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MAPPING OF TUBERCULOSIS CASE AND CLIMATE CONDITION OF PADANG CITY

* Elsa Yuniarti[1,2], Siti Fatimah[3], Indang Dewata[3], and Heldi[3]
[1]Doctoral Program of Environmental Science (Student), Universitas Negeri Padang
[2]Lecturer of Biology Department, Faculty of Mathematic and Natural Science,
Universitas Negeri Padang
[3]Lecturer of Environmental Science, Universitas Negeri Padang
Email: elsayuniarti@gmail.com

ABSTRACT

Padang as one of the cities in West Sumatra Province has a fairly high confirmed Tuberculosis case. The prevalence of pulmonary tuberculosis is influenced by ecological, geographic and climatic factors. Geographic Information Systems (GIS) that can be used as a tool that can show public health problems, especially health problems that are area-based. The aim of the study was to look at the distribution of positive smear pulmonary TB cases and the conditions of rainfall, humidity, temperature and wind speed with the use of the GIS web application in Padang City in 2018. Data are presented in the form of vulnerability maps and tables. The city of Padang has the highest humidity and suspected cases of AFB + in the Koto Tangah District.

Keywords: **TB Pulmonary, BTA positive, SIG, Climate**

INTRODUCTION

The contribution of climate change due to ecological imbalance affects the immune system against disease Aprihatin *et al*., 2020; Arlym *et al*., 2020; Armaita *et al*., 2020; Asman *et al*., 2020), one of which is tuberculosis (TB). TB is an infectious lung disease caused by the bacterium *Mycobacterium tuberculosis*. These bacteria get their energy from the oxidation of various simple carbon compounds and the temperature of 30-40˚C is the best temperature in stimulating bacterial growth (Ruswanto, 2010).

World Health Organization (WHO) data in 2014 showed TB killed 1.5 million people in the world, death occurred in 890,000 men, 480,000 in women and 180,000 in children (WHO, 2014). There are several countries that have the largest number of new TB cases in the world with Indonesia in WHO 2019 data as the top three in the world (WHO, 2019). In Indonesia the detected TB incidence is 61% or reaches 340,542

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confirmed patients. Whereas the TB incidence rate in West Sumatra reaches 43% (Sugihantono, 2019). Padang City as the capital of West Sumatra Province has quite high confirmed TB cases. During the period of 2018 in Padang City there were 10,642 suspected pulmonary TBs and 984 BTA + from the examination results (Dinas Kesehatan Kota Padang, 2019).

The prevalence of pulmonary TB is influenced by ecological, geographic, climatic and socio-economic factors, including regional heights, climate, air pollution, national economic levels, unemployment, poverty and social instability (Hastuti and Ibrahim, 2017). High temperatures, polluted air, the spread of diseases that cause infections. All of that is also the impact of climate change (Hermon, 2014; Heise, 2014). Climate change affects the body, even though the body has the ability to regulate body temperature. Some studies reveal that cold temperatures affect and weaken the immune system. Decreased immune system makes a person vulnerable to infection. Infection can be caused by viruses, parasitic bacteria or fungi (Prayoga, 2008). Mudiyarso in Hermon (2010); Hermon (2015); Prarikeslan *et al*., (2020); Suryani *et al*., (2020); Wilis *et al*., (2020) states that climate change can also cause that in the 20th century an increase in rainfall in the tropics by 0.2-0.3%.

Pulmonary TB data in Padang City are not in the form of Geographic Information Systems (GIS). Mapping the distribution of cases has not been done (Hermon, 2015; Chandra *et al*., 2020; Juita *et al*., 2020; Oktorie and Bert, 2020; Juita *et al*., 2020). This causes the description of the distribution of pulmonary TB cases by region in the city of Padang is not known with certainty. This study uses the concept of health geography which discusses diseases from spatial aspects. Through the GIS website using Arc GIS software (Delina, et.al., 2019) which has been developed with the relative importance and importance of each factor (Ghanavati, 2016; Yanti *et al*., 2020; Yuniarti *et al*., 2020). Health geography includes exploration, modeling of space and time of disease events, related to environmental issues, detection and analysis of clusters and patterns of disease spread, causal analysis and mitigation formulations related to pulmonary TB disease in the city of Padang.

