Meta-Analysis: Risk Factor Analysis of Tuberculosis Incidence

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Abstract

Tuberculosis is an infectious disease caused by the mycobacterium tuberculosis that remains a major global health problem with an estimated 10.4 million new cases of tuberculosis each year. Pulmonary Tuberculosis is a disease that has been around for a long time and is still a major problem in the health sector. Indonesia is the second largest contributor to the increase in tuberculosis cases globally. The meta study of this analysis aims to be a guide in decision making to prevent the community from Tuberculosis transmission in the future. Statistical methods in this Meta-Analysis study was combined the selected 6 articles of quantitative research from 47,474 by finding summary value using a review manager software version 5.4.1 and using a review of articles or journals that have been published for less than 5 years and are available in an online database such as Garuda, SINTA, PubMed, and Science Direct Meta analysis indicates that smoking behavior (95% ci : 1,93-6,62; P value < 0.0001), residential density (95% cl : 1,68-24,81; P value = 0.007), and humidity of 1,934 (95% ci : 1,02-2,43; P value = 0.004) increases the chances for tuberculosis. The study concluded that all variables such as smoking behaviour, residential density, and humidity increase the likelihood of tuberculosis. It has to recommended that the decision makers on Health Office force to providing more media promotion and education to patients and their families about efforts to prevent and control TB disease is expected to prevent transmission of pulmonary tuberculosis transmission in Indonesia.

Keywords: Meta-analysis, Risk factors, Tuberculosis

INTRODUCTION

Tuberculosis is a disease infection caused by bacteria Mycobacterium tuberculosis also known as Acid Fast Bacteria (BTA), a group of bacteria that can cause obstruction of the airways known as MOTT (Mycobacterium Other Than Tuberculosis) which sometimes can interfere with the diagnosis and tuberculosis treatment (Haryanik, 2023). According to the Health Organization World (WHO) statement in 2020, Mycobacterium (Kemenkes, 2018). Tuberculosis still become a major global health problem with an estimated 10.4 million new cases tuberculosis annually. Tuberculosis to be the cause of human death quite large worldwide with 95% deaths occur in developing countries. In 2020, the largest number of cases New TB cases, namely 43%, occurred in the Region WHO outheast Asia, followed by WHO Africa region, with 25% of cases and the WHO West Pacific Region with 18%. TB occurs in every part world (WHO, 2022). In 2020, 86% of TB cases occurred in 30 countries with a TB burden tall one. Eight countries accounts for two-thirds of TB cases such as India, China, Indonesia, Philippines, Pakistan, Nigeria, Bangladesh, and South Africa (WHO, 2022).

Globally, total incidents of tuberculosis are consistently declining every year, but not yet achieve the goal of End Tuberculosis. Strategy, namely reducing the total incidents of tuberculosis by 20% between 2015-2020. Average reduction in total incidents tuberculosis is 1.6% per year or 10,000 (132/100,000 population) in the period 2000 to 2018, however, new cases of relapsed tuberculosis and reported from 2000 to 2018 has increased to 7,253,116. The total incidence of tuberculosis decreased by 2% annually between 2017 and 2018. Southeast Asia region too decreased the total incidence tuberculosis from 2000 to 2018, that is, to 4,370 (220/100,000 population), and has increased for new tuberculosis cases recurrence and reported from 2000 until 2018 to 3,362,783. The total incidence of pulmonary tuberculosis in Indonesia from 2000 to 2018 experienced decreased to 845 (316/100,000 population), but cases of pulmonary tuberculosis recently relapsed and reported in Indonesia from 2000 to 2018 increased to 570,289 (WHO, 2022).

According to Ministry data RI Health, Indonesia is at third position with the highest number of tuberculosis sufferers in the world after India and China, followed by the Philippines, Pakistan, Nigeria, Bangladesh, and Democratic Republic of the Congo by successively. The number of cases found in 2021 there are 397,377 cases tuberculosis (TB) throughout Indonesia. This figure has increased over the year before, namely 351,936 cases in 2020. The highest number of tuberculosis cases mostly found in West Java, followed Central Java, and East Java. Case tuberculosis in the three provinces contributed a figure of 44% of the total number of cases of tuberculosis in Indonesia . Most of tuberculosis cases were found in the age group of 45–54 years with a proportion of 17.5% of the total national case. Followed by the age group 25–34 years with a proportion of 17.1%, and the age group of 15–24 years with 16.9% (Kemenkes, 2022).

