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Prioritizing the tuberculosis burden by the analytic hierarchy process for effective targeted intervention

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Abstract

Tuberculosis (TB) remains a major public health concern in India, with an estimated 2.69 million cases annually. This study aimed to identify priority TB burden groups in Mysuru District using the Analytic Hierarchy Process (AHP) to support targeted interventions. A retrospective cross-sectional analysis was conducted using 8,459 TB case records reported between 2017 and 2019. Urban areas accounted for most cases (64.8%), with Mysuru City alone contributing 36.5%. Integrating AHP with Geographic Information Systems (GIS), a secondary surveillance approach was used to prioritize high-risk populations and geographic zones. Type of residence, gender, age group, and co-morbidities were selected as key risk criteria based on epidemiological evidence and expert judgement. Relative weights were derived through pair-wise comparisons, with consistency verified using Consistency Ratio (CR), a metric used in the AHP to measure how logically consistent a decision-maker's subjective judgments are when comparing pairs of items. Rankings were assigned based on the highest (4) and lowest (1) proportional burden. The analysis identified urban males aged 40-59 and 20-39 years as the highest-risk groups, classified as "very high" priority, followed by urban females aged 20-39 years and elderly males as "high" priority. Younger and older age groups constituted moderate to low-risk categories. The findings highlight a disproportionately higher TB burden among urban, male, and working-age populations and demonstrate the utility of AHP in guiding targeted, evidence-based TB control strategies used.

Key words: tuberculosis, analytic hierarchy process, effective targeted intervention, GIS, Mysuru District, India.

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Introduction

Tuberculosis (TB) is a contagious disease caused by *Mycobacterium tuberculosis*, which typically affects the lungs but can also affect other body parts (Mohammadnabi *et al*., 2014). Most TB infections remain latent, with no symptoms, however about 10% of latent infections progress to active disease, which can be fatal if untreated (National Centre for Infectious Diseases, 2025). TB is an airborne infection that can be prevented and treated with antibiotics (WHO, 2025). Thirty low- and middle-income countries contribute 87% of the global TB burden, with India (26%), Indonesia (10%), China (6.8%), the Philippines (6.8%) and Pakistan (6.3%) accounting for more than 50% of all recorded infections (Chen *et al.,* 2025). In 2023, TB is more common in men (55%) than in women (33%), with 12% in children and adolescents (Verkuijl *et al.,* 2024). The global incidence rate rose from 10.1 million cases in 2020 to 10.8 million in 2023, equivalent to 134 per 100,000 population, including 662,000 HIV-positive and 400,000 multidrug-resistant infections (WHO, 2024). In 2023, Southeast Asia accounted for 45% of all new cases, Africa for 24% and the Western Pacific for 17% (WHO, 2025). Despite an 8.3% global incidence reduction since 2015, this remains far below the WHO's 50% reduction target by 2025 (WHO, 2024).

India's TB incidence rate declined from 237 to 195 per 100,000 people between 2015 and 2023 (Ahirwar *et al.,* 2025). In 2023, India reported approximately 2.7 million TB cases, treating 2.51 million, which constitutes around 27% of the global burden (Ahirwar *et al.,* 2025). India achieved a 17.7% incidence reduction during this period, surpassing the global average (AffairsCloud.com, 2024). Enhanced case detection raised notifications to 2.55 million in 2023, notably from increased private-sector reporting (Jain *et al.,* 2024). The estimated number of missing cases decreased from 1 million in 2015 to 260,000 in 2023 (PIB, 2025). India aimed to eliminate TB by 2025, ahead of the 2030 global Sustainable Development Goal (Kanmani *et al.,* 2024). Karnataka carries a significant TB burden, with a prevalence-to-notification ratio of 4.08, exceeding the national average of 2.84, indicating substantial under detection (Meundi & Richardus, 2025). The state has met its screening targets for High-Risk Groups, screening over 700,000 individuals (Srinivas *et al.,* 2019). HIV-positive cases form a significant portion of notified TB cases, with approximately 178,000 reported in 2022-2023. Tobacco use contributes notably to TB incidence, with around 70,000 TB patients and there is a similar number of those addicted to alcohol (Tun & Hong, 2020).

