

Relationships Between Healthcare-Seeking Behavior and Socioeconomic Disparities Among  
Kenyan Adults Presenting with Signs and Symptoms of Tuberculosis

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## Abstract

### Relationships Between Healthcare-Seeking Behavior and Socioeconomic Disparities Among Kenyan Adults Presenting with Signs and Symptoms of Tuberculosis

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#### Introduction

Kenya is a high-burden country for tuberculosis (TB), yet most symptomatic adults do not seek formal care. This study examined the association between formal healthcare-seeking and household socioeconomic status (SES) among Kenyan adults with TB symptoms, using data from the 2016 nationally representative TB prevalence survey.

#### Methods

We used data from the 2016 Kenya National TB Prevalence Survey (63,050 participants). Our analysis focused on 23,155 adults ( $\geq 15$  years) reporting TB-related symptoms. The outcome was formal care-seeking (yes/no) for TB symptoms, defined as any visit to a health facility for TB evaluation. Household SES was derived by principal-component analysis (PCA) of asset ownership and categorized into tertiles. Multivariable models adjusted for age, sex, schooling level, occupation, and marital status. To account for clustering at both the household and community levels, we employed multilevel logistic regression with random intercepts for household and survey cluster.

#### Results

Only 15.9% of symptomatic adults reported seeking formal care. Higher SES did not predict greater care-seeking with individuals in the top wealth tertile having marginally lower adjusted odds of seeking care than those in the bottom tertile ( $OR \approx 0.84$ ). In contrast, demographic factors were strongly associated with care-seeking. Older age groups were much more likely to seek care (age 30–50:  $OR \approx 1.39$ ;  $>50$ :  $OR \approx 1.97$  versus  $<30$ ), and men were substantially less likely than women to seek care ( $OR \approx 0.70$ ). Marital status also mattered. Married ( $OR \approx 1.5$ ) and divorced/separated/widowed ( $OR \approx 2.3$ ) adults were more likely than never-married peers to seek

care. Education showed only a modest association with care-seeking (middle vs. low: OR  $\approx$  0.86), and no significant difference was observed for high vs. low education.

### **Conclusion**

Formal care-seeking was uniformly low with about 84% of symptomatic adults not seeking treatment. Contrary to expectations, higher household wealth did not improve care-seeking, whereas demographic and social factors predominated. The results highlight men, younger adults, and unmarried individuals as subgroups with lower odds of seeking TB care, suggesting they may face greater barriers or reduced access. TB control programs should target outreach to these groups; for example, via male-friendly case finding and engaging family/community networks to amplify care-seeking. Continued use of high-quality surveillance data and community engagement will be essential to ensure that all symptomatic Kenyans promptly access TB diagnosis and care.

## Introduction

Tuberculosis (TB) continues to play a pivotal role in shaping the global public health landscape. Despite considerable efforts to contain its spread, TB remains a major health threat, particularly among underserved populations (1–3). TB is the leading cause of death from a single infectious disease (4). The global incidence rate is 133 per 100,000 people (5), with 1.18 million TB deaths reported in 2022, positioning TB as the fourth leading cause of mortality globally (6).

Kenya, one of 30 countries designated as high TB burden by the World Health Organization (WHO), significantly contributes to the global toll of the disease. In 2016, Kenya's TB prevalence was 558 per 100,000 (7,8). A similar high prevalence was found in a 2022 survey among neighborhoods in Nairobi (9). Although the entire population is at risk, the surveys highlighted substantial disparities in the disease's distribution. The burden was highest among individuals in the economically active 25-34 age group in the 2016 survey but in 45 to 54 years in the 2022 survey (7,9,10). Additionally, TB prevalence was notably higher in men (809 per 100,000) compared to women (359 per 100,000), and urban residents experienced a greater burden (760 per 100,000) than rural residents (453 per 100,000) (7,8). A similar trend was observed in the 2022 survey (9). These inequalities suggest that factors such as age, gender, and urbanization may contribute to differential exposure to TB (11), underscoring the importance of contextualizing TB control efforts.