Tuberculosis can be caused by historical factors tuberculosis in the family. If one family member is exposed to tuberculosis than a possibility other family members will be infected. Transmission of tuberculosis in the family occurs due to frequent contact directly with tuberculosis patients who live in one house. Besides that, patient behavior factors affect the occurrence of events tuberculosis. The sufferer's behavior of often throwing phlegm carelessly can affect the people around him contracted because TB bacteria are found in the patient's sputum. TB sufferers who do not apply cough ethics and PHBS in their residence can provide a chance of TB bacteria easily infecting other people (Widodo, 2021).

Another factor that could expose someone to TB disease is smoking behavior. If someone has a smoking habit then that person is more susceptible to infection by TB bacteria. Environmental conditions house could be another factor in TB incidents (Maria Loihala, 2016).

A house that doesn't have good and less lighting entered by sunlight is a factor that can make TB bacteria survive in the home environment so TB incidence was increased (Ediana, 2021; Mardjoen, 2019; Ulprastika, 2022)

The purpose of this research is to find out in more detail the factors with the highest risk of the incidence of tuberculosis using a meta-analysis method (Susanti, 2016).

METHODS

This research uses a meta-analysis method which is quantitative and combines some (two or more) research results with determines the summary value in review manager software version 5.4.1. with the theme Risk Factors tuberculosis in Indonesia. Strategy research protocol search using PRISMA (Preferred Reporting Items for Systematic Review and Meta-Analyses).

Search articles and journals using the Pubmed, Science Direct, Sinta, Garuda databases with the keywords risk factors, tuberculosis, environment, knowledge, and pulmonary tuberculosis. The selected research articles have the theme of tuberculosis risk factors with Indonesian and English as the language of instruction. With an article spanning the last 5 years and fully accessible. Total of articles that including the criteria was 152879 articles and pursed to 6 articles that meet the main criteria to be analysis.

RESULTS

The steps in conducting meta-analysis are study identification, study selection, data abstraction, and data analysis. First, study identification. From all the information obtained from each article presented in a systematic review, it was seen that the variables included in the social determinants of tuberculosis incidence. Second, study selection. The identified articles were selected based on established inclusion criteria, namely journals with an analytic study design and factors that are most at risk for the incidence of tuberculosis by looking at a p value <0.05.