Despite global progress, research gaps persist in understanding

factors that limit TB incidence decline, including social determinants, healthcare access disparities, co-morbidities such as HIV and diabetes, and underreporting particularly within private healthcare sectors. While detection and treatment have improved in India, evidence of drug-resistant TB, long-term outcomes and integration of novel diagnostics and digital tools remains limited. A major challenge in local TB control programs is the lack of structured prioritization frameworks, which constrains effective resource allocation (Shah *et al.,* 2025). District and sub-district level decisions are often based on aggregate case counts or uniform targets, with limited consideration of demographic, clinical, and socioeconomic risk factors, leaving high-risk populations and vulnerable areas under-prioritized. The Analytic Hierarchy Process (AHP) offers a systematic, transparent and evidence-based framework for quantifying the relative importance of multiple factors. This approach supports programme managers in prioritizing interventions, strengthening equity-focused planning and enhancing strategic TB control efforts in settings, such as Mysuru District (Sheela & Dhanasekar, 2024). The present study aimed to employ a structured decision-making approach using AHP to identify and prioritize high-risk demographic groups and guide the effective allocation of resources for targeted tuberculosis control interventions.

Materials and Methods

Site description

Mysuru District consists of Mysuru City and seven towns or 'taluks' in the urban sector plus 1,475 rural villages with distinct demographic and geographical characteristics (Figure 1). The district is thus divided into Mysuru, Nanjangud, Tirumakudalu Narsipura, Krishna Raja Nagara, Hunsur, Piriyapatna, Heggada Devana Kote and Sargur (Manjunatha *et al.,* 2025). It covers an area of 6310 km^2 and an elevation of 770 meters above the mean sea level, is located between 11^{0}45' to 12^{0}40' N latitude and 75^{0}54' to 77^{0}08' E longitude (Manjunatha *et al.,* 2017). The population is roughly 1.45 million in urban regions and 1.82 million in rural zones as per the 2011-2018 and the approximate population during 2019 was 30,95,888 (https://www.census2011.co.in/census/district/263-mysore.html).

Study setting

Mysuru District has ten Tuberculosis Units (TUs) distributed across seven taluks that maintains a TB database registry, which includes demographic and epidemiological information about notified TB patients. The district has a dedicated network of TB control activities, featuring both government TB units and private hospitals that diagnose and cure TB. The district health administration, in collaboration with the District Tuberculosis Control Centre and the Zilla Panchayat, actively promotes TB eradication, contact tracing and offers free treatment programmes.

Study population

Notified TB patients registered between January 2017 and December 2019 in Mysuru District under Revised National Tuberculosis Control Programme (RNTCP) (Khedkar *et al.,* 2014) make up the study population. Over a three-year period (2017-19), 11,415 TB cases were reported to 10 TU's in the district under study. After removal of 2,413 with incomplete addresses and 543 were duplicate cases repeated within the given database, the final dataset comprised of 8,459 TB cases to ensure reliability of subsequent epidemiological and spatial assessments.