One of the major obstacles to decreasing TB burden in Kenya is the low healthcare-seeking behavior (HSB) among adults with TB symptoms (12). The 2016 Kenya TB survey supports this, revealing that 80% of adults with noticeable TB signs and symptoms did not seek treatment, including 67% of individuals later confirmed to have TB (7,8,13). Similarly, the 2022 survey found that 76% of individuals with a persistent cough, a key symptom of TB, did not seek care (9). This delay in seeking treatment is common in high burden areas, with evidence showing that people often avoid seeking medical attention when symptoms are perceived as mild or self-limiting (8,14). In this same token, many individuals postpone treatment for months due to factors such as lack of awareness, fear of stigma, and concerns about the costs and inconvenience of accessing healthcare (14,15). HSB delays not only hinder early diagnosis but also contribute to ongoing transmission and poorer health outcomes.

Furthermore, healthcare services in Kenya are often overwhelmed, with TB services at health facilities insufficient to meet the demand posed by the high volume of people with TB symptoms (13). This imbalance between demand and supply can exacerbate barriers to care, as individuals may face long wait times to receive appropriate care. These systemic issues reflect broader challenges in the healthcare infrastructure, which can further discourage HSB, particularly in resource-limited settings.

The low HSB is especially concerning in Kenya, where TB primarily affects the productive age group, leading to significant economic losses. Research has shown that TB-related illness in this group can result in a 20-30% loss of household income (10), which further compounds the economic burden of the disease. The intersection of health and socioeconomic status (SES) is critical, with studies from several settings showing that individuals from lower SES backgrounds are more likely to experience both delayed diagnosis and poorer treatment outcomes, due to a variety of factors including limited access to healthcare, transportation costs, and living conditions that facilitate TB transmission (14–16). Conversely, higher SES individuals are more likely to seek care promptly and adhere to treatment (17). These socioeconomic

disparities in healthcare access and utilization further complicate efforts to control TB, especially in high-burden countries like Kenya.

Despite a substantial body of literature examining the relationship between HSB and SES, no published studies to date have specifically associations between SES and HSB for TB using nationally representative data from the 2016 Kenya TB Prevalence Survey. A further innovation of this study is the evaluation of changes in HSB over time by analyzing data from both the 2016 and 2022 surveys. In light of these gaps, the aim of this study is to explore the relationships between HSB and SES among Kenyan adults, providing new insights into how socioeconomic factors may impact the control and management of TB in Kenya, and whether patterns of HSB have changed between 2016 and 2022.

### Research Question and Hypothesis

*Research Question:* Is the health-seeking behavior of adults with TB symptoms in Kenya in 2016 associated with socioeconomic status? Does the relationship differ by age, region, and sex?

*Hypothesis:* We hypothesize that higher socioeconomic status among adults with symptoms of TB are associated with greater likelihood of seeking care.

### **Methodology**

#### Data Source

This study utilized data from the 2016 Kenya National TB Prevalence Survey, a nationally representative study conducted between July 2015 and July 2016. (12). This survey used a cluster-based, cross-sectional design to estimate TB prevalence in Kenya, directly addressing concerns that earlier WHO estimates had underestimated the country's true TB burden. Data on HSB and household assets were collected using methods adapted from the Demographic Health Survey (DHS) and WHO recommendations. These assets will be used to create SES indices, which will then be analyzed to assess their influence on TB patients' HSB. (9,12)

#### Target population

The 2016 Kenya National Tuberculosis (TB) Prevalence Survey targeted individuals aged 15 years and older residing across the country. The 2016 survey enrolled 63,050 participants.

#### Inclusion criteria

Individuals were eligible to participate in the surveys if they met two key inclusion criteria: (1) residence in the selected household for at least 30 consecutive days prior to the survey visit, (2) being 15 years of age or older, and (3) the presence of tuberculosis-related symptoms qualifying them for sputum sample collection and diagnostic testing.

