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Logistic Regression Analysis of Factors Influencing Tuberculosis Prevalence in Nairobi Embakasi Sub-Counties

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Abstract: This paper has examined the factors explaining prevalence of tuberculosis (TB) in the Embakasi sub-counties of Nairobi through logistic regression analysis. Patient records at the chest clinic of Mama Lucy Kibaki Teaching and Referral Hospital, which is the primary health facility of the Embakasi area, were used to gather the data. Tuberculosis is an infectious disease that is caused by *Mycobacterium tuberculosis* and normally attacks the lungs but may also propagate to other organs as a significant public health problem of the world. Although the infection has been managed through early diagnosis and treatment in developed countries, tuberculosis (TB) is still very widespread in most areas with low income levels such as sub-Saharan Africa. Kenya is in the 13^{th} position in the list of 22 countries that have contributed approximately 80 percent of the world tuberculosis (TB) burden with the majority of the infections falling within the 15-44 years age group. The research was conducted to determine the major socio-demographic and environmental factors that have a relationship with the prevalence of tuberculosis (TB) in Embaksi. The logistic regression analysis showed that alcoholism and congestion in the household were the most significant predictors of tuberculosis (TB) infection. The five sub-counties had similar prevalence rates and the likelihood of being infected with tuberculosis (TB) in Embaksi was, on the whole, some 4.66 times greater than the national one. This evidence highlights the necessity of specific interventions that should be delivered to mitigate behavioral and environmental risk factors in order to reduce tuberculosis (TB) transmission in urban low-income environments.

Keywords: Tuberculosis, Logistic Regression, Embakasi, Nairobi, Kenya, Public Health

1. Introduction

1.1. Background

Tuberculosis (TB), caused by the bacterium *Mycobacterium tuberculosis*, remains a leading infectious disease worldwide [9]. First identified by Robert Koch in 1882, tuberculosis (TB) primarily affects the lungs but can also spread to other organs such as the kidneys, liver, and [8]. The disease is transmitted through inhalation of contaminated air droplets from individuals with active pulmonary tuberculosis (TB). Although the pathogen may remain latent for years, it can progress to active disease when the immune system is compromised [4].

Globally, tuberculosis (TB) remains a major public health and economic burden, especially in low- and middle-income countries [7]. While developed nations have seen a steady drop in tuberculosis (TB) cases thanks to strong diagnosis and treatment systems, many developing countries are still battling a rise in infections driven largely by poor housing, fragile healthcare systems, and low public awareness [10]. Kenya stands among the 22 highest-burden countries, which together make up about 80% of all tuberculosis (TB) cases worldwide, placing it 13^{th} on the World Health Organizations list [5]. Between 1987 and 2020, Kenyas tuberculosis (TB)incidence jumped from 61 to 327 cases per 100,000 people [4]. The disease hits hardest among adults aged 15–44 the most productive years of life placing a heavy strain on both the workforce and the countrys healthcare system [2].

1.2. Research Gap

Although Kenya has invested a lot in the control of tuberculosis (TB), it has not conducted any localized research on the socio-environmental determinants of TB especially in the densely populated urban areas like those of Embakasi in Nairobi County[6]. Embakasi features overcrowding settlement, poor ventilation, poor socioeconomic status and poor healthcare conditions that are conducive to the spread of tuberculosis[3]. Nevertheless, there are limited empirical studies that have measured the role of these factors on the prevalence of TB in the sub-counties of Embaksi.

This gap is a hindrance to evidence-based interventions on the community level. Knowledge on localized tuberculosis (TB) dynamics is hence vital in enhancement of early detection of cases, resource mobilization and focus on prevention approaches. The national initiative in Kenya to curb the incidence and mortality of tuberculosis (TB) will also be enabled by filling this gap in knowledge in a bid to ensure the global objective of ending tuberculosis by the year 2030.

