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Exploring temporal trends and disparities of Tuberculosis prevalence in Indonesia (2007–2023)

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Abstract

Background: Tuberculosis (TB) remains a major public health challenge globally, and Indonesia continues to be among the countries with the highest TB burden. Despite progress in TB control, limited studies have examined long-term trends and regional disparities using repeated nationally representative surveys. **Objective:** This study aimed to analyze temporal trends and geographic disparities of TB prevalence in Indonesia between 2007 and 2023. **Methods:** This study employed a cross-sectional design using secondary data from the Indonesian National Basic Health Research (Riskesdas) surveys conducted in 2007, 2013, and 2018, and the Indonesian Health Survey (SKI) conducted in 2023. TB prevalence was defined based on self-reported diagnosis by healthcare professionals within one year prior to the survey. Descriptive and exploratory analyses were performed to assess changes over time and across demographic and regional groups. **Results:** TB prevalence demonstrated a general downward trend from 2007 to 2023, with a temporary increase observed in 2018. The decline was more evident among females and urban residents, whereas higher prevalence persisted among males, older adults, and those in urban areas. Substantial interprovincial disparities were also observed, with provinces outside Java showing consistently higher prevalence. **Conclusion:** Although overall TB prevalence in Indonesia has declined, persistent demographic and regional inequalities remain. These findings highlight the need for targeted, area-specific interventions and strengthened surveillance systems to support progress toward national and global TB elimination goals.

Keywords: tuberculosis; Indonesia; Riskesdas/SKI; prevalence; trend analysis; exploratory data analysis

Cite This Article

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INTRODUCTION

Although tuberculosis (TB) is a preventable and curable infectious disease, it remains a major health problem globally, nationally, and locally. The global TB incidence has only decreased by 8.3%, which is still far from the WHO target of a 50% reduction. According to the WHO Global Tuberculosis Report 2024, approximately 10 million new TB cases occurred worldwide in 2023. Indonesia ranks second globally, contributing around 10% of the total global TB cases, and has recorded one of the largest annual increases in TB burden. The estimated TB incidence in Indonesia in 2023 was 1,090,000 cases, equivalent to 387 per 100,000 population [1].

As a high-burden country with a national surveillance system that is not yet optimal in capturing all TB cases [2], Indonesia requires additional sources of data to complement routine surveillance. National health surveys such as Riset Kesehatan Dasar (Riskesdas) conducted in 2007, 2013, and 2018, and the Indonesian Health Survey (SKI) conducted in 2023 provide rich, population-based data that can be used to evaluate the temporal distribution and regional burden of TB. Several studies in Indonesia have used Riskesdas and SKI data to examine TB infection, treatment adherence [3–7], and associated determinants such as smoking [8], malnutrition and diabetes [5], poor environmental conditions [9], and socioeconomic status and healthcare access [10]. However, most studies have focused on single survey years or limited geographic areas.

Although many studies have examined TB burden in Indonesia, most have focused on single-year data or specific regions. Few studies have utilized repeated nationally representative surveys to analyse long-term temporal trends and geographic disparities in TB prevalence. Therefore, this study aimed to describe temporal trends and regional disparities in tuberculosis (TB) prevalence in Indonesia between 2007 and 2023, using data from multiple waves of national health surveys. The findings are expected to provide evidence to support national efforts toward achieving the WHO End TB Strategy goals and reducing regional inequalities in TB burden.

METHODS

Study design and setting

This study employed a cross-sectional design using secondary data from the Indonesian National Basic Health Research (Riskesdas) surveys conducted in 2007, 2013, and 2018, and the Indonesian Health Survey (SKI) conducted in 2023. All surveys were implemented by the Ministry of Health of the Republic of Indonesia.

Population, samples and sampling

The study population comprised all individuals residing in Indonesia, and the study sample included all respondents from the Riskesdas and SKI surveys. The Riskesdas and SKI surveys used a probability proportional to size (PPS) sampling method with a two-stage sampling design, in which census blocks were selected in the first stage and households in the second. In the present analysis, total sampling was applied including all respondents with complete data on the variables of interest. Respondents with incomplete information were excluded. The total number of respondents corresponded to the sample sizes of the national surveys: 973,657 in Riskesdas 2007, 1,027,763 in Riskesdas 2013, 1,017,290 in Riskesdas 2018, and 877,531 in SKI 2023.