#### Exclusion criteria

Special institutions, including prisons, military camps, healthcare facilities, schools, and diplomatic compounds, were excluded from the surveys due to the additional administrative approvals required for their inclusion.

### Outcome of Interest

The primary outcome was care-seeking behavior among adults reporting symptoms suggestive of tuberculosis. It was defined as any instance of seeking medical evaluation at a formal health facility following the onset of TB-related signs and symptoms. This variable captures both the decision to seek care and engagement with facility-based health services. It was operationalized as a binary indicator.

### Independent Variables

The analysis focused on two primary units: household-level SES and individual-level characteristics. Household-level SES was categorized into three groups - 40% bottom, 20% middle, and 40% top, consistent with 2020 Kenya EquityTool categorization of the households' SES (18), and included in the models as a main exposure variable. At the individual level, covariates of interest included age group, gender, educational level, occupation, and marital status. These covariates were incorporated to account for potential confounding effect.

### Data Analysis

**Handling Missing Data:** All “Don’t Know” responses were retained in their original form to preserve the integrity of participant-reported uncertainty. When a variable had less than 5% missing data, the affected cases were excluded from the analysis to ensure completeness and consistency. All other missing values not attributable to skip logic, treated as true item nonresponse, were also addressed through casewise deletion, if their missingness is less than 5% of observations for a given variable. This complete-case approach ensured consistency across analyses while maintaining transparency in handling incomplete data.

*Asset Selection for Principal Component Analysis (PCA):* We selected a concise set of household assets for our PCA-based wealth index estimation without sacrificing validity. Previous work has shown that small, strategically chosen subsets of durable goods perform nearly as well as longer batteries. For example, in the Indian DHS data, an eight-item index (TV, radio, watch, etc.) correlated strongly with detailed income measures ( $r \approx 0.79$ )(19). A ten-item index in 21 Latin American and Caribbean countries agreed closely with the longer items in the AmericasBarometer dataset(20). In 16 low- and middle-income countries, six-item, country-specific wealth indices achieved high reliability in both urban and rural areas ( $\kappa = 0.75$ )(21), and another study buttressed that shorter lists maintain strong agreement with full DHS indices(22). Furthermore, the 2016 Kenya EquityTool, which utilized 13 assets to estimate wealth indices, exceeded  $\kappa = 0.75$  when compared with full DHS wealth quintiles(23). These findings indicate that six to ten assets suffice to capture most variation in household wealth. Accordingly, we adapted the 2016 Kenya EquityTool asset list to construct our PCA wealth indices, ensuring strong concordance with established measures of SES while limiting the number of variables.

*Variable Recoding:* Prior to conducting PCA, variables were recoded to enhance interpretability and ensure compatibility with the methodological assumptions of PCA(19,24–26). One-hot (dummy) encoding was applied to all categorical variables, generating a separate binary indicator for each category. The resulting binary variables were assessed for variance, and columns with zero variance were removed, as such assets do not contribute to the principal component.

Distributional properties of the sole continuous variable, number of sleeping rooms, were evaluated using skewness. Although its skewness marginally exceeded 2, indicating moderately to strongly positively skewed data, we opted not to log-transform. Instead, the variable was mean-centered and scaled to unit variance prior to PCA, allowing the standardization step to mitigate its influence on the covariance structure.

*Variable Standardization:* Household asset data often comprises a mixture of variable types, including continuous variables (e.g., number of rooms) and binary indicators (e.g., ownership of a television). Continuous variables tend to have wider ranges of values, which can exert a disproportionate influence on the results of Principal Component Analysis (PCA) if not appropriately scaled. To address this imbalance and ensure that each variable contributed equally to the analysis, all continuous variables were standardized to have a mean of zero and a standard deviation of one. This standardization step was essential to harmonize the scale of measurement across variables and improve the validity of the PCA results. (19)

*Application of PCA:* Following asset selection, recoding, and standardization, PCA was conducted to construct a composite measure of household SES. The analysis was performed on the final set of binary and standardized continuous variables. The first principal component was retained, which was used to generate SES indices categorized into tertiles. (19)

*Regression Analysis:* To examine the association between HSB and SES among adults presenting with signs and symptoms of TB, we employed a Generalized Linear Mixed Effects Model (GLMM) with a logit link and binomial distribution, incorporating random intercepts at the household and cluster levels to account for intra-group correlation and unmeasured contextual variation.