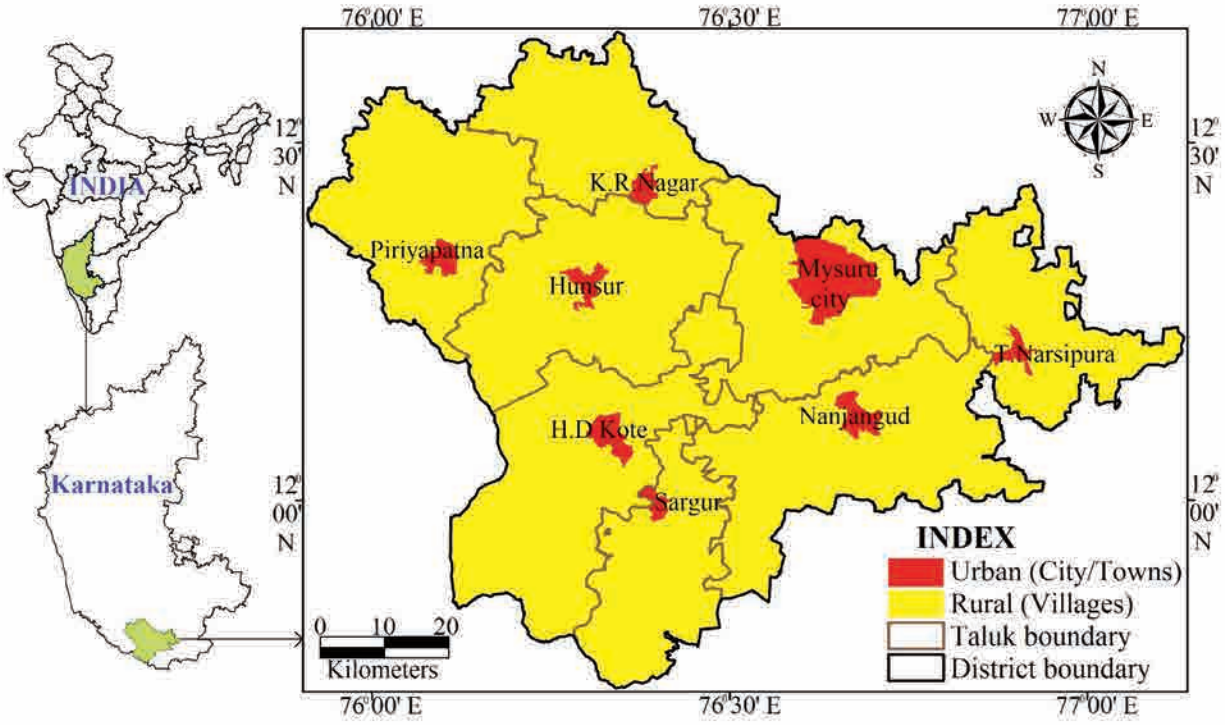

Figure 1. Urban and rural locations in Mysuru District.

Analytic hierarchy process

This approach, developed by Saaty in the 1970's, provides a structured and systematic framework for prioritizing complex public health problems and has been widely applied across disciplines, including health planning and policy analysis (Saaty, 2021). In this study, AHP was employed to assess TB risk in Mysuru District by decomposing the problem into hierarchical components comprising the overall objectives, key determinants (type of residence, gender, age group and co-morbidities) and corresponding sub-criteria (Rakshitha *et al.,* 2021). A pair-wise comparison matrix was constructed to evaluate the relative importance of each determinant based on epidemiological evidence and expert judgement. These comparisons were translated into normalized eigenvector weights, representing the relative contribution of each factor to TB burden.

The consistency of judgements was assessed using the Consistency Ratio (CR), which remained within the acceptable threshold (CR < 1.0), confirming the reliability of the weighting process. To enable integration across variables, each determinant was assigned a standardized suitability score ranging from 1 (low priority) to 4 (high priority). This AHP-based framework revealed the differential influence of demographic and clinical factors, highlighting urban residence, male gender, working-age population, and co-morbidities particularly diabetes and HIV as dominant contributors to TB risk. By combining expert judgement with quantitative weighting, the approach provides a transparent, reproducible, and analytically robust method for prioritizing TB risk and guiding targeted public health interventions.

AHP adds value beyond conventional epidemiological prioritization by integrating multiple determinants such as demographics, co-morbidities, and access to care into a structured weighting framework rather than relying solely on case counts. This approach enables differentiation between areas with high disease burden and those with high vulnerability or intervention need. By capturing the relative importance of diverse risk factors, AHP supports more targeted, equitable, and programmatically relevant prioritization than traditional incidence-based methods.

Data analysis

The final dataset was organized in MS Excel based on key criteria, including type of residence, gender, age group and coexisting factors, to facilitate interpretation. The AHP was employed to prioritize TB burden by ranking these criteria, with a pair-wise comparison matrix constructed using the standard Saaty scale and normalized through the rank-sum method to derive priority weight consisting of the high-risk demographic group (Corvin *et al.,* 2021). Expert judgement from a panel of three public health and TB program specialists validated the relevance and relative importance of the criteria. The reliability of the prioritization was confined through calculation of the Consistency Ratio (CR), with values below 1.0 indicating acceptable consistency. Spatial analysis of TB data, including mapping of residence type, TB density, demographic groups, co-morbidities and priority burden categories, was performed using ArcGIS software (v10.8.2) to support evidence-based, geographically targeted interventions.

Results

Urban-rural disparity

The prevalence of TB in Mysuru District is unevenly distributed across urban and rural areas. Mysuru has the highest TB burden (3,084 cases), with a density of 24.06 cases/km^2 (Table 1, Figure 2a), underlining the importance of population concentration and an improved reporting system. Among the towns, Tirumakudalu Narsipura (433 cases, 25.68/km^2) and Heggada Devana Kote (663 cases, 22.99/km^2) had the highest densities, reflecting the role of population clustering and potential healthcare access disparities. While Piriyapatna (167 cases, 8.04/km^2) and Sargur (40 cases, 3.23/km^2) had the lowest. In contrast, rural areas contributed 2,798 cases (33%) but had a very low density (0.46 cases/km^2) due to their large geographic distribution, which could disguise underreporting and diagnostic delays. This could also indicate underreporting and poor healthcare access. Tirumakudalu Narsipura town had the greatest TB density due to its smallest areal extent compared to other towns, including Mysuru City, which had the second highest TB density per km^2.