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METHOD

This type of research is quantitative analytic with ecological studies using GIS analysis techniques using Arc-GIS 10.5 Software with query and proximity analysis tools, namely by analyzing overlay maps, multi-ring buffer and buffer analysis, polygon to raster analysis, and weighted overlay analysis (Arlym, et.al., 2019). The sample in this study is the population that is the whole person / individual affected by pulmonary TB disease listed on the health profile of Padang City in 2018. The variables in this research are population density, rainfall, humidity, temperature and wind speed obtained from secondary data. Data is presented in the form of vulnerability maps and tables with cross tabulation calculations.

RESULTS AND DISCUSSION

The incidence of pulmonary TB in Padang City was found 10,942 suspected patients and 984 smear + pulmonary TB patients.

Table 1. Rainfall

Sub-district	Suspect	BTA +	Rainfall mm/m
Koto Tangah	2421	176	341 – 360 Medium
Lubuk Begalung	1417	114	<250 Low
Kuranji	1350	140	301 – 340 Low
Padang Timur	1237	127	251 – 300 Low
Padang Selatan	1094	126	251 – 300 Low
Lubuk Kilangan	702	22	251 – 300 Low
Padang Barat	646	36	251 – 300 Low
Padang Utara	561	72	251 – 300 Low
Nanggalo	504	66	251 – 300 Low
Pauh	377	63	251 – 300 Low
Bungus Teluk kabung	333	42	251 – 300 Low

In general, it is located in a low rainfall area. In areas that have a range of medium to high rainfall have a high prevalence of disease. The high rainfall is one of the supporting factors for developing the disease. The results of this analysis show that the Koto District is an area with 341-360 mm/month rainfall which is the most dominant prevalence of lung TB, with confirmed cases of 2421 suspected patients and 176 AFB+. Kecepatan angin memiliki hubungan dengan kejadian TB paru.

Table 2. Wind velocity

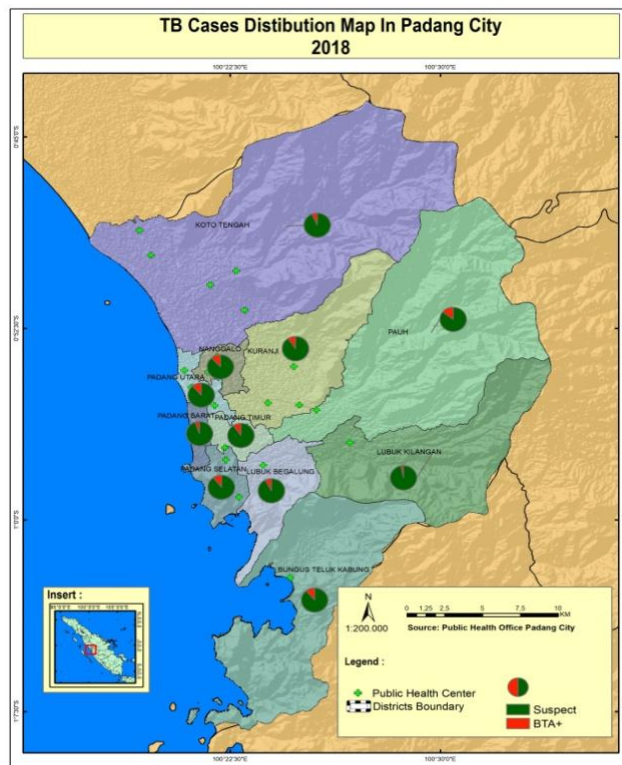| Sub-district	Suspect	BTA +	Wind Velocity (Km/h)
Koto Tangah	2421	176	3
Lubuk Begalung	1417	114	4
Kuranji	1350	140	4
Padang Timur	1237	127	4
Padang Selatan	1094	126	3
Lubuk Kilangan	702	22	4
Padang Barat	646	36	5
Padang Utara	561	72	4
Nanggalo	504	66	3
Pauh	377	63	4
Bungus Teluk kabung	333	42	4

Fig. 1. TB Cases in Padang City

The working area of the Padang City Public Health Center on average most of the area is normal air speed, this is an excellent medium for the development of microorganisms and *Mycobacterium tuberculosis*. The relationship of the characteristics of wind speed with the spread of cases of pulmonary tuberculosis shows, that most of the areas in the normal wind velocity of spreading the most cases are in the highlands blood.