Instruments and criteria

Data on TB prevalence were obtained from the individual-level questionnaires administered in each survey. Information on sex, age, area of residence (urban/rural), and province was collected from the household questionnaires. All variables were gathered through face-to-face interviews conducted by trained enumerators. Respondents were classified as having pulmonary tuberculosis (TB) if they reported having been diagnosed by a healthcare professional (doctor, nurse, or midwife) with TB or lung infection within one year prior to the survey.

Procedure and data collection

The data used in this study were derived from the official national survey datasets and accompanying reports released by the Ministry of Health. TB prevalence and sociodemographic variables were extracted, cleaned, and compiled from the 2007, 2013, 2018 Riskesdas, and 2023 SKI databases.

Statistical analysis

Data were processed and analyzed using STATA version 13. Descriptive statistics were computed to summarize TB prevalence according to survey year, sex, age group, area of residence, and province. Temporal trends were visualized using line charts

Ethical considerations

This study received ethical approval from the Health Research Ethics Committee of Politeknik Kesehatan Jambi, with approval number LB.02.06/2/1352/2025.

RESULTS

Demographic characteristics of respondents

Table 1 presents the demographic characteristics of respondents from the four national health surveys (Riskesdas 2007, 2013, and 2018, and SKI 2023). The total number of respondents ranged from 877,531 in SKI 2023 to 1,027,763 in Riskesdas 2013. The sex composition remained relatively balanced across all survey years, with females consistently representing a slightly higher proportion (50.8–52.8%) than males (47.2–49.2%).

Table 1. Demographic characteristics of respondents

Characteristics	Riskesdas 2007 (n= 973,657)		Riskesdas 2013 (n= 1,027,763)		Riskesdas 2018 (n= 1,017,290)		SKI 2023 (n= 877,531)	
	n	%	n	%	n	%	n	%
Sex								
Male	478,411	49.1	505,409	49.2	498,050	49.0	414,262	47.2
Female	495,246	50.9	522,354	50.8	519,240	51.0	463,269	52.8
Age								
0-5 years	116,796	12.0	102,983	10.0	113,841	11.2	101,319	11.6
6-11 years	130,895	13.4	135,009	13.1	128,536	12.6	97,582	11.1
12-23 years	200,821	20.6	204,322	19.9	193,476	19.0	128,550	14.7
24-35 years	186,803	19.2	171,179	16.7	164,605	16.2	137,589	15.7
36-47 years	159,156	16.4	187,159	18.2	181,009	17.8	175,741	20.0
48-59 years	99,574	10.2	135,922	13.2	138,416	13.6	139,411	15.9
60-64 years	26,618	2.7	34,406	3.4	36,737	3.6	39,460	4.5

Characteristics	Riskesdas 2007 (n= 973,657)		Riskesdas 2013 (n= 1,027,763)		Riskesdas 2018 (n= 1,017,290)		SKI 2023 (n= 877,531)	
	n	%	n	%	n	%	n	%
65-69 years	20,457	2.1	21,758	2.1	25,325	2.5	26,975	3.1
70-74 years	15,599	1.6	17,591	1.7	15,646	1.5	16,373	1.9
≥75 years	16,938	1.7	17,434	1.7	19,699	1.9	14,531	1.7
Area of residence								
Urban	353,632	36.3	465,949	45.3	430,156	42.3	469,549	53.5
Rural	620,025	63.7	561,814	54.7	587,134	57.7	407,982	46.5

The age distribution was generally stable across the surveys, with the largest proportions found among the 12–23-year and 24–35-year age groups, each accounting for roughly 15–20% of respondents. Older adults aged 65 years and above constituted less than 6% of participants in all survey years. In terms of area of residence, there was a noticeable shift in the population distribution. The proportion of respondents living in urban areas increased from 36.3% in 2007 to 53.5% in 2023, while the proportion living in rural areas declined from 63.7% to 46.5% over the same period.

Temporal trends in tuberculosis (TB) prevalence

Figure 1 illustrates the overall trend in TB prevalence in Indonesia from 2007 to 2023. After remaining relatively stable at approximately 0.4% in 2007 and 2013, then increased to 0.42% in 2018, followed by a marked decrease to 0.30% in 2023.