Third, data abstraction. This is done based on all the information obtained from each selected research article. All data is then converted into a tabular format which includes the author's name, the year the article was published, case data (events and totals) and control data (events and totals).
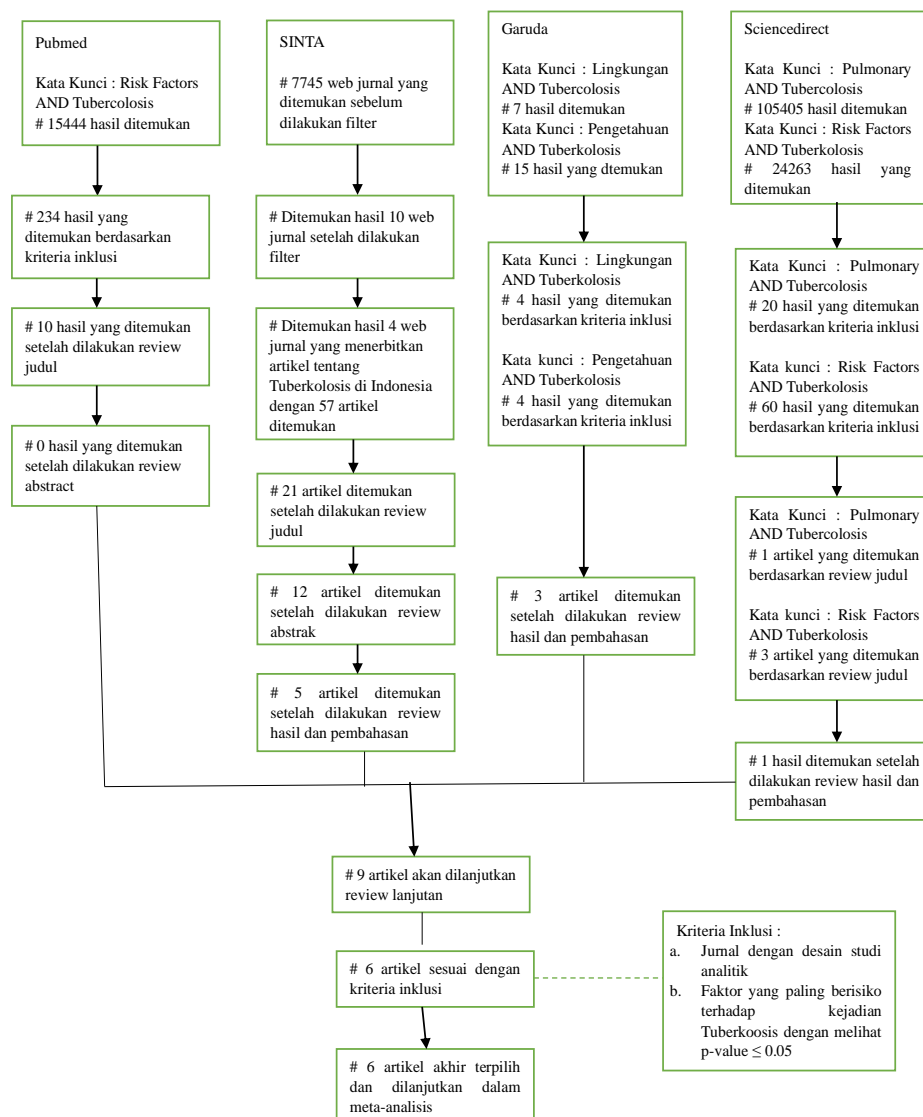
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SINTA

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5 artikel ditemukan setelah dilakukan review hasil dan pembahasan

Garuda

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Kata Kunci : Lingkungan AND Tuberkolosis
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Kata Kunci : Pulmonary AND Tubercolosis
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Kata kunci : Risk Factors AND Tuberkolosis
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9 artikel akan dilanjutkan review lanjutan

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6 artikel sesuai dengan kriteria inklusi

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6 artikel akhir terpilih dan dilanjutkan dalam meta-analisis

Kriteria Inklusi :
a. Jurnal dengan desain studi analitik
b. Faktor yang paling berisiko terhadap kejadian Tuberkoosis dengan melihat p-value ≤ 0.05

Figure 1. *Prisma Diagram*

And the last one is data analysis. Data analysis is used by looking at the p-value heterogeneity to determine whether the data is heterogeneous or homogeneous, looking at the I^2 value to determine the range of data diversity, looking at the p-value to determine whether a variable is significant or not significant, and looking at the combined OR value to determine the level of risk of a variable to tuberculosis incident.

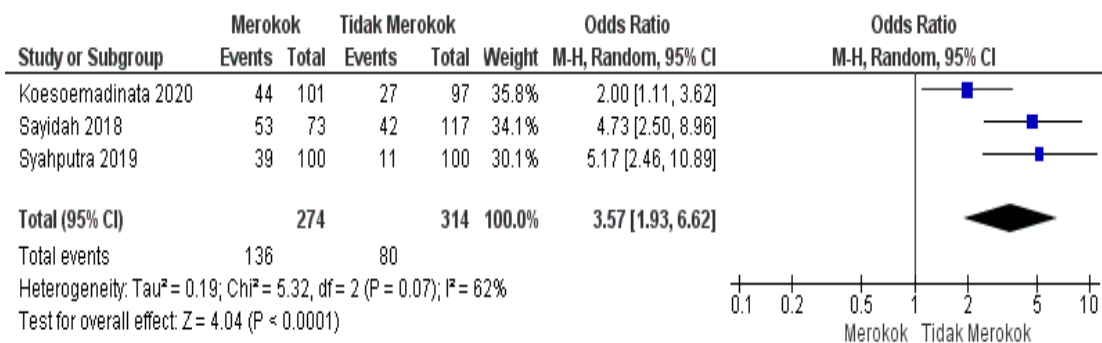## 1. Effect of Smoking Behavior on Tuberculosis Incidence

