

Epidemiologi Deskriptif Tuberkulosis di Kota Surabaya Tahun 2018-2022

The Descriptive Epidemiology of Tuberculosis in the City of Surabaya from 2018 to 2022

Asti Alya Rahmahdia^{1*}, Siti Shofiya Novita Sari^{1,2}, Erni Astutik^{1,3}

¹Department of Epidemiology, Biostatistics, Population Studies, and Health Promotion, Faculty of Public Health, Universitas Airlangga, Surabaya, 60115, Indonesia

²Airlangga Disease Prevention and Research Center - One Health Collaborating Center, Universitas Airlangga, Surabaya, 60115, Indonesia

³Research Group for Health and Well-being of Women and Children, Universitas Airlangga, Surabaya, 60115, Indonesia

Article Info

*Correspondence:

Asti Alya Rahmahdia
asti.alya.rahmahdia-2020@fkm.unair.ac.id

Submitted: 11-03-2024

Accepted: 20-08-2024

Published: 12-12-2024

Citation:

Rahmahdia, A. A., Sari, S. S. N., & Astutik, E. (2024). The Descriptive Epidemiology of Tuberculosis in the City of Surabaya from 2018 to 2022. *Media Gizi Kesmas*, 13(2), 652–658. <https://doi.org/10.20473/mgk.v13i2.2024.652-658>

Copyright:

©2024 by Rahmadia, Sari, and Astutik, published by Universitas Airlangga. This is an open-access article under CC-BY-SA license.



ABSTRAK

Latar Belakang: Tuberkulosis (TB) merupakan penyakit menular yang masih menduduki peringkat teratas dalam faktor penyebab morbiditas dan mortalitas di Indonesia. Kota Surabaya memiliki kasus TB tertinggi di Jawa Timur pada tahun 2022, dengan prevalensi kasus sebesar 355 per 100.000 penduduk.

Tujuan: Penelitian ini bertujuan untuk memberikan gambaran kasus tuberkulosis di Kota Surabaya dari tahun 2018 hingga 2022.

Metode: Penelitian dengan pendekatan deskriptif menggunakan desain studi ekologi. Data agregat bersumber dari Laporan Dinas Kesehatan Kota Surabaya dengan unit analisis kecamatan digunakan dalam penelitian ini. Sumber penelitian dari artikel lain kami gunakan sebagai pembandingan atas temuan dalam penelitian ini.

Hasil: Sepanjang tahun 2018 hingga 2022, penyebaran TB lebih tinggi pada laki-laki daripada perempuan dengan prevalensi di atas 53%. Berdasarkan wilayah, prevalensi TB di setiap wilayah berbeda-beda dan berganti dengan tidak selalu diampu oleh wilayah dengan kepadatan penduduk tinggi. Berdasarkan waktu, terjadi peningkatan kasus TB sebelum dan setelah Pandemi COVID-19, pada tahun 2021 terdapat 4.628 kasus TB yang kemudian meningkat menjadi 8.218 kasus di tahun 2022.

Kesimpulan: Beban kasus tuberkulosis (TB) di Kota Surabaya pada laki-laki sepanjang tahun 2018-2022 lebih tinggi daripada perempuan, disebabkan sebagian oleh pilihan gaya hidup dan merokok, sementara kepadatan penduduk tidak selalu menjadi faktor utama dalam prevalensi TB karena sifatnya yang multifaktor; selain itu, kebangkitan kembali kasus TB pasca-pandemi tidak selalu menandakan hal negatif, karena hal itu mungkin menunjukkan peningkatan pelaporan kasus TB yang lebih baik dibandingkan dengan periode pandemi COVID-19.

Kata kunci: COVID-19, Epidemiologi tuberkulosis, Penyakit menular, Prevalensi TB, Tuberkulosis

ABSTRACT

Background: Tuberculosis (TB) remains a top-ranking communicable disease in terms of morbidity and mortality factors in Indonesia. Surabaya city has the highest TB cases in East Java in 2022, with a prevalence rate of 355 per 100,000 population.

Objectives: This study will provide an overview of tuberculosis cases in Surabaya City from 2018 to 2022.