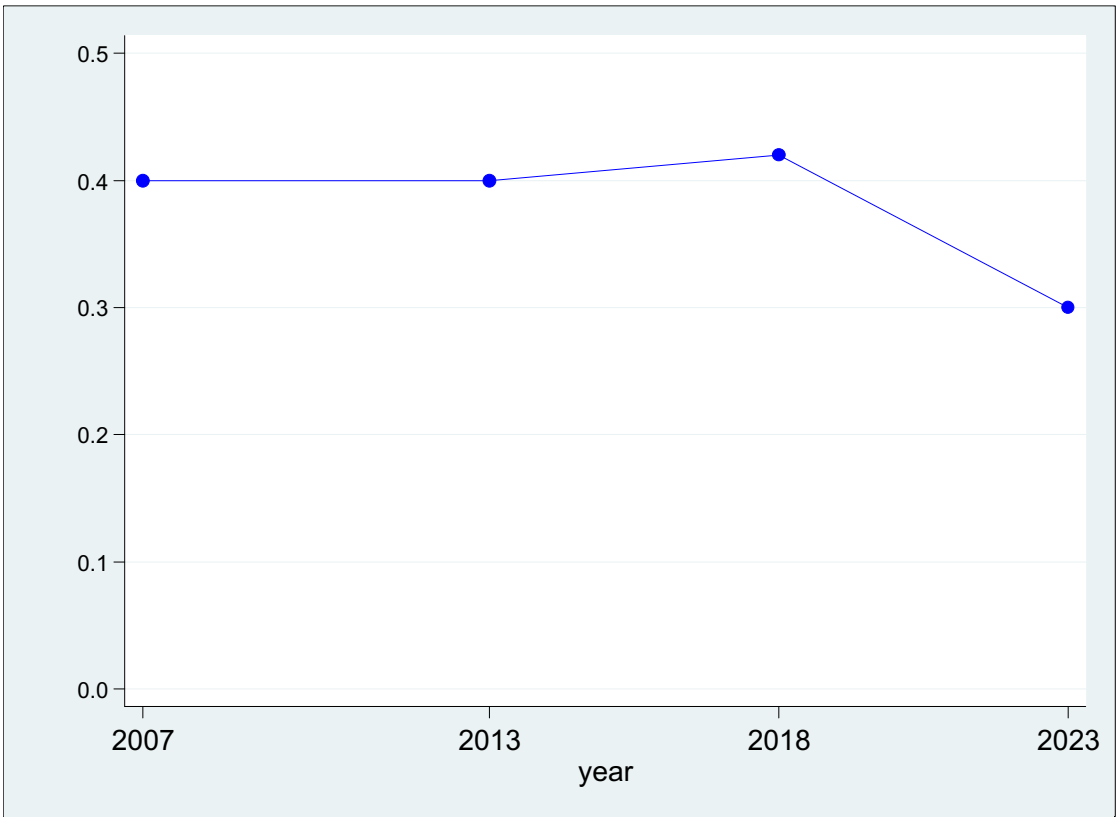

Figure 1. Trends in Prevalence TB, Indonesia, 2007-2023

TB prevalence by sex

As depicted in Figure 2, TB prevalence declined in both males and females during the study period, although the pattern of change differed between the two groups. Among males, the prevalence slightly decreased from 0.44% in 2007 to 0.40% in 2013, followed by a temporary increase to around 0.50% in 2018, and subsequently declined to about 0.38% in 2023. In females, a similar fluctuation was observed, with a gradual decrease from 0.35% in 2007 to 0.30% in 2013, a rise to 0.40% in 2018, and a marked reduction to approximately 0.22% by 2023. Despite these temporal variations, TB prevalence remained consistently higher among males than females throughout all survey years. The gender gap appeared to narrow between 2007 and 2018 but widened again by 2023.