1.3. Study Objective

The research problem that is addressed by this study is to determine the socio-demographic, behavioral, and environmental determinants that affect the prevalence of tuberculosis (TB) in the sub-counties of Embaksi in the Nairobi County. In particular, the study aims to: (i) establish the relationship between the risk factors chosen including household congestion, education level, nutrition, smoking, alcoholism, ventilation, and tuberculosis awareness and prevalence of tuberculosis (TB); (ii) determine the extent to which the risk factors are collectively predictive of tuberculosis (TB) infection by using a binary logistic regression model; (iii) compare the prevalence of TB in the five sub-counties within Embakasi with the prevalence of tuberculosis (TB) in the country; and (iv) evaluate the difference between the prevailing tuberculosis (TB) within the The results would be used to offer evidence-based results to inform intervention in public health, enhance local tuberculosis (TB) control efforts, and aid the creation of evidence-based policy development to help lower infection rates and enhance treatment outcomes in high-density urban areas.

2. Methods

2.1. Study Design and Area

In this study, the design of the study was an analytical cross-sectional study to examine the factors related to tuberculosis (TB) prevalence in Embaksi, the Nairobi County. The subject of the study was the patients visiting the Mama Lucy Kibaka Teaching and Referral Hospital between January 2020 and March 2022 and having the symptoms indicative of tuberculosis (TB). The hospital is the primary referral center of the five sub-counties East, West, North, South and Central, which are highly populated low to middle-income communities that are characterized by informal jobs, high-rise rentals, and inadequate ventilation. Figure 2 presents the Nairobi City County map, highlighting the study area.

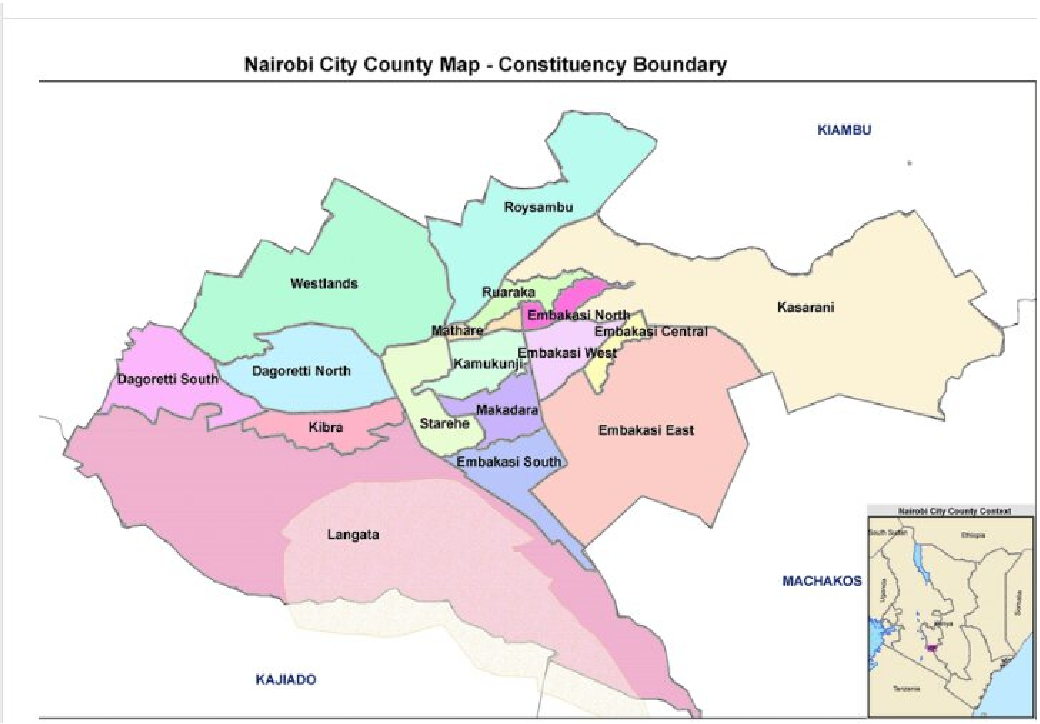

Figure 1. *Nairobi City County and Embakasi sub-counties.*

2.2. Data Collection and Variables

The secondary data were collected by use of the tuberculosis (TB) clinic register of the hospital and it contained the sputum test results of presence of *Mycobacterium tuberculosis*. Patients were classified as positive (TB-positive) or negative (TB-negative). The data included 300 people (191 male and 109 female) aged 6 months to 80 years.