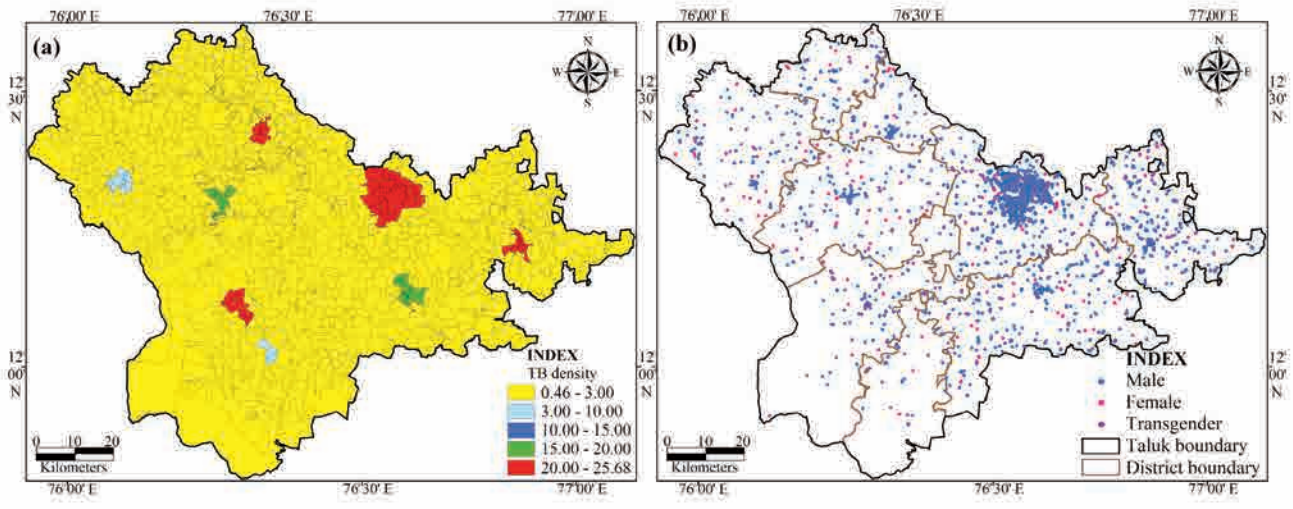

Figure 2. a) TB density; **b**) TB gender-wise point locations in Mysuru district.

Gender distribution

The gender distribution of TB patients in Mysuru district indicates a strong male predominance. Out of 8,459 total cases, 5,877 (69.4%) were male, 2,577 (30.4%) were female and only 5 cases were documented among trans-gender individuals (Figure 2b; Table 2). This pattern aligns with national and global patterns, at which men are at risk from occupational exposure, smoking, alcohol use and health-seeking behaviours, whereas women may encounter impediments to timely diagnosis and care. At the taluk level, Mysuru had the highest load (3,916 cases, 46.3%), followed by Nanjangud (1,155 cases) and Tirumakudalu Narsipura (815 cases). Smaller taluks, such as Sargur (80 cases) contributed minimally. Across all taluks, the male-to-female ratio remained skewed towards males, with Mysuru and Nanjangud showing the greatest disparity.

Age distribution

Most TB cases occur in the productive age group, particularly among adults aged 26 to 55, with a significant burden also observed in urban slum populations and a strong male predominance. The age distribution of TB cases shows that the disease is most frequent in the productive age groups (20-59 years; Figure 3a, Table 3). Individuals aged 20-39 years (38.2%), and 40-59 years (35.5%) accounted for nearly 74% of all cases, demonstrating the high risk of the working population due to occupational exposure, mobility and social interactions. The elderly population (>60 years; 16.9%) also made a notable share, most likely due to age-related co-morbidities and decreased immunity. In comparison, the 0-19-year-old group accounted for just 9.4%, implying decreased transmission among children or under-detection due to diagnostic challenges in younger age groups.

Coexisting factors

Diabetes has a major impact on the clinical manifestation, disease progression and treatment outcomes of TB. The co-morbidity profile of TB patients reveals that the majority (86.9%) had TB without any associated diseases (Figure 3b, Table 3). Diabetes (7.4%) and HIV infection (5.6%) were the most prevalent coexisting morbidities, with only a 0.14% having both. These morbidities worsen TB vulnerability, complicate treatment, and demand integrated care strategies. The increased prevalence of TB and diabetes emphasizes the confluence of infectious and non-communicable diseases, whereas TB-HIV con-infection remains a major public health concern.