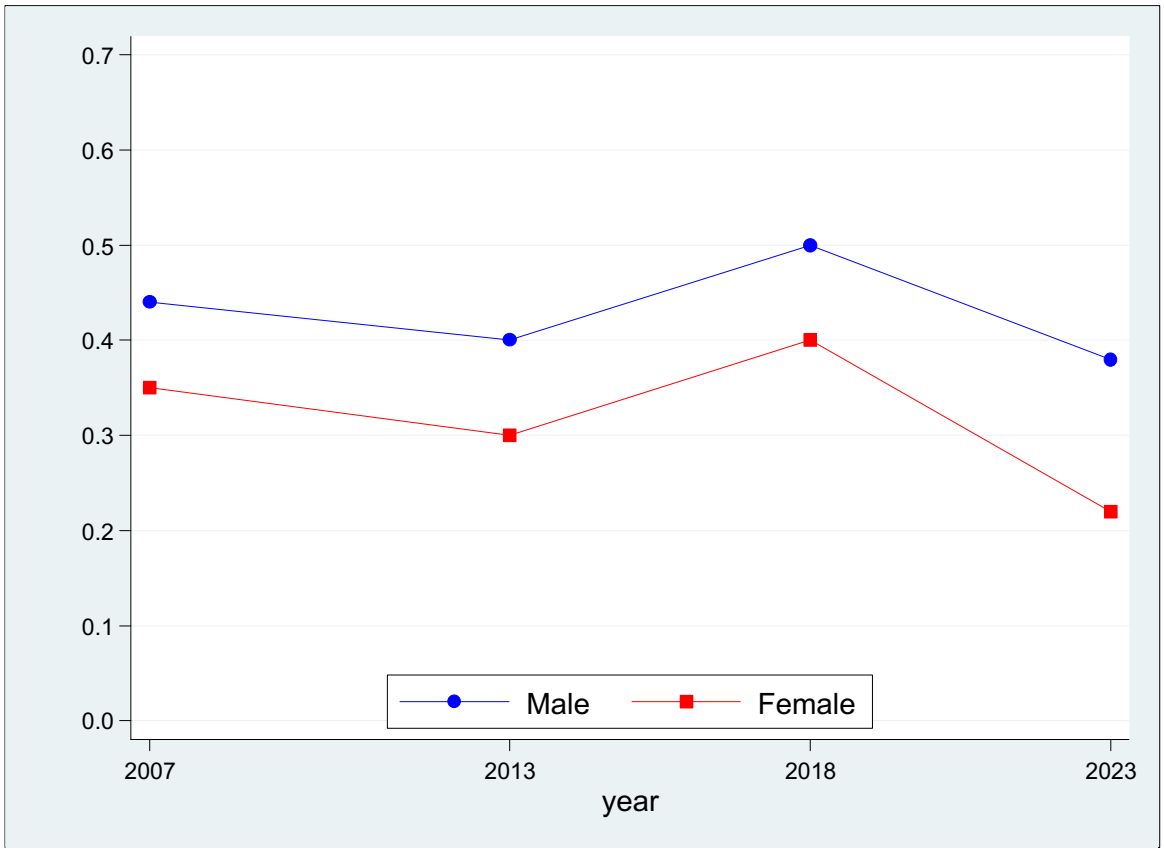

Figure 2. Trends in TB Prevalence by Sex, 2007–2023

TB prevalence by age group

According to figure 3, TB prevalence showed minor fluctuations across survey years in all age categories, with no pronounced increasing or decreasing pattern in most groups. Among children aged 1–4 years and 5–14 years, TB prevalence remained relatively low and stable over time. In contrast, adults aged 35–44 years, 45–54 years, and 55–64 years exhibited slightly higher prevalence levels, with small peaks observed around 2018, followed by modest declines by 2023. Older adults, particularly those aged 65–74 years and ≥75 years, consistently demonstrated higher TB prevalence compared with younger groups, although a gradual decline was evident in the most recent survey year.