Methods: The research employs a descriptive approach using an ecological study design. The aggregate data sourced from the Surabaya City Health Office's reports,

with the analysis unit being the sub-district, are utilized in this study. Other articles serve as comparative sources for the findings in this research.

Results: Throughout the years 2018 to 2022, the spread of TB was higher in males than females, with a prevalence exceeding 53%. Based on regions, the prevalence of TB varies across different areas and does not always correlate with regions with high population and density. In terms of time, there was an increase in TB cases before and after the COVID-19 pandemic which is in 2021, there were 4,628 TB cases, which then rose to 8,218 cases in 2022.

Conclusion: TB cases burden in Surabaya City among males during 2018-2022 surpassed females, attributed partly to lifestyle choices and smoking, while population density isn't always the primary factor in TB prevalence due to its multifactorial nature; moreover, the resurgence of TB cases post-pandemic doesn't necessarily signify negativity, as it might indicate improved TB case reporting compared to the COVID-19 pandemic period.

Keywords: Communicable disease, COVID-19, Epidemiology of tuberculosis, TB prevalence, Tuberculosis

INTRODUCTION

One of the infectious diseases posing a global health threat is Tuberculosis (Nyarko *et al.*, 2021). Tuberculosis (TB), as a challenge in health, continues to persist in Indonesia and ranks at the top of the list of factors contributing to the rate of morbidity and mortality (Kaaffah *et al.*, 2023). Globally, targets for tuberculosis control have been set to reduce TB-related deaths by 90% by 2030 under the Sustainable Development Goals (SDGs) (Silva *et al.*, 2021). Based on the data retrieved from WHO in 2019, Indonesia ranks third with the highest incidence of tuberculosis in the world after India and China (Rahmawati *et al.*, 2021). There are 30 countries with a high burden of TB contributing to 87% of TB cases worldwide in 2022, and two-thirds of global cases are in eight countries, including Indonesia, which ranks second highest with 10% of cases (WHO, 2023). Based on bacteriological TB test evidence, the prevalence of TB per 100,000 population in Indonesia is 759 (95% CI: 589.7-960.8) (Noviyani, Nopsopon and Pongpirul, 2021).

The causative agent of TB is *Mycobacterium tuberculosis*, which can damage the lungs as well as other organs. The bacteria can spread through the air when TB patients cough, sneeze, or speak without a mask (Dinkes Jatim, 2023). Due to weakened immune systems, TB patients who do not receive comprehensive and complete treatment are at risk of developing other diseases and are also at risk of death (Dinkes Jatim, 2023). The total number of tuberculosis cases detected in Indonesia in 2020 was 351,936 cases, with 44% of cases contributed by provinces with the highest number of cases, namely West Java, East Java, and Central Java (Kemenkes RI, 2022). According to the East Java Health Profile for the year 2022, East Java Province ranked as the second region with the highest number of tuberculosis cases in 2022, totaling 78,799 cases, with an increase from

the previous year totaling 43,247 cases. The city with the highest number of tuberculosis cases detected in 2022 was Surabaya City, with a total of 10,382 cases (Dinkes Jatim, 2023).

One indicator of TB control that can be measured is the Case Detection Rate (CDR). CDR depicts the proportion of newly identified and treated patients against the estimated number of new patients in a particular area. In 2021, the Tuberculosis CDR in Surabaya was 45.92%, an increase from the previous year's rate of 41.19% (Dinkes Kota Surabaya, 2022). This increase indicates the seriousness and concerns among related parties of TB control in the City of Surabaya.

Tuberculosis cases in Surabaya City are a concern that needs immediate attention. To control the increase in TB cases, efforts are needed to understand the overview of TB cases. This research aims to provide an overview of tuberculosis cases in Surabaya City from 2018 to 2022 using an epidemiological approach, which encompasses the study of people, places, and time. It is hoped that this research can assist relevant stakeholders in TB control efforts, particularly in understanding the situation and intervention program targets to formulate TB control policies.