Study or Subgroup	Merokok Events	Total	Tidak Merokok Events	Total	Weight	Odds Ratio M-H, Random, 95% CI
Koesoemadinata 2020	44	101	27	97	35.8%	2.00 [1.11, 3.62]
Sayidah 2018	53	73	42	117	34.1%	4.73 [2.50, 8.96]
Syahputra 2019	39	100	11	100	30.1%	5.17 [2.46, 10.89]
Total (95% CI)		274		314	100.0%	3.57 [1.93, 6.62]
Total events	136		80			

Heterogeneity: Tau² = 0.19; Chi² = 5.32, df = 2 (P = 0.07); I² = 62%
Test for overall effect: Z = 4.04 (P < 0.0001)

Figure 2. Effect of Smoking Behaviour on Tubercolosis

From the results of the forest plot in Figure 2. the heterogenity section obtained a p value <0.5, which is equal to 0.07, meaning that the data is heterogeneous with a diversity level of 62%, so the results used are a random effect model. In addition, a p-value <0.0001 was obtained, which means that there was a significant relationship between smoking behavior and the incidence of tuberculosis with a combined OR of 3.57, meaning that people who smoke have a risk of contracting tuberculosis 3.57 times compared to people who do not smoke.

This is in line with research conducted by Koesoemadinata (2020), obtained a p value of 0.021 which indicates a significant relationship between smoking behavior and the incidence of tuberculosis with an OR of 2.00 meaning that people who smoke have a risk of contracting tuberculosis 2 times compared to people who smoke. do not smoke. So it can be said that smoking behavior factors influence the occurrence of tuberculosis (Koesoemadinata et al., 2020).

2. Effect of Residential Density on Tuberculosis Incidence

Study or Subgroup	Kasus Events	Total	Kontrol Events	Total	Weight	Odds Ratio M-H, Random, 95% CI
Devi 2020	14	24	38	80	32.7%	1.55 [0.62, 3.89]
Sayidah 2018	44	98	6	96	32.7%	12.22 [4.88, 30.59]
Syahputra 2019	63	75	32	115	34.6%	13.62 [6.50, 28.54]
Total (95% CI)		197		291	100.0%	6.46 [1.68, 24.81]
Total events	121		76			

Heterogeneity: Tau² = 1.22; Chi² = 14.80, df = 2 (P = 0.0006); I² = 86%
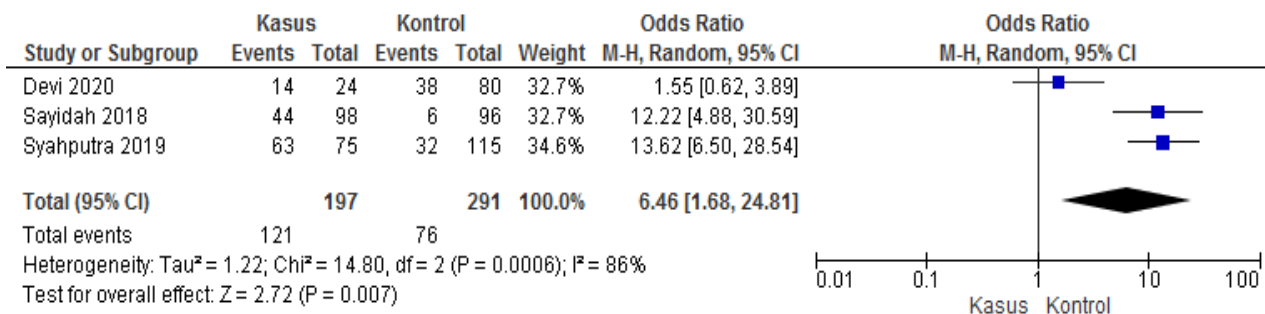Test for overall effect: Z = 2.72 (P = 0.007)