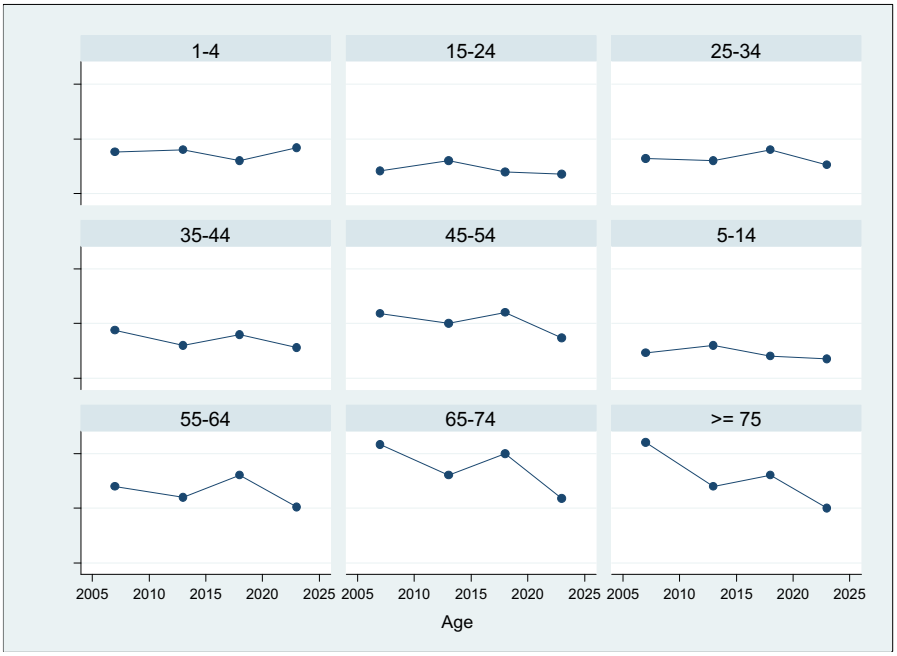

Figure 3. Trends in TB Prevalence by Age, 2007–2023

TB prevalence by area of residence

Figure 4 illustrates the temporal patterns of TB prevalence in Indonesia between 2007 and 2023, stratified by residential area. Both rural and urban populations exhibited declining TB prevalence; however, the magnitude and temporal patterns of this decline differed between the two settings. In rural areas, TB prevalence decreased steadily from approximately 0.45% in 2007 to around 0.27% (95%CI: 0.24-0.31) in 2023. In contrast, TB prevalence in urban areas remained relatively stable around 0.4% from 2007 to 2018, followed by a modest decline in 2023. Despite overall progress, the urban–rural gap persisted, with urban areas generally showing slightly higher TB prevalence throughout the observation period.

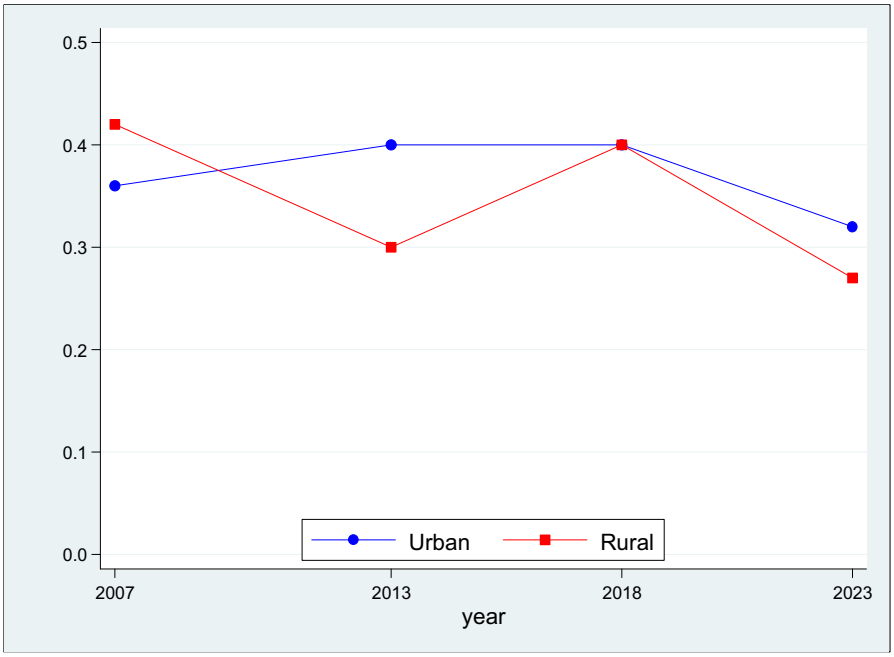

Figure 4. Trends in TB Prevalence by Residence, 2007–2023

Provincial distribution of TB prevalence

Figure 5 displays that most provinces demonstrated a declining or relatively stable trend in TB prevalence over time, although the pace and pattern of change varied considerably across regions. Several provinces, East Java, Central Java, and West Java, showed gradual decreases in prevalence throughout the observation period. In contrast, a few provinces, including those in eastern Indonesia such as Papua and Maluku, exhibited persistently higher prevalence levels or fluctuating patterns. Notably, provinces outside Java tended to maintain higher TB prevalence compared with those on Java Island.