METHODS

Study Design

This study employs a descriptive approach utilizing an ecological study design. It utilizes the aggregated data from secondary sources, specifically the Surabaya City Health Office reports, with the analysis unit being the sub-district. The study describes the results of the analysis concerning the epidemiological overview of tuberculosis (TB) cases and prevalence, as well as population density in Surabaya City from 2018 to 2022.

Sample and Population

The population and sample used in this study are sourced from secondary data published by the Surabaya City Health Office. This secondary data is comprised of the Surabaya City Health Profile for the years 2018-2022. This study uses aggregate data in the form of the number of tuberculosis cases and population density data in Surabaya City from 2018 to 2022 in the Surabaya City Health Profile Report.

Management and Variables

The variables examined in this study are based on the people, place, and time variables. The people variable includes tuberculosis (TB) cases by gender. The place variable consists of population density and TB prevalence based on sub-district regions. The time variable involves the TB case trends throughout the years 2018 to 2022.

Data Analysis

Data analysis is conducted epidemiologically according to the perspectives of people, place, and time, which will be presented using tables, figures, and graphs. The depiction of TB prevalence in each region will be presented using

Quantum Geographic Information System (QGIS) application version 3.32.5 in map form. The map will be presented with five color gradients for population density and scaled centroid points to represent the magnitude of TB prevalence.

Ethical Clearance

This research has received ethical approval from the Health Research Ethics Committee No. 218/EA/KEPK/2023

RESULTS AND DISCUSSION

The Spread of Tuberculosis Patterns based on Person Variables

Throughout the years 2018-2022, male tuberculosis patients in Surabaya have consistently outnumbered females, according to this study. Over the years 2018-2022, the number of TB cases by gender experienced both increases and decreases. As seen in (refer to figure 1), there was an increase in cases during 2018-2019, and again during 2020-2022. Then, there was a significant decrease in cases during 2019-2020, with a difference of 1,951 cases for males and 1,848 cases for females.

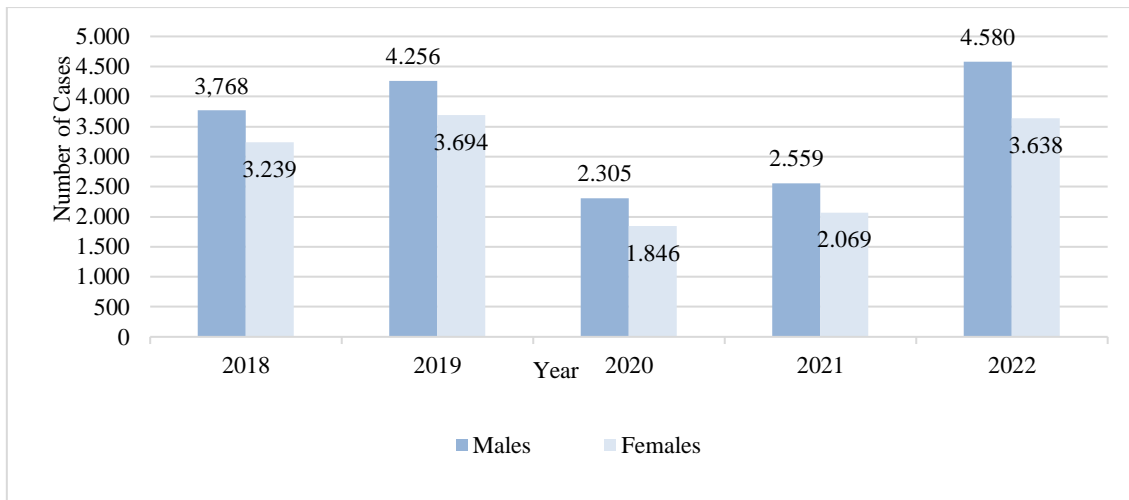


Figure 1. Number of Tuberculosis cases in Surabaya City 2018-2022

Table 1. Distribution of Tuberculosis Cases Based on Person Variables in Surabaya City 2018-2022