To investigate the possible risk factors, socio-demographic, environmental, and behavioral variables were extracted. These were gender, age, level of education, employment type, tuberculosis (TB) awareness, ventilation of house, congestion, alcohol consumption, smoking, level of nutrition, and past history of tuberculosis (TB) infection. tuberculosis (TB) infection status was a dependent variable ($Y = 1$ for positive, $Y = 0$ for negative). Only those individuals who had lived long enough to qualify as permanent residents of the study area six months, and those who had complete records were included in the analysis.

2.2.1. Criteria for Inclusion

Those individuals who visited Mama Lucy Kibaki teaching and referral hospital tuberculosis clinic exhibiting tuberculosis symptoms were the primary target group. Individuals should have been residents of the study are for at least half a year. Also the individuals should be in the hospital's tuberculosis registers . The sample comprised of individuals in the age brackets 0-14, and those with age bracket 15-80.The research involved both female and male gender.

2.2.2. Sample Size Calculation

The study used a sample size of three hundred(300) individuals. A total of 109 were females and 191 of the respondents were males. This was the entire list of patients who had visited the chest clinic at Mama Lucy Kibaki teaching and referral hospital during the period from January,2022 to April 2022. The youngest of the subjects being 6 months old and the oldest being 80 years old.

2.3. Statistical Analysis

All analyses were performed using R statistical software. Descriptive statistics summarized demographic and socio-economic characteristics. Associations between categorical variables and tuberculosis (TB) status were examined using the Pearson Chi-square and Fishers exact tests at a 5% significance level.

2.3.1. Chi-square Test

For an $r \times c$ contingency table, the Chi-square statistic was computed as:

$$\chi^2 = \sum_{i=1}^{r}\sum_{j=1}^{c} \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$$

where O_{ij} and E_{ij} represent observed and expected frequencies, respectively. Under the null hypothesis (H_0), no significant association exists between tuberculosis status and the predictor variable.

2.3.2. Fishers Exact Test

For smaller expected cell counts (< 5), the Fishers exact test was used. For a 2×2 table with cell counts $n_{11}, n_{12}, n_{21}, n_{22}$, the exact probability was computed as:

$$P(n_{11}) = \frac{\binom{n_{1+}}{n_{11}}\binom{n_{2+}}{n_{+1}-n_{11}}}{\binom{n}{n_{+1}}}$$

where n_{i+} and n_{+j} denote the marginal row and column totals, respectively.

2.3.3. Odds Ratio and Confidence Intervals

The strength of association between exposure and tuberculosis infection was estimated using the odds ratio (OR):

$$\hat{\theta} = \frac{n_{11}n_{22}}{n_{12}n_{21}}$$

The 95% confidence interval (CI) for $\hat{\theta}$ was given by:

$$\mathrm{CI}_{95\%} = \exp\left[\ln(\hat{\theta}) \pm 1.96 \times \sqrt{\frac{1}{n_{11}} + \frac{1}{n_{12}} + \frac{1}{n_{21}} + \frac{1}{n_{22}}}\right]$$

2.3.4. Binary Logistic Regression Model

Multiple binary logistic regression was applied to identify independent predictors of tuberculosis infection. The model estimated the probability of infection $\pi(\mathbf{X})$ as:

$$\pi(\mathbf{X}) = \frac{\exp(\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k)}{1 + \exp(\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k)}$$

or equivalently in logit form:

$$\log\left(\frac{\pi(\mathbf{X})}{1 - \pi(\mathbf{X})}\right) = \beta_0 + \sum_{i=1}^{k} \beta_i x_i$$

where $\pi(\mathbf{X})$ denotes the probability that an individual is TB-positive, β_0 is the intercept, and β_i are regression coefficients. Exponentiating β_i gives the odds ratio for the i^{th} predictor:

$$\mathrm{OR}_i = e^{\beta_i}$$

2.3.5. Parameter Estimation

Parameters ($\hat{\beta}$) were estimated using the maximum likelihood method:

$$L(\beta; \mathbf{y}, \mathbf{X}) = \prod_{i=1}^{n} \pi_i^{y_i}(1 - \pi_i)^{1-y_i}$$

with log-likelihood function:

$$\ell(\beta) = \sum_{i=1}^{n} [y_i \ln(\pi_i) + (1 - y_i)\ln(1 - \pi_i)]$$

Estimates were obtained by maximizing $\ell(\beta)$ using iterative reweighted least squares.

2.3.6. Wald Test and Confidence Intervals

For large samples, the Wald test statistic for β_j was computed as:

$$Z = \frac{\hat{\beta}_j}{\text{se}(\hat{\beta}_j)} \sim N(0,1)$$

The 95% confidence interval for β_j was:

$$\hat{\beta}_j \pm Z_{\alpha/2}\{\text{se}(\hat{\beta}_j)\}$$

and for the odds ratio:

$$\text{CI}_{95\%} = \exp\left[\hat{\beta}_j \pm Z_{\alpha/2}\{\text{se}(\hat{\beta}_j)\}\right]$$

2.3.7. Model Evaluation

Goodness-of-fit was assessed using the deviance statistic:

$$D = -2(\ln L_m - \ln L_s)$$

where L_m and L_s are the maximum log-likelihoods of the fitted and saturated models, respectively. A likelihood ratio test (LRT) compared nested models:

$$\chi^2_{LRT} = 2[\log L(\hat{\beta}) - \log L(0)]$$

A significant χ^2_{LRT} ($p < 0.05$) indicated that at least one predictor significantly contributed to the model fit.

All statistical tests were two-tailed with significance set at $p < 0.05$. Variables with $p < 0.10$ in bivariate analysis were retained in the multivariate model.

ROC Curve for Logistic Regression Model

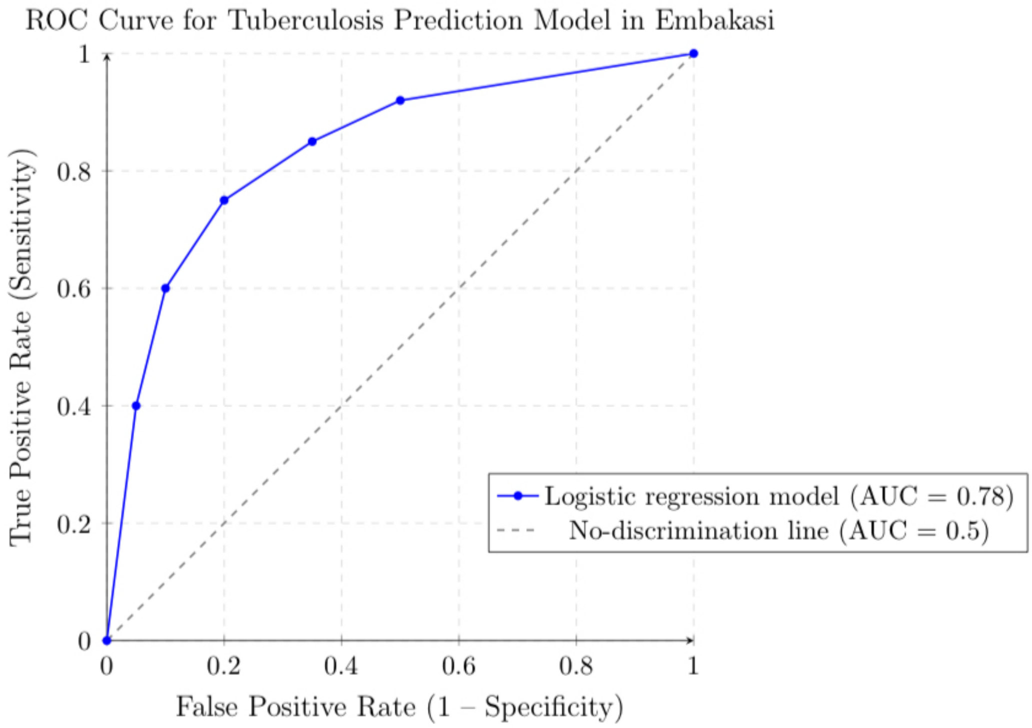

***Figure 2.** Receiver Operating Characteristic (ROC) curve showing the predictive performance of the logistic regression model for tuberculosis infection in Embakasi.*

