meets the standard.

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