Cases	Variable				Total (%)
	Males		Females		
	n	%	n	%	
Before the Pandemic of COVID-19					
2018	3,768	53.77	3,239	46.23	7,007 (100.0)
2019	4,256	53.53	3,694	46.47	7,950 (100.0)
During the Pandemic of COVID-19					
2020	2,305	55.53	1,846	44.47	4,151 (100.0)
2021	2,559	55.29	2,069	44.71	4,628 (100.0)
After the Pandemic of COVID-19					
2022	4,580	55.73	3,638	44.27	8,218 (100.0)

Source: Dinkes Kota Surabaya 2018-2022

The increase and decrease in TB cases in Surabaya City throughout the years 2018-2022 can be linked to the COVID-19 pandemic. The COVID-19 pandemic era referred to be occurred in 2020-2021. Based on the data in Table 1, there is a significant decrease in the number of cases before and after the COVID-19 pandemic. According to the annual group categories before, during, and after the COVID-19 pandemic, there is a noticeable increase in the percentage of cases. The percentage of cases for males before the COVID-19 pandemic was 53.65%, increased to 55.40% during the COVID-19 pandemic, and then increased again after the COVID-19 pandemic to 55.73%. Furthermore, the percentage of cases in females continued to decrease, with a total of 46.35% before the COVID-19 pandemic, decreasing to 44.60% during the COVID-19 pandemic, and then decreasing again after the COVID-19 pandemic to 44.27%.

The higher incidence of tuberculosis (TB) in males compared to females in Indonesia can be attributed to several factors. Based on a study conducted by (Noviyani, Nopsopon and Pongpirul, 2021) on the prevalence variation of TB in various regions in Indonesia, it was found that 1.2% of females smoke, while 47.3% of males smoke. Smoking is a potential risk factor for TB, as individuals who smoke one cigarette per day for one year have a 7.89 times higher chance of being infected with TB (Sulistiyawati and Ramadhan, 2021). Therefore, smoking behavior, which is significantly higher in men, can be a potential risk factor for TB.

Based on the description, the higher prevalence of TB in men in Indonesia can be influenced by several factors such as smoking behavior, socialization, and lifestyle, and the higher prevalence of TB cases in urban areas. Relevant studies and research are needed to present targeted interventions to reduce the burden of TB, especially in men in Indonesia.

The Spread of Tuberculosis Patterns Based on Place Variables

The distribution of Tuberculosis cases based on the place variable is depicted in the form of maps showing population density and TB prevalence throughout the years 2018-2022 according to districts in Surabaya City (refer to Figure 2). Each year, population density tends to be similar, with Simokerto being the area with the highest population density, in other words, Simokerto District has the densest population throughout the years 2018-2022. Although Simokerto is the most densely populated area, the highest number of cases throughout the years 2018-2022 is held by Sawahan Sub-district,

according to the Surabaya City Health Profile data for the years 2018-2022 (refer to Figure 2). Referring to the TB prevalence data throughout the years 2018-2022, the sub-district with the highest prevalence varies each year. In 2018, the highest prevalence was in Benowo Sub-district. Subsequently, it was followed by Pabean Cantikan, Tandes, Sukomanunggal, and Tegalsari Sub-districts in consecutive order from 2019 to 2022. The depiction of the percentage of this prevalence aims to determine the extent of the TB case distribution issue in each region from 2018 to 2022.

Based on the depicted map (Figure 2), it can be observed that regions with the highest population density do not always have the highest number of cases. Additionally, regions with the highest number of cases do not necessarily have the highest prevalence percentage. Therefore, it can be said that the magnitude of the TB problem according to TB case prevalence each year is not consistently represented by the same region but varies and changes.

In this study, it was found that high population density in certain districts of Surabaya City does not always have the highest number of TB cases throughout the year. Additionally, the magnitude of the TB problem according to TB case prevalence is not consistently represented by the same region but varies and changes. Referring to other studies conducted in Yogyakarta City, the Umbulharjo district with the lowest population density among a total of 14 analyzed sub-districts had the highest TB incidence (Ardiyanti, Sulistiyawati and Puratmaja, 2021). Furthermore, the findings of this study are also consistent with other research conducted in Semarang, specifically in the working area of Puskesmas Bandarharjo. The number of TB cases is lower in areas with high Population density categories compared to areas with low population density categories (Yulia Nafsi and Ratna Rahayu, 2020).