The logistic regression model discriminatory performance was evaluated using the Receiver Operating Characteristic (ROC-Curve)) as shown in figure 2. The model demonstrated acceptable predictive performance with an Area Under the Curve (AUC) of 0.78 (95% CI: 0.72-0.84). This indicates that the model has a 78% probability of correctly distinguishing between individuals with and without tuberculosis.

2.4. Ethical Considerations

Ethical approval was obtained from the Mama Lucy Kibaki Teaching and Referral Hospital administration. All patient data were anonymized before analysis, and confidentiality was strictly maintained throughout. The study adhered to the principles of the Declaration of Helsinki (2013).

2.5. Limitations of the Study

The study uses secondary data and therefore the the data may not be a well representation of the whole population. Also due to the small sample size, the results obtained may not give accurate situation o the tuberculosis prevalence in the region.

3. Results

3.1. Tuberculosis Prevalence Factors

In Embakasi, several demographic and behavioral characteristics were found to influence the prevalence of pulmonary tuberculosis (TB). This section presents results of the descriptive and inferential analyses, including chi-square and Fishers exact tests, as well as logistic regression modeling.

3.1.1. Prevalence by Gender

From the laboratory results, 7 out of every 10 males tested for tuberculosis returned a positive test result, while 6 out of 10 females tested positive. This translated to prevalence rates of 69.6% among males and 65.1% among females who attended the chest clinic at Mama Lucy Kibaki Hospital (Table 1).

Table 1. *Tuberculosis prevalence according to gender.*

Gender	Positive	Negative	Total	Prevalence(%)
Male	132	59	190	69.6
Female	72	37	110	65.1

Testing for differences between the two genders, the null hypothesis stated that the prevalence rates were equal ($H_0 : \mu_i = \mu_j$), while the alternative hypothesis suggested otherwise ($H_1 : \mu_i \neq \mu_j$). Fishers exact test gave an odds ratio of 1.23, proportion difference of 0.045, and $p = 0.249$ (95% CI between 0.74 and 2.02. Since $p > 0.05$, there was no statistically significant difference between males and females in tuberculosis prevalence.

3.1.2. Prevalence by Smoking Habits

The prevalence of tuberculosis among smokers was 78.6%, compared to 61.7% among non-smokers (Table 2).

Table 2. *Tuberculosis prevalence among smokers and non-smokers.*

Smoking Habit	Positive	Negative	Total	Prevalence(%)
Yes	81	22	103	78.6
No	121	76	197	61.7

Fishers exact test revealed an odds ratio (OR) of 2.13 and $p = 0.004$ (95% CI: 1.24-3.68), indicating a statistically significant difference. Thus, smokers were 2.13 times more likely to develop tuberculosis than non-smokers.

3.1.3. Alcoholism and Tuberculosis Prevalence

The prevalence among alcohol consumers was 75.4% compared to 59.0% among non-alcoholics (Table 3).

Table 3. *Tuberculosis prevalence by alcohol consumption.*

Alcohol Use	Positive	Negative	Total	Prevalence (%)
Yes	138	45	183	75.4
No	69	48	117	59.0

Fishers test indicated $p = 0.002$, odds ratio = 2.17 (95% CI: 1.33-3.57). Alcoholic individuals were therefore 2.17 times more likely to contract TB than non-alcoholics.

3.1.4. Nutrition and Tuberculosis Prevalence

Individuals who took only one meal a day had a TB prevalence of 81.5%, compared to 68.9% for those with two meals and 63.2% for those with three meals (Table 4).