Analytic hierarchy process

Urban residence (64.8%) accounted for a large share of cases than rural areas (35.2%), demonstrating the influence of high pop-

Table 1. Overview of tuberculosis density in Mysuru District 2017-2019.

Type of residence			Reported cases (no.)	Percentage (%)	Area (km^2)	TB density (per km^2)
Urban	City	Mysuru	3,084	36.45	128.14	24.06
	Town	Tirumakudalu Narsipura	433	5.11	16.86	25.68
		Heggada Devana Kote	663	7.83	28.83	22.99
		Krishna Raja Nagar	382	4.51	16.98	22.49
		Hunsur	398	4.70	21.36	18.63
		Nanjangud	494	5.83	27.73	17.81
		Piriyapatna	167	1.97	20.75	8.04
		Sargur	40	0.47	12.37	3.23
Rural	Village	1475	2,798	33.07	6,037.76	0.46
Total Geographic Area (TGA)			8,459		6,310.78	

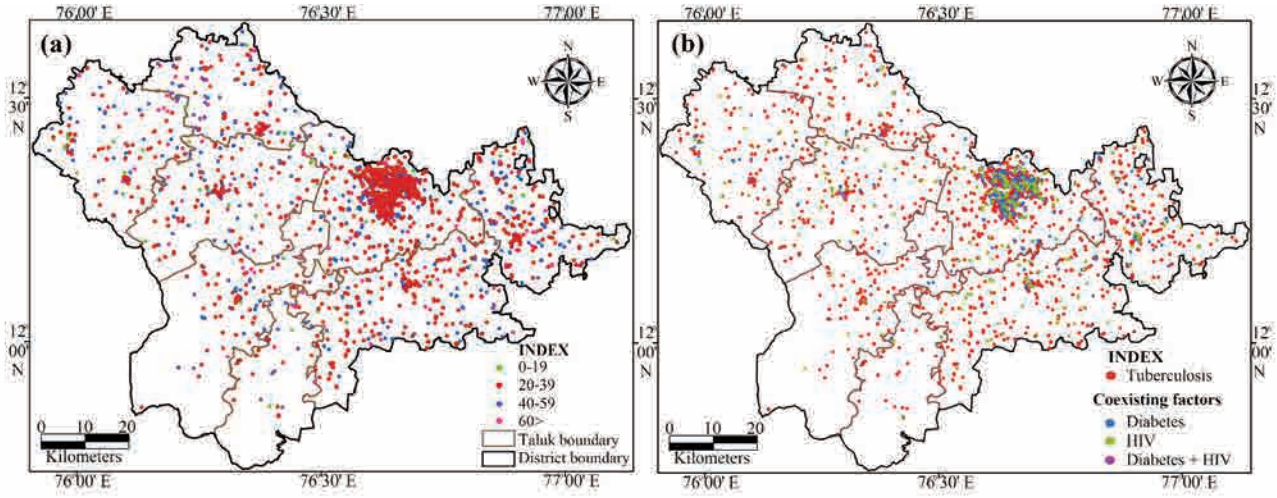

Figure 3. a) Age-wise patients' location; **b)** Tuberculosis and coexisting factors in Mysuru district.

ulation density, overcrowding, and improved reporting in cities. Gender distribution shows a strong male predominance (69.47%), which is consistent with national and global trends. Female cases accounted for 30.46% (Table 3), while only 5 cases were reported among transgender people, implying under-detection or underreporting in this population. Age-wise, the productive age groups (20-59 years) accounted for nearly three-quarters of all cases, emphasizing occupational and social exposure as key drivers. The elderly (>60 years) represented 16.9% of cases, whereas children (0-19 years) accounted for 9.4%, probably due to diagnostic challenges in paediatric TB. When compared to co-morbidities, TB alone accounted for 86.9% of cases (Table 3). Diabetes (7.4%) and HIV (5.6%) were found to be important coexisting factors, highlighting the combined burden of communicable and non-communicable illness interactions. Although rare (0.14%), TB-diabetes-HIV co-infection poses a critical concern for treatment outcomes.

The AHP pairwise comparison matrices quantify the relative importance of key TB risk factors with acceptable to high consistency (CR=0 – 0.82; Table 4). Urban residence is prioritized over rural due to higher population density and transmission risk. Males receive higher weighting than females and transgender individuals, reflecting occupational exposure and case distribution. Adults aged 20-59 years carry the greatest risk, while children and older adults have lower weights (Table 4). Co-morbidities, particularly TB with diabetes with HIV, are assigned the highest priority, highlighting the amplified vulnerability of these groups. Collectively, the matrices provide a transparent, structured framework for targeting interventions to the most at-risk populations.