In contrast to other research conducted in Sidoarjo District throughout the years 2019-2021, the highest number of TB cases appeared in districts with high population density (Kartika and Qurniyawati, 2023). This is further supported by another study in India in 2020, where the highest number of TB cases was found in areas with high population density as well (Rao and Johnson, 2021). These differences can be attributed to the multifactorial nature of TB (Panaiotov, Madzharov and Hodzhev, 2022). Additionally, variations in the characteristics of regions based on rural-urban distinctions can influence the risk of TB transmission (Wang *et al.*, 2021).

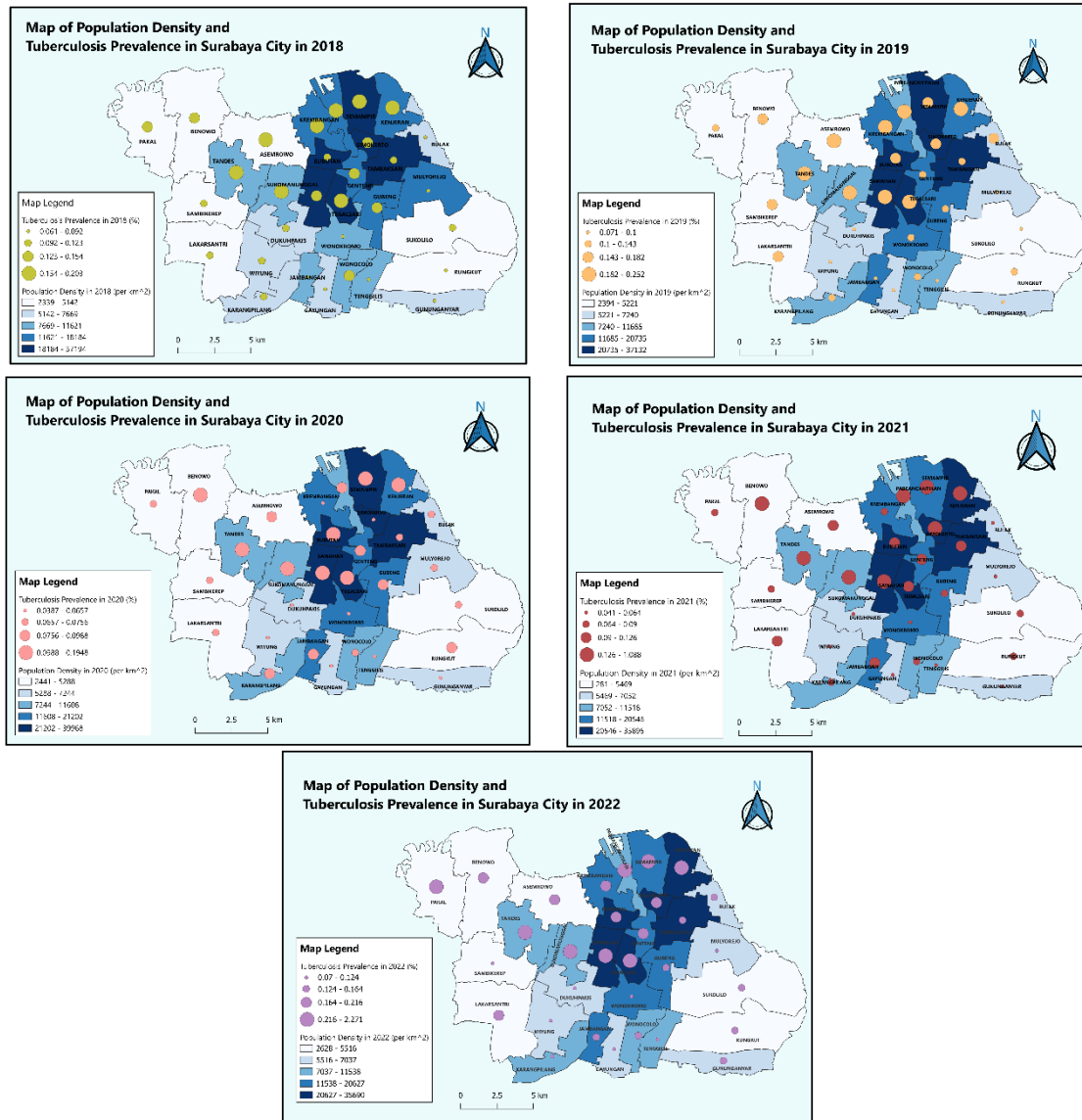


Figure 2. Map of Population The Density and Tuberculosis Prevalence in The City of Surabaya 2018-2022