Figure 3. Forest Plot Effect of Residential Density on Tuberculosis Incidence

From the results of the forest plot in Figure 3. the heterogeneity section obtained a p-value <0.5 which is equal to 0.0006 meaning that the data is heterogeneous with a diversity level of 86% so the results used are the random effect model. In addition, a p-value of <0.05 was obtained, which was 0.007, which meant that there was a significant relationship between occupancy density and the incidence of tuberculosis with a combined OR of 6.46, meaning that people who live in an environment with a high level of occupancy density have a risk of contracting tuberculosis 6, 46 times compared to people living in neighborhoods with low occupancy rates (Diana Sayidah et al., 2018; Lusy Ika Susanti, 2016; Suari Melinda Dewi, 2018).

This is in line with research conducted by Syahputra (2019), obtained a p value <0.001 which indicates a significant relationship between smoking behavior and the incidence of tuberculosis with an OR of 10.35 meaning that people who smoke have a risk of contracting tuberculosis 10.35 times compared to non-smokers. So it can be said that the occupancy density factor has an influence on the occurrence of tuberculosis.

3. The Effect of Humidity on the Incidence of Tuberculosis

Study or Subgroup	Kasus Events	Total	Kontrol Events	Total	Weight	Odds Ratio M-H, Fixed, 95% CI
Amelia s 2021	20	200	12	200	32.9%	1.74 [0.83, 3.66]
Devi A 2020	25	47	22	47	31.3%	1.29 [0.57, 2.90]
Rindu MS 2022	35	62	27	62	35.8%	1.68 [0.83, 3.42]
Total (95% CI)		309		309	100.0%	1.58 [1.02, 2.43]
Total events	80		61			

Heterogeneity: Chi² = 0.33, df = 2 (P = 0.85); I² = 0%
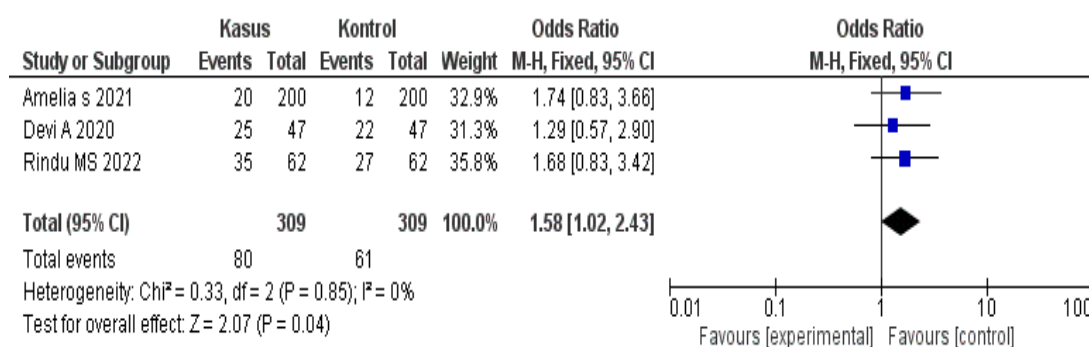Test for overall effect: Z = 2.07 (P = 0.04)

Figure 3. Forest Plot Effect of Humidity on Tuberculosis Incidence

From the results of the forest plot in Figure 3. the heterogeneity section obtained a p value > 0.5 which is equal to 0.85 meaning that the data is homogeneous so that the results used are the fixed effect model. In addition, a p value of <0.05 was obtained, which was 0.04, which meant that there was a significant relationship between humidity and the incidence of tuberculosis with a combined OR of 1.58, meaning that people with residences that did not meet humidity requirements had a risk of contracting tuberculosis 1.58. compared to people with a place of residence that meets humidity requirements (Pangaribuan et al., 2020; Perdana & Putra, 2018; Sari, 2018).