The dataset was derived from three survey instruments: a census module, a TB symptoms module, and a household assets module. The census and TB symptoms instruments collected data at the individual level, while the household assets module was administered at the household level. This multi-level data structure informed our modeling approach, ensuring that SES, derived from household-level asset data, was appropriately linked to individual-level healthcare-seeking outcomes within a nested sampling design.

*Model Building Approach:* Variable selection for the regression models was determined a priori. We began with a baseline model that included the outcome and primary exposure variables. Covariates - age group, sex, schooling, occupation, and marital status - were then added sequentially in subsequent models.

To facilitate robust statistical analysis and reduce model complexity, we collapsed detailed categories of education and occupation into broader, conceptually coherent groups. Educational

attainment was recoded into three levels - Low Education (no schooling through completed primary), Medium Education (some or completed secondary), and High Education (post-secondary) - to reflect meaningful distinctions in formal educational exposure. Similarly, occupational status was regrouped into Formal Employment (government and private sector jobs), Informal/Independent Work (farming, fishing, and small business), and Not in Labor Force / Dependent (students, homemakers, unemployed, and others). Marital status was also recoded as Single (never been married), Married, and Divorced/Separated/Widowed. This recoding aligns with standard practices in demographic and health research, improves model stability, and ensures adequate cell sizes for multivariable modeling(27–30).

Age was log-transformed to address skewness and reduce the influence of large values, improving model convergence and stabilizing variance relative to other covariates. This transformation enhances the interpretability of interaction terms by compressing the scale of age, which is especially important in models involving continuous predictors. The overall specified model structure for the first research questions is outlined below:

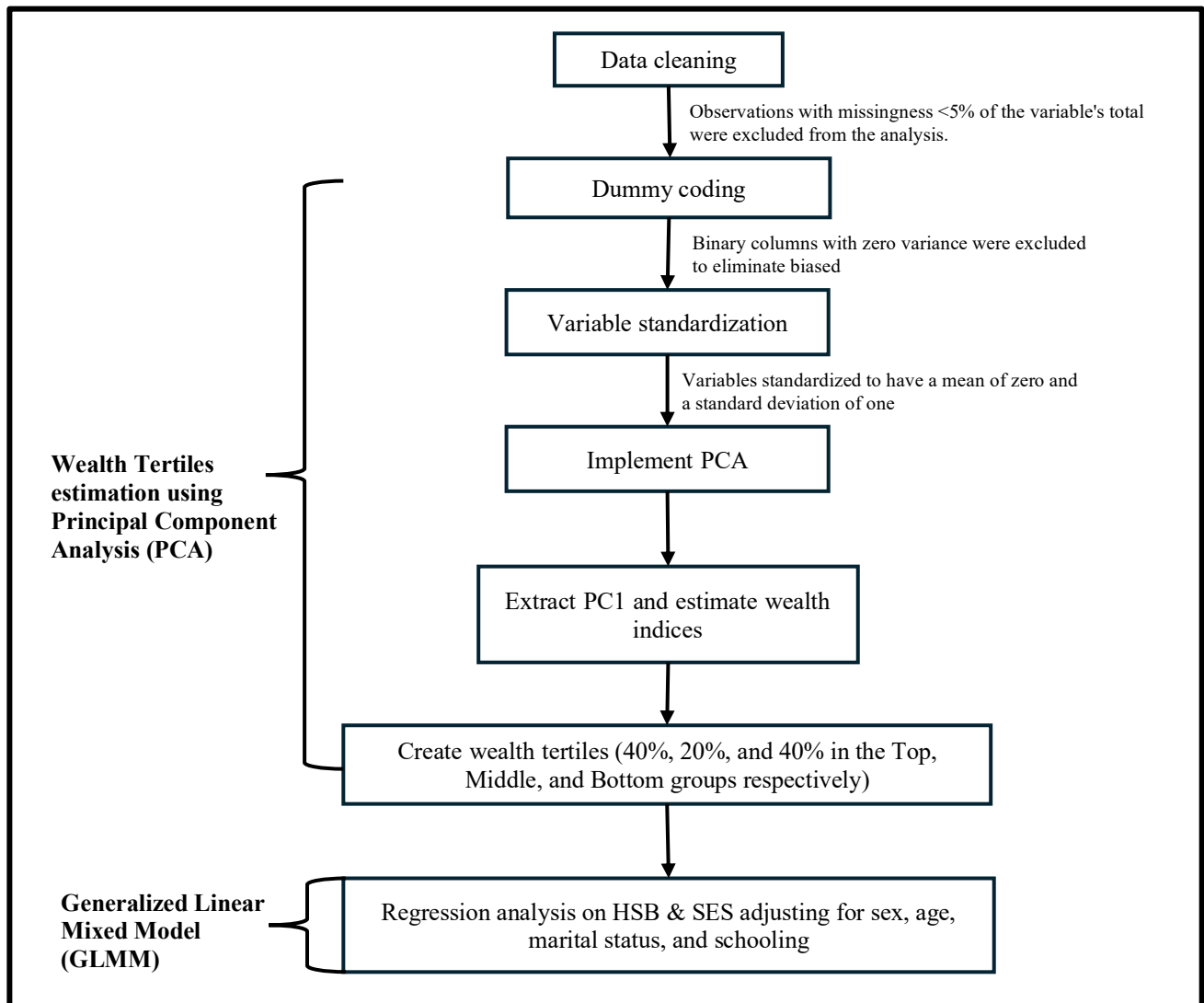
$$\text{logit}(PHSB_{ij} = 1) = \beta_0 + \beta_1 \text{Middle}_{ijk} + \beta_2 \text{Top}_{ijk} + \beta_3 \text{Covariates}_{ijk} + u_k + v_{jk}$$