The Spread of Tuberculosis Patterns Based on Time Variables

The spread of Tuberculosis (TB) based on the time variable is depicted in the form of TB cases and prevalence trends per 1,000 population throughout the years 2018-2022 (see Figure 3 and 4). It can be observed that TB cases increased throughout the years 2018-2019 and the years 2020-2022. Additionally, in 2019-2020, there was a decrease in cases accompanied by a decrease in TB prevalence, from 7,950 cases in 2019 to 4,151 cases in 2020.

The trend of tuberculosis (TB) cases before, during, and after the COVID-19 pandemic shows fluctuating numbers. According to WHO data from 2022, initially, TB cases reached their lowest point in 2020 at 10.1 million cases. However, shortly after around 10.6 million people were infected with tuberculosis (TB) in 2021 (Falzon *et al.*, 2023). This indicates an increase of 4.5% from 2020, with 1.6 million deaths due to TB. Based on the Global

Tuberculosis Report 2022 data, the burden of drug-resistant tuberculosis (DR-TB) also increased by 3% during the years 2020-2021, with 450,000 new cases of tuberculosis resistant to rifampicin (RR-TB) (Ikrama *et al.*, 2024). This number represents the first increase in TB and drug-resistant TB cases in several years.

However, according to a study conducted in Indonesia (Surendra *et al.*, 2023), despite a 26% decrease in reported TB cases and an 11% decrease in TB treatment coverage during the pandemic, the mortality rate due to all causes during tuberculosis treatment did not change significantly. Additionally, the multivariable analysis revealed that the decrease in reported TB cases was associated with the high reporting of COVID-19 cases and fewer GeneXpert machines per 100,000 population, while the decrease in TB treatment coverage was associated with the high reported COVID-19 rates and fewer primary healthcare services and doctors per 100,000 population. The decrease in tuberculosis cases and

treatment is likely due to disrupted tuberculosis healthcare services during the COVID-19 pandemic, leading to reduced diagnosis and reporting, as well as the potential reduction in tuberculosis transmission due to social distancing, mask-wearing, and mobility restrictions.