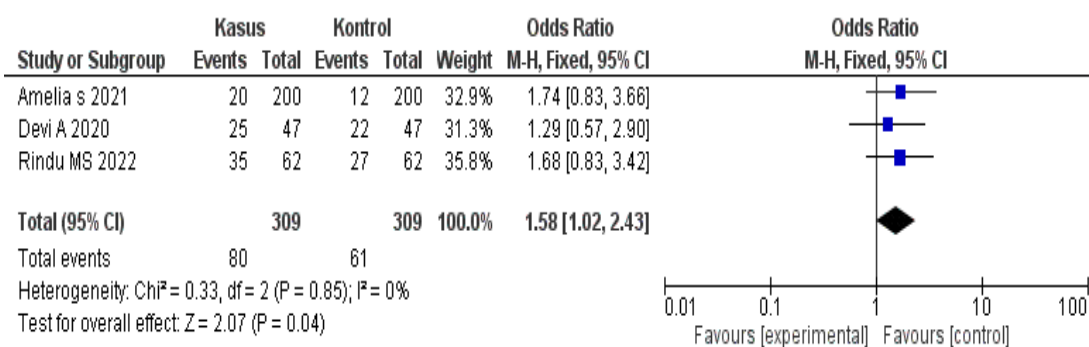## 4. The Effect of Humidity on the Incidence of Tuberculosis

Study or Subgroup	Kasus Events	Total	Kontrol Events	Total	Weight	Odds Ratio M-H, Fixed, 95% CI
Amelia s 2021	20	200	12	200	32.9%	1.74 [0.83, 3.66]
Devi A 2020	25	47	22	47	31.3%	1.29 [0.57, 2.90]
Rindu MS 2022	35	62	27	62	35.8%	1.68 [0.83, 3.42]
Total (95% CI)		309		309	100.0%	1.58 [1.02, 2.43]
Total events	80		61			

Heterogeneity: Chi² = 0.33, df = 2 (P = 0.85); I² = 0%
Test for overall effect: Z = 2.07 (P = 0.04)

Figure 4 Forest Plot Effect of Humidity on Tuberculosis Incidence

From the results of the forest plot in Figure 4. the heterogeneity section obtained a p-value> 0.5 which is equal to 0.85 meaning that the data is homogeneous so that the results used are the fixed effect model. In addition, a p-value of <0.05 was obtained, which was 0.04, which meant that there was a significant relationship between humidity and the incidence of tuberculosis with a combined OR of 1.58, meaning that people with residences that did not meet humidity requirements had a risk of contracting tuberculosis 1.58 compared to people with a place of residence that meets humidity requirements (Amelia S, 2021; Rindu et al., 2022; Dewi, 2018).

This is in line with research conducted by Amelia (2020) which obtained a p value of 0.045 which showed a significant relationship between humidity and the incidence of tuberculosis with an OR of 2.528 meaning that people with residences that do not meet humidity requirements have a risk of contracting tuberculosis 2.528 compared to people with a residence that meets humidity requirements. So it can be said that the humidity factor has an influence on the occurrence of tuberculosis (Amelia S, 2021; Sayidah et al., 2018; Sriagustini, 2018).

DISCUSSION

Agent, Host and Environment Factors

The results of the description of each Regency/City on the agent factor, Jambi regency and Sungai Penuh City and Batanghari Regency with the highest risk of COVID-19 disease cases must make various efforts in countermeasures and Prevention to break the chain of transmission (Ristianto et al., 2021). Efforts to prevent COVID-19 disease can be done with the five levels of prevention efforts by means of counseling, community development, advocacy; specific protection by using a mask, hensanitaizer, and washing hands with soap in

running water, protecting yourself (stay safe), early diagnosis by screening such as rapid tests and PCR, disability limitation monitoring the treatment of COVID-19 disease, rehabilitation with intensive treatment in the hospital (Verawati et al., 2021).

The results of the description of each district / city to the host factor, Sarolangun and Tanjab Barat Regency and Bungo regency is an area with the highest vulnerable groups of pregnant women. Vulnerable groups such as pregnant women have a high level of anxiety about getting pregnant during the covid-19 pandemic to carry out pregnancy consultations to health service facilities such as puskesmas and hospitals (Oktavienty et al., 2019; Widyastuti et al., 2021). Excessive anxiety can cause stress and fatigue, so that the condition can cause the body's immune tends to decrease. Based on the results of research conducted by Aslinda Hafid, it shows that the COVID-19 pandemic affects pregnant women during the COVID-19 pandemic. Thus, the results of the research by Setyawan et al, show that pregnant women suffering from COVID-19 are at higher risk of severe disease, morbidity, and mortality compared to the general population (Hafid & Hasrul, 2021).