The ranking of variables *(e.g.*, urban=4, rural=3) was derived from a combination of expert judgment, empirical evidence from the literature, and observed case distribution within the study area (Table 5). Specifically, rankings were informed by epidemiological evidence indicating higher TB transmission in urban settings due to population density, overcrowding, and mobility; local surveillance data showing a greater concentration of reported TB cases in urban and peri-urban areas; and expert consultation with public health professionals familiar with the district's TB epidemiology. The assigned scores reflect the relative contribution of each category to TB risk rather than absolute differences, enabling consistent comparison across variables within the AHP framework. This approach ensures that the ranking is both evidence-informed and contextually grounded, rather than arbitrary.

The priority classification combines TB burden data with AHP-derived weights to identify population groups for targeted intervention in Mysuru District. Urban residents and males are very high priority, contributing 64.8% and 69.5% of cases, respectively, driven by population density, mobility, and occupational exposure (Table 6). Both received dominant AHP weights, highlighting their control role in transmission and the need for focused interventions. Adults aged 20-59 years and TB patients with dia-

Table 2 Gender-wise tuberculosis disparity in Mysuru District 2017-2019.

Type of residence			Gender Male (no.)	Female (no.)	Male-to-female ratio	Trans- gender (no.)	Total cases (no.)
Urban	City	Mysuru	2,086	996	2.09	2	3,084
	Town	Heggada Devana Kote	468	194	2.41	1	663
	'Taluk'	Nanjangud	347	147	2.36	-	494
		Tirumakudalu Narsipura	317	115	2.76	1	433
		Hunsur	293	105	2.79	-	398
		Krishna Raja Nagar	277	105	2.64	-	382
		Piriyapatna	110	57	1.93	-	167
		Sargur	21	19	1.11	-	40
Rural	Villages	1475	1,958	839	2.33	1	2,798
Total	5,877	2,577	2.28	5	8,459		

Table 3. Epidemiological distribution of tuberculosis and its influencing factors in Mysuru District 2017-2019.

Code	Influencing factor	Sub-criterion	Case (no.)	Percentage
C1	Type of residence	Urban	5,481	64.79
		Rural	2,978	35.20
C2	Gender	Male	5,877	69.47
		Female	2,577	30.46
		Trans-gender	5	0.00
C3	Age group	20-39	3,228	38.16
		40-59	3,002	35.49
		60>	1,431	16.92
		0-19	798	9.43
C4	Coexisting factors	TB	7,351	86.90
		Diabetes	622	7.35
		HIV	474	5.60
		Diabetes + HIV	12	0.14
Total			8,459	

betes were classified as high priority. The 20-39 and 40-59 age groups account for 38.2% and 35.5% of cases, representing the economically productive population with high transmission potential, while diabetes (7.3%) significantly amplifies TB risk, supporting integrated TB-diabetes management (Table 6).

Moderate-priority groups include TB patients with HIV (5.6%) and rural residents (33%). HIV increases immunological susceptibility, and rural populations face limited healthcare access despite lower case counts, warranting attention for equitable intervention. The reported HIV prevalence of 5.6% is considerably higher than estimates from previous studies and routine surveillance in Mysuru District, where prevalence in the general population has consistently remained below 1%. District-level data and community-based studies indicate HIV prevalence ranging between 0.4% and 0.9%, suggesting that the observed higher rate in the present study may reflect a concentration of high-risk populations rather than the overall population burden. Low-priority groups such as children and adolescents (0-19 years) and dual diabetes-HIV co-infection have lower prevalence, although the latter poses clinical severity (Table 6). This framework emphasizes a risk and impact-informed approach, integrating epidemiological burden, vulnerability, and programmatic feasibility, thereby guiding resource-efficient and targeted TB control strategies (Figure 4).