Table 4. *Nutrition level and tuberculosis prevalence.*

Meals per Day	Positive	Negative	Total	Prevalence (%)
1	22	5	27	81.5
2	115	52	167	68.9
3	67	39	106	63.2

The chi-square test yielded $\chi^2 = 3.43$, $p = 0.180$, indicating no significant difference in tuberculosis prevalence across nutritional categories.

3.1.5. Education Level and Tuberculosis Prevalence

Tuberculosis prevalence decreased with higher education levels: 79.2% (no education), 66.9% (primary), 63.5% (secondary), and 41.9% (tertiary) (Table 5).

Table 5. *Education level and tuberculosis prevalence.*

Education Level	Positive	Negative	Total	Prevalence (%)
None	38	10	48	79.2
Primary	85	42	127	66.9
Secondary	40	23	63	63.5
Tertiary	26	36	62	41.9

The chi-square test ($\chi^2 = 5.52$, $p = 0.136$) indicated that education level was not a statistically significant factor.

3.1.6. History of Tuberculosis Infection

Individuals without prior tuberculosis infection had a prevalence of 72.9%, while those with previous infection had 61.1% (Table 6).

Table 6. *Previous infection history and tuberculosis prevalence.*

Tuberculosis History	Positive	Negative	Total	Prevalence (%)
Yes	91	58	149	61.1
No	110	41	151	72.9

Fishers test yielded OR = 0.59, $p = 0.022$ (95% CI: 0.36-0.96), suggesting individuals with previous tuberculosis infection were 41.3% less likely to test positive than those without prior infection.

3.1.7. Occupation and Tuberculosis Prevalence

Prevalence was 67.5% for formally employed, 74.6% for informal workers, and 64.5% for unemployed individuals (Table 7).

Table 7. *Tuberculosis prevalence by employment type.*

Employment Type	Positive	Negative	Total	Prevalence (%)
Unemployed	53	29	82	64.5
Formal	54	26	80	67.5
Informal	103	35	138	74.6

The chi-square test ($\chi^2 = 6.06$, $p = 0.048$) showed significant differences among employment types.

3.1.8. Ventilation and Tuberculosis Prevalence

Poorly ventilated households had a prevalence of 71.5% compared to 40.0% for well-ventilated homes (Table 8).

Table 8. *Ventilation and tuberculosis prevalence.*

Ventilation Level	Positive	Negative	Total	Prevalence (%)
Good	12	18	30	40.0
Poor	193	77	270	71.5

Fishers test gave OR = 0.34, $p = 0.008$ (95% CI: 0.16-0.74), confirming ventilation as a significant determinant of tuberculosis prevalence.

3.1.9. Tuberculosis Awareness

Individuals with good tuberculosis awareness had a prevalence of 59.7%, while those with poor awareness recorded 72.8% (Table 9).

Table 9. *Tuberculosis awareness and prevalence.*

Awareness Level	Positive	Negative	Total	Prevalence (%)
Good	43	29	72	59.7
Poor	166	62	228	72.8

Fishers test ($p = 0.014$, OR = 0.53, 95% CI: 0.31-0.90) showed that individuals with good awareness were 47% less likely to contract tuberculosis.

3.1.10. Congestion and Tuberculosis Prevalence

Tuberculosis prevalence was 74.1% among individuals living in congested housing, compared to 57.6% among those in non-congested dwellings (Table 10).

Table 10. *Congestion and tuberculosis prevalence.*

Congestion Level	Positive	Negative	Total	Prevalence (%)
Yes	149	52	201	74.1
No	57	42	99	57.6

Fishers test reported $p = 0.004$, OR = 2.04 (95% CI: 1.23-3.38), confirming that congested living conditions significantly increased tuberculosis risk.

3.2. Logistic Regression Model of Tuberculosis Prevalence

A multiple logistic regression model was developed to assess the combined influence of demographic, behavioral, and environmental factors. The overall model was statistically significant (Deviance difference = 29.1, df = 10, $p = 0.0033$). Alcoholism ($p = 0.041$) and congestion ($p = 0.048$) were identified as the most significant predictors of tuberculosis prevalence (Table 11).