In addition to the vulnerable group of pregnant women, toddlers are a vulnerable group that must be considered during the COVID-19 pandemic. The districts / cities with the highest toddler vulnerable groups are Muaro Jambi regency and Bungo regency and Merangin Regency. Vulnerable groups under five must be of particular concern during the COVID-19 pandemic, especially in obtaining health and nutritional needs. Nutritional needs can affect growth and development to prevent malnutrition problems such as stunting. Based on the results of research conducted by Besti Verawati and Yesti Yuwansyah, it shows that COVID-19 affects the nutritional status of toddlers in the level of maternal knowledge of nutrition during the COVID-19 pandemic (Yuwansyah et al., 2021)

In addition to vulnerable groups of pregnant women and toddlers, vulnerable groups of the elderly or elderly have a high risk of transmission of COVID-19 disease cases. A weakened immune system plus the presence of chronic diseases can increase the risk of COVID-19 in the elderly, both the risk of COVID-19 infection and the risk of causing severe disorders, even death. Things like this must be watched out by the government against the elderly (elderly). Based on the results of research conducted by Hidayani, the most dominant is the age of 65 years with HR 2,563, which means that people or patients aged 65 years are at 2.6 times greater risk of covid-19 than those aged less than 65 years (Ratna et. al, 2020).

Environmental Factors (Social Demographics)

The spread of COVID-19 disease is not only based on agent and host factors. However, environmental factors have a considerable role in the spread directly and indirectly in the increase in cases of COVID-19 disease. Jambi city, Sungai Penuh City and Bungo regency are areas with high population density. The high level of population density will pose a risk of high transmission rates in the transmission of the spread of COVID-19 disease. Efforts that can be made are social restrictions, social and physical distancing, complying with health protocols and washing hands before and after activities. In addition to these efforts, the government also requires the conduct of vaccination efforts. This effort is proven to reduce the transmission of the spread of COVID-19 disease. Social restriction efforts are listed in Government Regulation Number 21 of 2020 concerning large-scale social restrictions in order to accelerate the handling of Corona Virus Disease (COVID-19) (Amin et al., 2021).

The Corona Virus Disease-19 (COVID-19) pandemic has had a significant impact on various sectors of life, including the Indonesian economy, which has also been affected. To overcome the poverty level in the new normal era due to the COVID-19 pandemic, the government has tried hard. One of the efforts made is to provide and distribute government social assistance (BANSOS) and also non-cash food assistance (BNPT) to the community. Thus, with the efforts made by the government, in accordance with the circular letter of the Minister of Home Affairs number 440/2622/SJ on the establishment of the task force for the acceleration of handling the Corona Virus (COVID-19) in 2020 that in the event that social restrictions cause an impact on community groups with low income, the regions can provide social assistance.

Efforts to overcome the Corona Virus Disease-19 (COVID-19) pandemic cannot be separated from the importance of health care centers such as hospitals and health centers. Health care is basically an activity that improves the optimal health status for the community. The efforts that can be done by the government are optimizing health services in hospitals and health centers, making recommendations for referral hospitals for Corona Virus Disease-19 (COVID-19) and establishing special hospitals for COVID-19 patients. This is the effort that the government should make. Efforts like this are also included in the health Decree Number 01.07/230/year 2020 regarding guidelines for organizing field hospitals/emergency hospitals during the Corona Virus Disease-19 (COVID-19) pandemic.

CONCLUSIONS

From the results of the meta-analysis, it can be concluded that the highest risk factor for tuberculosis is occupancy density. This variable has a 6.46 times greater risk of developing tuberculosis compared to individuals who live in an environment with a low level of occupancy density. It is suggested to relevant policymakers to further improve health promotion related to tuberculosis prevention, especially in groups with environmental risk factors such as occupancy density, humidity, and smoking habits.

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