Where:

- $Y_{ijk}$  = binary indicator of whether individual  $i$  in household  $j$  and in cluster  $k$  sought care
- $SES_{ijk}$  = socioeconomic status (wealth tertiles)  $Sex_{ijk}$  = sex of the individual
- $AgeGroup_{ijk}$  = age of the individual
- $u_k \sim N(0, \sigma_u^2)$  = random intercept for cluster
- $v_{jk} \sim N(0, \sigma_v^2)$  = random intercept for household

### Ethical Consideration

This project adhered to the ethical guidelines set forth by the University of Washington’s (UW) Master of Public Health (MPH) program. The data used in this analysis are secondary datasets derived from the 2016 Kenya National TB Prevalence Survey, for which we received ethical clearance from the relevant regulatory bodies in Kenya. The datasets utilized in this study are de-identified, with no personal identifiers included, ensuring the confidentiality and privacy of the participants.



**Figure 1:** Steps involved in data analysis.

## Results

### Descriptive Characteristics of the Sample

Table 1 presents the sociodemographic characteristics and treatment-seeking behavior of 23,155 adults with symptoms suggestive of tuberculosis in Kenya in 2016. Overall, 43.1% of

participants were in the lowest wealth tertile, 19.8% in the middle, and 37.1% in the highest tertile. The sample was predominantly female (60.6%), and most participants were aged 30-50 years (38.8%), followed by those under 30 years (32.3%) and over 50 years (28.8%).

Only 0.7% of respondents were pregnant at the time of the survey. Most participants were engaged in informal or independent work (60.0%), while 30.0% were not in the labor force or were dependents, and 10.0% reported formal employment. Educational attainment was generally low, with 68.5% having low education, 25.8% medium education, and only 5.7% high education. In terms of marital status, 70.5% were married, 20.9% had never been married, and 8.6% were divorced, separated, or widowed. Despite the presence of TB symptoms, only 15.9% of participants reported seeking treatment, highlighting substantial gaps in health-seeking behavior among symptomatic individuals.