Discussion

Unlike conventional hotspot mapping, which primarily reflects case concentration, AHP integrates epidemiological, demographic, and contextual indicators to distinguish between areas of high disease burden and those of greatest programmatic priority. This distinction is critical, as several locations with moderate case counts emerged as high-priority zones due to compounded vulnerabilities such as dense living conditions, socioeconomic disadvantage, limited healthcare access, and a high prevalence of co-morbidities. In this way, AHP shifts TB control from a burden-centric to a risk-informed and equity-oriented framework. This study demonstrates how the AHP approach enables a multidimensional and decision-oriented approach to prioritizing TB burden (Hashemian *et al.,* 2019). It further indicates that urban residence, male sex, and working-age populations (20-59 years) function not merely as correlates but as key drivers of TB risk, shaped by occupational exposure, population mobility, and delayed health-seeking behaviour (George *et al.,* 2019). The greatest weighting of diabetes relative to HIV reflects an evolving epidemiological transition in which non-communicable conditions increasingly exacerbate TB susceptibility (Ciccacci *et al.,* 2024). This finding underscores the importance of integrated TB-diabetes screening and management, particularly in urban and peri-urban settings. Additionally, observed gender disparities highlight the need for male-focused outreach strategies and improved access for women, whose underdiagnosis may reflect structural and sociocultural barriers rather than lower disease prevalence (Maas *et al.,* 2025).

A central contribution of the AHP framework lies in its capacity to distinguish areas of epidemiological significance from those of strategic importance for intervention (Al-Hgaish *et al.,* 2025). Several rural and peri-urban areas with moderate TB incidence were identified as high priority due to limited healthcare access, socioeconomic deprivation, and constrained diagnostic capacity (Zumla *et al.,* 2025). This demonstrates that reliance on case counts alone may misguide resource allocation, whereas AHP-based prioritization supports more equitable and context-sensitive

Table 4. Pairwise comparison matrices for sub-criteria using Saaty's ratio.

C1. Type of Residence [CR=0 (perfectly consistent)]				
	Urban	**Rural**		
Urban	1	1.33		
Rural	0.75	1		
C2. Gender [CR=0.82 (acceptable)]				
	Male	**Female**	**Transgender**	
Male	1	1.33	4.00	
Female	0.75	1	3.00	
Transgender	0.25	0.33	1	
C2. Age Group [CR=0.39 (high consistency)]				
	20-39	**40-59**	**>60**	**0-19**
20-39	1	1.33	2.00	4.00
40-59	0.75	1	1.50	3.00
>60	0.50	0.67	1	2.00
0-19	0.25	0.33	0.50	1
C4. TB and its coexisting factors [CR=0.39 (high consistency)]				
	TB	**Diabetes**	**HIV**	**Diabetes + HIV**
TB	1	1.33	2.00	4.00
Diabetes	0.75	1	1.50	3.00
HIV	0.50	0.67	1	2.00
Diabetes + HIV	0.25	0.33	0.50	1

TB, tuberculosis; CR, consistency ratio; HIV, infection by human immunodeficiency virus; As the matrices follow a strict rank-based dominance structure, internal consistency is maintained, and the implied CR is < 1.0.

decision-making. From a policy perspective, these findings provide a practical foundation for district-level action (Bullock *et al.,* 2021). AHP-informed prioritization can guide micro-planning by optimizing the placement of diagnostic services, directing mobile screening initiatives, and targeting high-risk populations. Compared with conventional hotspot analyses, the AHP-GIS framework offers a more nuanced, scalable, and policy-relevant tool that aligns with the objectives of the National Tuberculosis Elimination Programme. By integrating epidemiological burden with social vulnerability and health system capacity, this approach strengthens the precision, equity, and effectiveness of TB control strategies and offers a replicable model for broader public health applications.

Strengths and limitations

This study demonstrates the value of AHP as a transparent and reproducible decision-support tool for prioritizing TB burden. Its integration with GIS and alignment with the National Tuberculosis Elimination Programme support effective district- and sub-district-level micro-planning and targeted resource allocation. The use of large surveillance dataset strengthens the reliability of observed spatial and demographic patterns. However, several limitations should be noted. The AHP weighting process may retain subjectivity, particularly when expert panels are limited. Reliance on routine surveillance data may introduce underreporting biases, especially among marginalized populations such as migrants, transgender individuals, and children. The analysis also excludes key behavioural and environmental determinants, including smoking, housing conditions, and occupational exposure, and does not stratify TB by drug resistance or disease severity. Additionally, the use of data from 2017-2019 restricts temporal generalizability. Despite these limitations, the study provides a robust framework for evidence-based TB prioritization and programmatic decision-making.

Conclusions

By systematically integrating epidemiological, demographic, and contextual indicators, AHP enables objective identification of high-risk populations and areas, strengthening targeted interven-

Table. 5. AHP analysis with obtained ranks and weights.