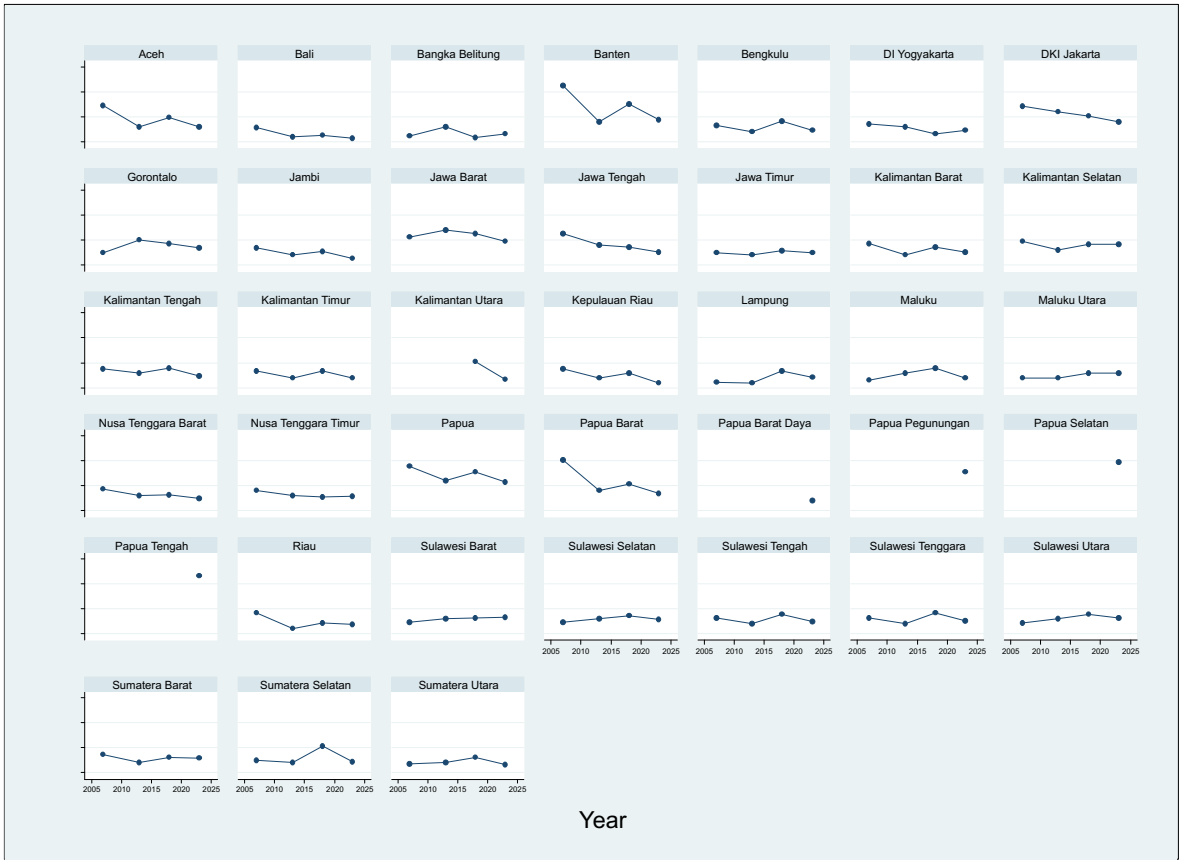

Figure 5. Trends in TB Prevalence by Province, 2007–2023

DISCUSSION

This study revealed a general decline in TB prevalence in Indonesia between 2007 and 2023, despite minor fluctuations observed in 2018. The decline was more pronounced among females and urban residents, whereas higher prevalence persisted among males, older adults, and urban populations. Regional disparities remained evident, with eastern provinces consistently exhibiting higher prevalence.

The findings of this study indicate a decrease in TB prevalence in Indonesia over more than a decade, although a slight increase was observed in 2018. TB prevalence in this study was measured based on self-reported diagnosis, that is, whether respondents reported having been diagnosed with TB by a healthcare worker or physician within the past year. Therefore, the observed trend may reflect changes in public access to TB health services. This pattern aligns with the national trend in TB case detection rates [11]. The detection rate has shown an overall upward

trajectory over the years, except for 2020–2021 when the COVID-19 pandemic disrupted health services. The rate subsequently increased again in 2022–2023. The decline in TB prevalence in 2023 may indicate a true reduction in disease burden, possibly resulting from improvements in TB program performance, as reflected by increased treatment coverage, wider provision of preventive therapy, and greater investment in health services [1,12].