**Table 1: Socio-Demographic Characteristics of Participants with TB Signs and Symptoms**

Characteristic	Level	n,%
n		23155
Wealth Tertile	Bottom	9986 (43.1)
	Middle	4589 (19.8)
	Top	8580 (37.1)
Sex	F	8772 (60.6)
	M	5714 (39.4)
Age Group	<30	4684 (32.3)
	30–50	5624 (38.8)
	>50	4178 (28.8)
Pregnant	Yes	101 (0.7)
	No	14385 (99.3)
Occupation	Formal Employment	1455 (10.0)
	Informal/Independent Work	8691 (60.0)
	Not in Labor Force/Dependent	4340 (30.0)
Schooling	Low Education	9923 (68.5)
	Medium Education	3742 (25.8)
	High Education	821 (5.7)
Marital Status	Single (never been married)	3026 (20.9)
	Married	10211 (70.5)
	Divorced/Separated/Widowed	1249 (8.6)
Treatment Sought	Yes	2297 (15.9)
	No	12189 (84.1)

## Scree Plots for PCA Results

Figures 2 present scree plots for the national, urban, and rural samples, respectively. In each case, the first principal component explained just over 6 % of the variance, and an “elbow” appeared after the 10<sup>th</sup> to 15<sup>th</sup> components, beyond which additional components contributed minimally. To reach approximately 80 % cumulative variance required 24 components in rural areas compared to 17 in urban areas, reflecting greater heterogeneity in rural asset ownership. Across all samples, PC1 consistently captured the largest share of socioeconomic variation. In line with previous studies, PC1 was therefore retained to construct robust wealth indices for subsequent analyses(24,25).

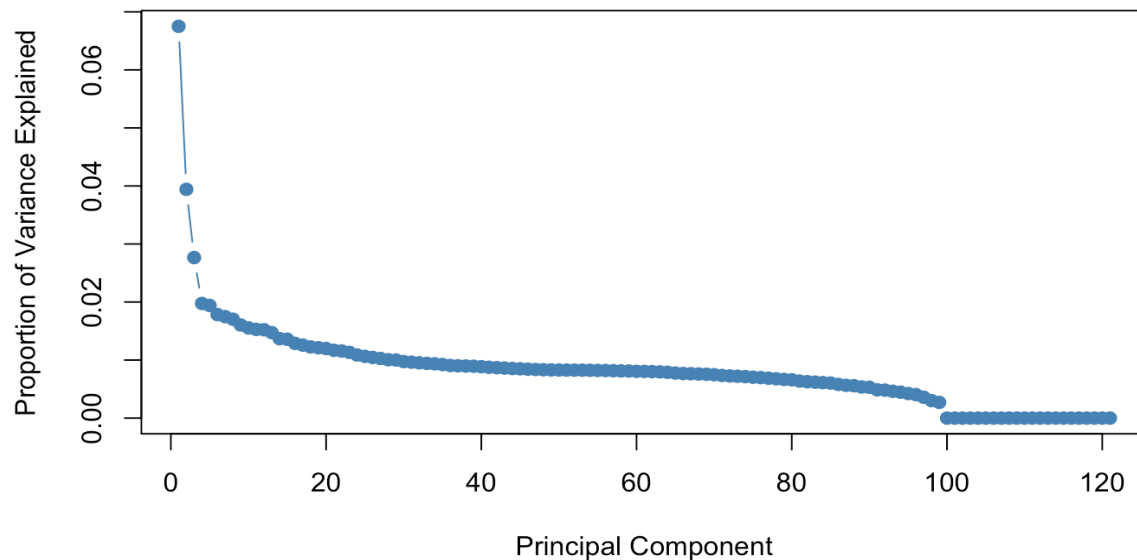


Figure 2: Scree plot showing variance explained by each PC

## Validation and Robustness of SES Estimation through Household Asset Proxies

We validated the PCA-derived wealth tertiles by comparing four key household indicators: water treatment, cooking fuel, television ownership, and roofing material. From the PCA results, 60% of top-tertile households lacked water treatment versus 84% in the bottom tertile, indicating greater access to treated water among wealthier households and hence less water treatment. Charcoal use was unexpectedly higher in the top tertile (26%) than the bottom (6%), perhaps reflecting urban environmental constraints. Television absence followed the expected pattern (18 % in the top tertile vs. 94% in the bottom), and thatch roofing was used by 15% of bottom-tertile households but by none in the top tertile.