Sub-criterion	Case (no.)	Percentage	Rank	Weight
C1. Type of Residence				
Urban	5.481	64.79	4	0.57
Rural	2.978	35.20	3	0.43
C2. Gender				
Male	5.877	69.47	4	0.50
Female	2.577	30.46	3	0.38
Trans-gender	5	0.00	1	0.12
C3. Age Group				
20-39	3.228	38.16	4	0.40
40-59	3.002	35.49	3	0.30
>60	1.431	9.43	2	0.20
0-19	798	9.43	1	0.10
C4. TB and its coexisting Factors				
TB Positive	7.351	86.90	4	0.40
Diabetes	622	7.35	3	0.30
HIV	474	5.60	2	0.20
Diabetes + HIB	12	0.14	1	0.10

AHP, analytic hierarchy process; TB, tuberculosis; HIV, infection by human immunodeficiency virus.

Table 6. Effective targeted interventions for reducing the burden of tuberculosis.

Priority level	Population group	Evidence from data
Very high priority	Urban Residents	Highest TB case share (64.79%), highest AHP weight
Very high priority	Males	69.47% of cases, dominant AHP weight
High priority	Age group of 20-39 years	Highest burden (38.16%), high transmission potential
High priority	Age group 40-59 years	Substantial burden (35.49%), economic productive group
High priority	TB patients with Diabetes	Highest co-morbidity burden (7.35%)
Moderate priority	TB patients with HIV	Significant immunological risk (5.60%)
Moderate priority	Rural residents	Lower share than urban but access-limited
Low priority	Children/adolescents (0-19 years)	Lowest TB burden
Low priority	Diabetes + HIV co-infection	Low prevalence but clinically severe

AHP, analytic hierarchy process; TB, tuberculosis; HIV, infection by human immunodeficiency virus.

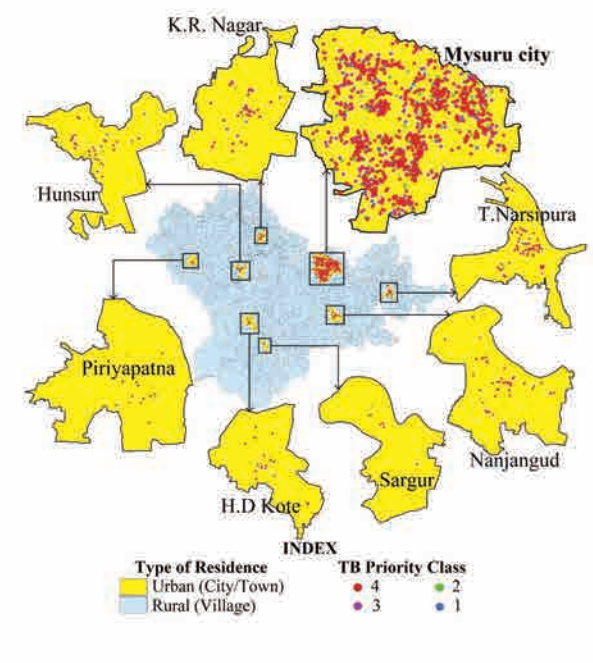

Figure 4. Class and priority with respect to the tuberculosis burden in Mysuru urban region based on the analytic hierarchy process (AHP).

tion planning beyond conventional surveillance approaches. Its ability to incorporate expert judgement, spatial heterogeneity, and multiple risk dimensions enhances the precision of programmatic decision-making. The analysis highlights a disproportionate TB burden among urban residents, particularly males aged 20-59 years, with metabolic and immunological co-morbidities significantly amplifying risk. Through structured multi-criteria evaluation, AHP effectively identifies these priority groups and locations, supporting focused and efficient resource allocation. Importantly, the AHP framework is scalable and replicable across districts and adaptable to other public health challenges, offering a robust foundation for evidence-based, context-sensitive TB control and broader health system planning aligned with national elimination goals.

Recommendations

Aligned with AHP-based prioritization, TB control strategies should focus on high-risk hotspots in Mysuru District, particularly in Mysuru City and densely populated towns such as Tirumakudalu Narsipura and Heggada Devana Kote, where population density, mobility, and occupational exposure heighten transmission risk. Targeted active case finding should prioritize males aged 20-59 years, supported by workplace screening, evening clinics, and community-based sputum collection in slum and migrant settlements to enhance early detection. Integrated TB-diabetes and TB-HIV screening should be institutionalized at PHC and urban health facility levels through bidirectional screening, shared registries, and coordinated follow-up mechanisms. District TB programs should utilize AHP-GIS based micro-planning to guide resource allocation, hotspot prioritization, and deployment of mobile diagnostic services. Regular updating of AHP weights using expert input and surveillance data, alongside inclusion of socioeconomic, environmental, and nutritional indicators, will strengthen equity-oriented, data-driven TB control efforts.

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