The flow of strong wind speeds can affect air temperature, humidity and rainfall around the area so that it can cause the physical environment of the house to change is humidity and room air temperature will decrease, and this can affect the development of *Mycobacterium tuberculosis* germs to grow. The speed of the wind in the city of Padang during the day is a bit strong, but at night the wind speed becomes normal. The working area of the Padang City Public Health Center has high humidity levels.

Table 3. Humidity

Sub-district	Suspect	BTA +	Humidity RH
Koto Tangah	2421	176	82
Lubuk Begalung	1417	114	86
Kuranji	1350	140	82
Padang Timur	1237	127	83
Padang Selatan	1094	126	82
Lubuk Kilangan	702	22	83
Padang Barat	646	36	84
Padang Utara	561	72	84
Nanggalo	504	66	83
Pauh	377	63	85
Bungus Teluk kabung	333	42	85

This is not a good medium for the growth of the *Mycobacterium tuberculosis* bacteria that causes pulmonary TB. Areas that have suspected TB and AFB + (positive TB) in Padang City have high air humidity, increased air humidity is an appropriate medium for pathogenic bacteria including tuberculosis. Humidity of the air in the house becomes a suitable medium for the growth of bacteria that cause pulmonary TB so transmission to occurrence will be very easy to occur with the support of these unhealthy environmental factors. Research conducted by Indriyani, et.al. (2016) states that there is a significant relationship between humidity and the incidence of pulmonary tuberculosis with an OR value of 4.792, which means a house with a high humidity level will affect its inhabitants to get pulmonary TB as much as 4,792 times compared to a house with a low humidity level. Humidity is one of the factors that has a very strong relationship with the incidence of pulmonary TB, evidenced in the results of a 2015 study at UPK Puskesmas Perum 2 Pontianak City with an OR value of 4.643 (p value 0.007) (Widyarsih, et.al., 2015). High humidity (> 60%) easily becomes a place to live for bacteria and supports the presence of these bacteria in a room making it easier to spread.

The working area of Puskesmas Kota Padang has an average temperature range of 27°C-30°C, there is a positive relationship between temperature and the presence of *Mycobacterium tuberculosis* so that the temperature is not according to the conditions, potentially increasing conditions conducive for the bacteria to live and also potentially increasing transmission of pulmonary TB disease (Ayomi, *et.al.,* 2012).

Table 4. Temperature

Sub-district	Suspect	BTA +	Temperature °C
Koto Tangah	2421	176	28
Lubuk Begalung	1417	114	29,3
Kuranji	1350	140	28
Padang Timur	1237	127	27
Padang Selatan	1094	126	29
Lubuk Kilangan	702	22	28
Padang Barat	646	36	30
Padang Utara	561	72	29,6
Nanggalo	504	66	29
Pauh	377	63	28,5
Bungus Teluk kabung	333	42	29

The study states that there is a relationship between temperature and the incidence of pulmonary TB in line with the results of this study. The occurrence of pulmonary TB is most likely to occur at temperatures that do not meet the requirements because the bacterium *Mycobacterium tuberculosis* will survive at a temperature of 23°C-40°C so that it is likely that the bacteria will be inhaled by families in the room (Ayomi, et.al., 2012). Research Widyarsih, et.al. (2015) had the same result that there was a significance value of the relationship between temperature and the incidence of pulmonary TB. Further analysis indicated that respondents who lived at room temperature did not match the risk of 3.125 times to experience pulmonary TB compared with respondents who lived at room temperature according to regulations. Research conducted by Kenedyanti (2017) states that the *Mycobacterium tuberculosis* bacteria can grow optimally in the temperature range of 25°C-40°C, and can develop optimally at a temperature of 31°C-37°C so as to allow TB transmission.

Mapping the distribution of pulmonary TB patients in Padang City is divided into two types of cases, the first is suspected (suspected) and the second is BTA+ (positive TB). In suspected cases, there were 10,642 cases, the highest in Koto District and at least in Bungus Teluk Kabung District. While the highest BTA+ cases are also found in Koto Tangah District and the lowest is in Bungus Teluk Kabung District and several other scattered areas.

CONCLUSION

The working area of Padang City which has high TB and BTA+ (positive TB) suspects. In the city of Padang has high air humidity, increased air humidity is the right medium for pathogenic bacteria including tuberculosis. Mapping the distribution of pulmonary TB patients in Padang City is divided into two types of cases, the first is suspected (suspected) and the second is BTA+ (positive TB). The highest suspicion of cases and AFB + is in Koto Tangah District.

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