Overall, the asset-based PCA tertiles behave as expected. Higher-SES households show greater access to treated water, television ownership, and modern roofing, while lower-SES households lack these amenities. The one anomalous finding (higher charcoal use in the top tertile) likely reflects context-specific fuel choices rather than a misclassification of wealth. Taken together, these patterns support the validity of our SES estimates.



**Table 2: Odds of Seeking Care among Adults with TB Signs and Symptoms**

Term	Unadjusted Model		Adjusted for Sex		Adjusted for Age Group		Adjusted for Marital Status		Adjusted for Schooling		Adjusted for Occupation	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
<b>Wealth Tertiles</b>												
Middle	1.08	0.94-1.25	1.08	0.93-1.24	1.10	0.95-1.27	1.10	0.95-1.27	1.10	0.95-1.27	1.07	0.93-1.24
Top	0.85	0.71-1.00	0.83	0.70-0.98	0.88	0.74-1.05	0.86	0.72-1.02	0.86	0.73-1.03	0.84	0.71-0.99
<b>Sex</b>												
M			0.70	0.63-0.77								
<b>Age Group</b>												
30-50					1.39	1.23-1.57						
>50					1.97	1.73-2.24						
<b>Marital Status</b>												
Married							1.51	1.33-1.72				
Divorced /Separated /Widowed							2.26	1.89-2.72				
<b>Schooling</b>												
Medium									0.86	0.76-0.96		
High									0.97	0.78-1.19		
<b>Occupation</b>												
Informal/Independent /Work											0.89	0.76-1.04
Not in Labor Force/Dependent											0.95	0.80-1.12

## Regression Model Results

This study examined the association between HSB and SES among adults with symptoms of TB in Kenya, using nationally representative data from the 2016 TB prevalence survey. The findings reveal important variations in this relationship across socioeconomic groups and demographic subgroups. We fitted six mixed-effects logistic models to assess the association between HSB and SES, measured by wealth tertile for TB symptoms, sequentially adjusting for key covariates. Across the models, several consistent and significant associations emerged, underscoring the complex interplay of wealth, sex, age, education, marital status, and occupation in shaping care-seeking outcomes.

In the unadjusted model, we observed no statistically significant association between HSB and wealth. However, individuals in the top wealth tertile had slightly lower odds of seeking care compared to those in the bottom tertile (OR = 0.85, 95% CI: 0.71-1.00,  $p = 0.052$ ). This marginal finding hints at a potentially counterintuitive dynamic, suggesting that wealth alone may not drive care-seeking, and in some cases, those with higher resources might delay or deprioritize formal care-seeking.

Adjustment for age highlighted the influence of age in care-seeking for TB. Adults aged 30–50 (OR = 1.39, 95% CI: 1.23-1.57,  $p < 0.001$ ) and those over 50 (OR = 1.97, 95% CI: 1.73-2.24,  $p < 0.001$ ) were significantly more likely to seek care than those under 30. This indicates a strong positive association between age and HSB, likely driven by higher health risk awareness and severity perception among older individuals.

After adjusting for sex, the top wealth tertile was significantly less likely to seek care (OR = 0.83, 95% CI: 0.70–0.98,  $p = 0.030$ ). Males were substantially less likely to seek treatment than females (OR = 0.70, 95% CI: 0.63–0.77,  $p < 0.001$ ), reinforcing gender disparities in health service utilization.