Table 11. *Logistic regression model of tuberculosis prevalence factors.*

Variable	Odds Ratio	95% CI	p-value
Alcoholism	2.11	1.03 - 4.33	0.041
Congestion	1.91	1.01 - 3.64	0.048

After backward elimination of non-significant terms, the reduced model (Table 12) showed that alcoholism and congestion remained strong independent predictors, with a significant interaction effect ($p = 0.014$).

Table 12. *Reduced logistic regression model of the prevalence of tuberculosis.*

	$\hat{\beta}_i$	Se($\hat{\beta}_i$)	e($\hat{\beta}_i$)	95% CI for e($\hat{\beta}_i$)	Z	p-value
Intercept	-0.5123	0.3634			-1.3822	0.16754
Alcoholism	1.5121	0.4583	4.5418	1.8520, 11.137	3.319	0.00083
Smoking	0.552	0.3042	1.7552	0.9655, 3.1915	1.851	0.06548
Congestion	1.4028	0.4247	4.0635	1.7648, 9.3563	3.283	0.00089
Alco:Conge	-1.3779	0.5585	0.2529	0.0851, 0.7530	2.454	0.01362
Null deviance: 372.47 on 297 df; Residual deviance: 340.12 on 290 df						

The logistic model equation was:

$$log[\frac{\hat{\pi}(x)}{1-\hat{\pi}(x)}] = -.501 + 1.513(alcoh) + .562(smk) + 1.401(cong) - 1.379(alch.cong)$$

3.3. Comparison of Tuberculosis Prevalence by Sub-County

Prevalence rates varied slightly across the five Embakasi sub-counties West (61.9%), Central (70.5%), East (63.4%), North (72.7%), and South (64.7%) (Table 13). However, chi-square analysis indicated no statistically significant difference ($\chi^2_4 = 2.14$, $p = 0.071$).

Table 13. Tuberculosis prevalence by sub-county in Embakasi.

Sub-county	Prevalence (%)	Total Sample
West	61.9	42
Central	70.5	139
East	63.4	41
North	72.7	44
South	64.7	34

3.4. Comparison with National Tuberculosis Prevalence

The prevalence of tuberculosis in Embakasi was estimated at 21 cases per 10,000 population, compared to a national prevalence of 14 per 10,000 [1]. The chi-square test ($\chi^2_1 = 576.38$, and $p < 0.001$) confirmed a statistically significant difference, with an odds ratio of 4.66 (95% CI: 4.62-4.71), implying that residents of Embakasi were over four times more likely to have TB than the national average (Table 14).

Table 14. Comparison of Embakasi and national TB prevalence.

Region	Cases per 10,000	Odds Ratio	p-value
Embakasi	21	4.66	< 0.001
Kenya	14	–	–

4. Discussion

A study done in the sub-counties of Nairobi in the Embakasi area has shown that tuberculosis (TB) is a significant issue of public health in this urban location with prevalence rate of 68 % significantly exceeding the national rate of 14 per 10,000[1]. This sharp contrast speaks volumes of the difficulty in managing tuberculosis under the conditions of overpopulated urban life.

The research established that both men and women have a comparable prevalence of TB, with men exhibiting a very slight difference (69.6%) over women (65.1%) but this was not statistically significant ($p = 0.249$). Nonetheless, the use of lifestyle, such as alcohol and smoking, was a significant risk factor. Smokers had more than twice the likelihood of testing positive to tuberculosis ($p = 0.004$, $OR = 2.13$) and those who consumed alcohol were at risk of being infected more than twice ($p = 0.002$,$OR = 2.17$). Such results indicate that addictive behaviors such as smoking and drinking are a major contributor to tuberculosis in the population.

The living conditions also played a major role. Individuals in poorly ventilated households were also far more susceptible to tuberculosis (71.5%) than individuals in well-ventilated households (40 %) ($p = 0.008$). One more important factor was overcrowded households where the risk of getting infected with tuberculosis was more than twice higher in those cases ($p = 0.004$, $OR = 2.04$). These outcomes demonstrate the role that shoe-box-sized houses with poor ventilation in cities can play as sources of tuberculosis.