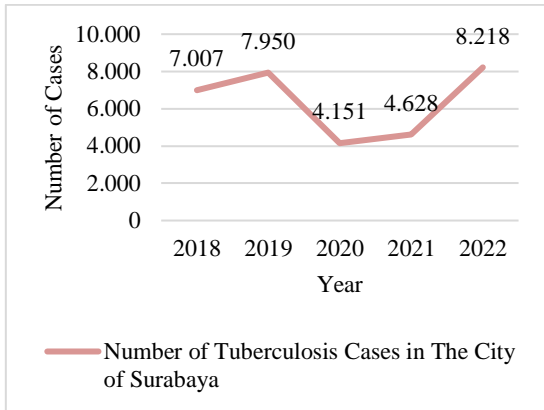


Figure 3. Trends in Tuberculosis Cases in Surabaya City 2018-2022

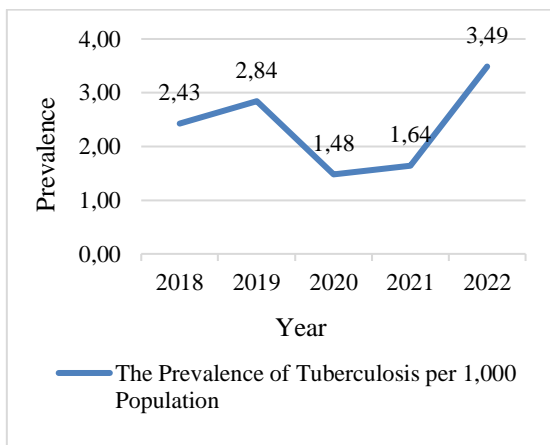


Figure 4. Tuberculosis Prevalence Trends in Surabaya City 2018-2022

The decrease in TB cases due to implementing health protocols during the COVID-19 pandemic indeed has a positive impact. However, the decrease in TB cases due to errors or delays in diagnosis will likely have repercussions in the future. This is reinforced by research in Portugal indicating an increase in the number of delayed TB diagnoses after one year of the pandemic emergency by up to 68.8%. Consequently, the likelihood of increased TB case reporting in the future is higher (Rodrigues *et al.*, 2022).

Policy Implications

Expanding TB control efforts through descriptive analysis remains a fundamental initial step in determining more systematic TB control policies. Environmental-based TB control by promoting healthy lifestyle choices can also be

implemented to reduce the greater burden of TB on men. Sanitarians and environmental health workers are crucial in preventing and treating tuberculosis (TB) by advocating for healthy lifestyles and environments. Especially for those who are ill and those living in densely populated areas and areas with high TB case prevalence. Additionally, using healthcare tools to expedite diagnosis can also be a preventive measure for TB control in Indonesia.

Research Limitations

This study utilized secondary data sources with sub-districts as the unit of analysis, which were limited to analysis based on the variables of people, place, and time. Due to TB being a multifactorial disease, further analysis regarding other TB risk factors is necessary. This could better illustrate the causal relationship between risk factors and outcomes

CONCLUSION

The burden of tuberculosis (TB) cases in Surabaya City among men throughout the years 2018-2022 is higher than among women. Lifestyle factors and smoking are known as the contributing factors. Population density is not always the main factor in the increase in TB prevalence, as TB is a multifactorial disease. Furthermore, the increase in TB cases and prevalence post-pandemic is not necessarily interpreted as something negative, as it may indicate better reporting of TB cases compared to during the COVID-19 pandemic.

Acknowledgments

Acknowledgements are extended to the Surabaya City District Health Office and the East Java Provincial Health Office for providing the data used in this study.

Conflict of Interest and Funding Disclosure

None.

Author Contributions

AAR: Conceptualization, methodology, data visualization, analysis, writing—original draft, writing—review, and editing. SSNS: Manuscript review and Proofreading, Final approval of this study. EA: Editing, Manuscript review and Proofreading, Final approval of this study.

REFERENCES

Ardiyanti, M., Sulistyawati, S. and Puratmaja, Y. (2021) ‘Spatial Analysis of Tuberculosis, Population and Housing Density in Yogyakarta City 2017-2018’,