Men consistently exhibited higher TB prevalence than women. This finding is consistent with results from national TB prevalence surveys conducted in Lesotho and the Philippines [13,14]. The higher prevalence among males may be attributed to behavioral and biological factors such as smoking [14] and delays in seeking TB diagnosis and treatment [13,15].

By age group, individuals aged 65 years and above showed the highest TB prevalence compared with other age categories. Most TB cases among the elderly are associated with the reactivation of previously dormant lesions, mainly due to age-related changes in the immune system (immunosenescence) [13]. Other contributing factors include anatomical and physiological changes related to aging, undernutrition, and comorbidities [16]. A study in India found that high TB prevalence among the elderly was associated with male sex, undernutrition, smoking, and a previous history of TB [17]. These findings underscore the importance of active TB screening programs targeting older populations.

TB prevalence was generally higher in urban than in rural areas, except in 2007, when the prevalence in rural areas was slightly higher—possibly due to a larger proportion of respondents residing in rural settings that year. The high prevalence in urban areas may be associated with crowded urban slum environments, which facilitate TB transmission [14]. However, population-based molecular epidemiology studies suggest that individual heterogeneity significantly influences TB transmission dynamics, particularly in rural settings. Rural populations are typically less prone to explosive outbreaks than urban communities, mainly due to environmental, social, and cultural factors rather than differences in infectiousness. In urban settings, residents tend to live closer to healthcare facilities and thus have better access to TB diagnosis and treatment, which can shorten the infectious period and reduce transmission risk [18]. Differences in knowledge, attitudes, and preventive behaviors between rural and urban populations may also contribute to the observed variations in TB prevalence [19].

At the provincial level, most regions in Indonesia showed a generally declining or stable trend in TB prevalence, although the rate of decline varied. In several provinces, such as North Maluku and West Sulawesi, a slight increase in prevalence was observed. Substantial interprovincial variations in infrastructure, human resources, socioeconomic conditions, and the coverage of TB and other health programs may explain these differences [20]. The variation in TB prevalence across provinces may also be attributed to differences in access to healthcare services [21,22], TB program coverage [23], socioeconomic status [22], and other TB risk factors such as smoking [24], diabates mellitus [25], underweight [26], and HIV infection [27]. Overall, these findings highlight the need for region-specific and gender-sensitive TB control strategies. Strengthening early case detection, improving screening coverage in urban areas, and integrating community-based TB surveillance are essential to accelerate progress toward national elimination targets. A major strength of this study is the use of repeated, nationally representative survey data

spanning more than 15 years, which allows for the assessment of long-term trends and disparities. However, the reliance on self-reported TB diagnosis may lead to an underestimation of true prevalence, and variations in survey design and implementation across years could contribute to fluctuations in the estimates.

CONCLUSIONS

In conclusion, this study identified a gradual decline in tuberculosis (TB) prevalence in Indonesia from 2007 to 2023, based on nationally representative survey data. Despite this progress, persistent demographic and regional disparities remain, with higher prevalence among males, older adults, urban residents, and provinces outside Java. These findings suggest that improvements in TB control have been uneven and highlight the need for strengthened surveillance, equitable access to diagnostic and treatment services, and region-specific interventions to accelerate progress toward achieving the WHO End TB Strategy targets.

CONFLICT OF INTEREST

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

FUNDING

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DECLARATION OF ARTIFICIAL INTELLIGENCE USE

This study used artificial intelligence (AI) tools and methodologies in the following capacities:

1. **Manuscript writing support**: AI-based language models were employed to
    1. Language refinement (improving the grammar, sentence structure, and readability of the manuscript).
    2. Content summarization (assisting in summarizing the findings and conclusions concisely).
    3. Technical writing assistance (providing suggestions for structuring complex technical descriptions more effectively)
    4. Generate scientific content, interpret data, and draw conclusions
2. **Simulation and forecasting**: Predictive modelling and simulations were conducted using AI frameworks to validate the research hypotheses.

We confirm that all AI-assisted processes were critically reviewed by the authors to ensure the integrity and reliability of the results. The final decisions and interpretations presented in this article were solely made by the authors. We hereby confirm that no artificial intelligence (AI) tools or methodologies were utilized at any stage of this study, including during data collection, analysis, visualization or manuscript preparation. All work presented in this study was conducted manually by the authors without the assistance of AI-based tools or systems".

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