Positively, there was a sense of protection of being aware of tuberculosis. Those with knowledge about the disease were lower (59.7%) than the ones with little knowledge (72.8%) ($p = 0.014$). Employment was also a contributing factor with informal workers such as those in unstable or poorly paid jobs registering the highest TB rates (74.6%) as $P = 0.048$) indicating how harsh economic and working environments can expose an individual to the disease. Although there was no strong statistical correlation between education and nutrition, individuals having higher levels of education and who were well fed were more likely to have lower levels of TB suggesting the existence of some protection benefits.

The further analysis of the study proved that alcohol consumption and overpopulation under the same roof were the most significant predictors of tuberculosis (p = 0.0406 and 0.048 respectively). Interestingly, when the two factors were used together their effect was not as dire as it was supposed to be, which implies that they might have an overlap in some environmental set ups. The total results were very essential (deviance difference = 32.35, $p < 0.0001$), which is why these risk factors should be dealt with.

Older people aged (65 - 80) did not significantly influence the results ($p = 0.096$), but the highest tuberculosis rates were observed in old people (88.9%), which indicates that they might be more susceptible. The prevalence of tuberculosis among the five sub-counties in the entire of Embakasi was almost similar and there was no significant disparity between them ($p = 0.071$). Nevertheless, the general rate of the area (21 per 10,000) was much higher than the national average (only $p < 0.000001$,$OR = 4.66$), which could be explained by the peculiarities of the urban life such as high population density and inadequate infrastructure.

To put it short, lifestyle factors such as smoking and drinking and environmental problems such as cramped and poorly ventilated houses are major causes of tuberculosis in Embakasi. To address this, the public health campaigns should relocate their approach to assist the population in adopting healthier lifestyles and improving their living conditions as well as creating awareness regarding TB as a way of controlling its transmission in urban population.

5. Conclusion

This paper has discussed the determinants that affect the number of cases of tuberculosis (TB) within the two sub-counties of Nairobi and its surroundings through a logistic regression model. It has been demonstrated that the general TB rates in the region (68%) were significantly more challenging than the national rates, which highlights the unequal impact of large populations and poor economic statuses on the urban communities. Alcoholism, and household congestion were the most important predictors of TB infection and smoking had a significant, but not very significant impact. Poor ventilation, poor awareness, and informal employment were also environmental factors that were linked to high risk of infection.

The results indicate that the structural and behavioral determinants interact in the environment of the high rate of urbanization and poverty to promote TB transmission in the community of the Embakasi area. The age of 25-45 years was disproportionately impacted on males, as it is a group of occupational exposure, lifestyle predisposition, and poor healthcare access. It is interesting to note that the prevalence of TB in the five sub-counties of Embakasi is similar, which means that the prevalence conditions are also evenly distributed within the larger area.

These findings have a public health implication, whereby multi-sectoral TB control measures are needed beyond biomedical treatment. The policies are to focus on housing and ventilation standards improvement, education on alcohol and tobacco use at the community level, and economical empowerment measures that would decrease exposure risk indirectly. Promoting the community spread by stronger urban clinical diagnoses will also reduce community spread.

Longitudinal and spatial models used in future studies would be useful in capturing the dynamics of TB over time and in the quantification of the socioeconomic and environmental covariates to a greater extent. A combination of geospatial risk mapping and epidemiological surveillance may generate useful information on the targeted intervention planning. The current paper is relevant to the existing body of knowledge concerning the determinants of TB in urban Kenya and the vision of the Ministry of Health to eradicate tuberculosis by 2030 with the help of evidence-based and community-based strategies.

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Abbreviations

TB	Tuberculosis
OR	Odds Ratio
CI	Confidence Interval
ROC	Receiver Operating Curve
AUC	Area Under the Curve

Conflicts of Interest

The authors declare no conflicts of interest.

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