- Epidemiology and Society Health Review (ESHR)*, 3(1), pp. 28–35. Available at: <https://doi.org/10.26555/eshr.v3i1.3629>.
- Dinkes Jatim (2023) *Profil Kesehatan Jawa Timur 2022*. Surabaya.
- Dinkes Kota Surabaya (2022) *Profil Kesehatan Kota Surabaya Tahun 2021*. Surabaya.
- Falzon, D. *et al.* (2023) ‘The impact of the COVID-19 pandemic on the global tuberculosis epidemic’, *Frontiers in Immunology*. Frontiers Media SA. Available at: <https://doi.org/10.3389/fimmu.2023.1234785>.
- Ikrama, I.H. *et al.* (2024) ‘Tuberculosis prevalence and rifampicin resistance among presumptive patients in Nasarawa State: A three-year retrospective study’, *One Health Bulletin*, 4(2). Available at: <https://doi.org/10.4103/ohbl.ohbl3123>.
- Kaaffah, S. *et al.* (2023) ‘Knowledge, Attitudes, and Perceptions of Tuberculosis in Indonesia: A Multi-Center Cross-Sectional Study’, *Infection and Drug Resistance*, 16, pp. 1787–1800. Available at: <https://doi.org/10.2147/IDR.S404171>.
- Kartika, P. and Qurniyawati, E. (2023) ‘Gambaran Epidemiologi Kasus Tuberkulosis di Kabupaten Sidoarjo Tahun 2019-2021’, *Media Gizi Kesmas*, 12(2), pp. 947–954. Available at: <https://doi.org/10.20473/mgk.v12i2.2023.947-954>.
- Kemenkes RI (2022) *Profil Kesehatan Indonesia 2021*. Jakarta.
- Noviyani, A., Nopsopon, T. and Pongpirul, K. (2021) ‘Variation of Tuberculosis Prevalence Across Diagnostic Approaches and Geographical Areas of Indonesia’, *PLoS ONE*, 16(10). Available at: <https://doi.org/10.1371/journal.pone.0258809>.
- Nyarko, R.O. *et al.* (2021) ‘Tuberculosis a Globalized Disease: Review’, *Asian Journal of Pharmaceutical Research and Development*, 9(1), pp. 198–201. Available at: <https://doi.org/10.22270/ajprd.v9i1.898>.
- Panaiotov, S., Madzharov, D. and Hodzhev, Y. (2022) ‘Biodiversity of Mycobacterium tuberculosis in Bulgaria Related to Human Migrations or Ecological Adaptation’, *Microorganisms*, 10(1). Available at: <https://doi.org/10.3390/microorganisms10010146>.
- Rahmawati, S. *et al.* (2021) ‘Hubungan Lingkungan Fisik Rumah dengan Kejadian Tuberkulosis di Wilayah Kerja Puskesmas Pekalongan Kabupaten Lampung Timur Tahun 2020’, *Indonesian Journal Of Health and Medical*, 1(2), pp. 254–265. Available at: <https://rcipublisher.org/johm/index.php/johm/article/view/45>.
- Rao, M. and Johnson, A. (2021) ‘Impact of Population Density and Elevation on Tuberculosis Spread and Transmission in Maharashtra, India’, *Journal of Emerging Investigators*, 4, pp. 1–5. Available at: <https://doi.org/https://doi.org/10.59720/21-056>.
- Rodrigues, I. *et al.* (2022) ‘Impact of the COVID-19 Pandemic on Tuberculosis Services’, *Pulmonology*, 28(3), pp. 210–219. Available at: <https://doi.org/10.1016/j.pulmoe.2022.01.015>.
- Silva, S. *et al.* (2021) ‘Economic Impact of Tuberculosis Mortality in 120 Countries and The Cost of Not Achieving the Sustainable Development Goals Tuberculosis Targets: A Full-income Analysis’, *The Lancet Global Health*, 9(10), pp. e1372–e1379. Available at: [https://doi.org/10.1016/S2214-109X\(21\)00299-0](https://doi.org/10.1016/S2214-109X(21)00299-0).
- Sulistiyawati, S. and Ramadhan, A.W. (2021) ‘Risk Factors for Tuberculosis in an Urban Setting in Indonesia: A Casecontrol Study in Umbulharjo I, Yogyakarta’, *J UOEH*, 43(2), pp. 165–171. Available at: <https://doi.org/10.7888/juoeh.43.165>.
- Surendra, H. *et al.* (2023) ‘Impact of the COVID-19 pandemic on tuberculosis control in Indonesia: a nationwide longitudinal analysis of programme data’, *The Lancet Global Health*, 11(9), pp. e1412–e1421. Available at: [https://doi.org/10.1016/S2214-109X\(23\)00312-1](https://doi.org/10.1016/S2214-109X(23)00312-1).
- Wang, L. *et al.* (2021) ‘Spatio-temporal variation in tuberculosis incidence and risk factors for the disease in a region of unbalanced socio-economic development’, *BMC Public Health*, 21(1). Available at: <https://doi.org/10.1186/s12889-021-11833-2>.
- WHO (2023) *Global Tuberculosis Report 2023*. 2023rd edn. Available at: <https://iris.who.int/>.
- Yulia Nafsi, A. and Ratna Rahayu, S. (2020) ‘Analisis Spasial Tuberkulosis Paru Ditinjau dari Faktor Demografi dan Tingkat Kesejahteraan Keluarga di Wilayah Pesisir’, *JPPKMI*, 1(1). Available at: <https://doi.org/https://doi.org/10.15294/jppkmi.v1i1.41419>.