Inclusion of schooling showed that medium educational attainment was associated with lower odds of seeking care compared to those with low education (OR = 0.86, 95% CI: 0.76–0.96,  $p = 0.010$ ). Surprisingly, those with high education showed no significant difference. This challenges the assumption that more education invariably promotes positive health behaviors and points to a potential gap between knowledge and practice, especially for TB-related care.

In the model that adjusted for marital status, we found that being married (OR = 1.51, 95% CI: 1.33–1.72,  $p < 0.001$ ) or divorced/separated/widowed (OR = 2.26, 95% CI: 1.89–2.72,  $p < 0.001$ ) significantly increased the likelihood of seeking care relative to never-married individuals. This suggests that social support systems and life experiences may enhance health awareness and responsiveness to symptoms.

Finally, when occupation was added to the model, we observed that individuals in the informal or independent work and those not in the labor force did not differ significantly in HSB from those formally employed. However, those in the top wealth tertile continued to exhibit lower odds of seeking care (OR = 0.84, 95% CI: 0.71–0.99,  $p = 0.040$ ), reinforcing earlier findings that affluence does not guarantee prompt care-seeking.

## Discussion

This study explored the relationship between HSB and SES among Kenyan adults with symptoms of TB using data from the nationally representative 2016 Kenya TB Prevalence Survey. Overall, HSB was generally low, with only 15.9% of symptomatic individuals seeking care. Additionally, household wealth was not associated with higher care-seeking, and in fact participants in the top wealth tertile had marginally *lower* odds of seeking formal care than those in the bottom tertile. In contrast, several sociodemographic factors were strongly and reliably associated with care-seeking behavior. Adults aged 30–50 and over 50 were much more likely to seek care than those under 30, while men were significantly less likely to seek treatment than women (OR  $\approx$  0.70). Interestingly, individuals with middle-level education were less likely to seek care than those with no or only primary education (OR  $\approx$  0.86), while those with the highest education level showed no significant difference. Marital status was positively linked to care-seeking as married adults had higher odds (OR  $\approx$  1.5) and divorced/separated/widowed even higher odds (OR  $\approx$  2.3) of seeking care relative to never-married individuals. Occupation showed no significant effect after adjustment, with informal and non-labor-force categories similar to formally employed. These patterns suggest that, in our sample, factors like age, sex, marital support, and education played a larger role in driving health-seeking than household wealth.

Several limitations should be noted. The cross-sectional design means causality cannot be inferred as associations may reflect unmeasured confounding or reverse causation (e.g. illness affecting income). Recall bias is a concern, since HSB was self-reported and may be under- or overestimated. Symptoms and care-seeking could be misremembered, especially among older respondents. Some socioeconomic measures (e.g. asset ownership) may not fully capture household economic realities, and residual confounding by factors like stigma or health literacy is possible. Future research could address these gaps through longitudinal or interventional studies. For example, cohort or case–control designs could better establish causal links between SES and care-seeking. Qualitative studies should explore reasons why wealthier individuals or men delay care. Moreover, analysis of the 2022 Kenya TB survey data could examine trends over time and validate our findings.

Despite these limitations, our study has important strengths. To our knowledge, this is the first study that utilized the large 2016, nationally representative TB dataset of Kenyan adults, ensuring broad geographic and demographic coverage. We applied rigorous analytic methods, including multilevel mixed-effects logistic regression to account for clustering by region, and a carefully constructed principal-component-derived wealth index. Our SES measure follows Demographic and Health Survey convention (PCA on household assets), a validated approach in low-income settings(26). By examining both household and individual-level predictors, we isolated the independent contribution of SES from other factors. The large sample of symptomatic individuals provided adequate power to detect modest effects.

Comparison with other studies highlights both consistencies and contrasts. The pronounced gender disparity in health-seeking echoes prior evidence: men in Kenya bear a much higher TB burden and are known to delay care more than women(31,32). This is attributed to social and occupational roles, stigma, and health behaviors among men. Our finding (male OR  $\approx$  0.70) aligns with qualitative research calling for male-focused TB interventions(31). The positive influence

of older age is biologically plausible and somewhat expected, as older individuals may perceive symptoms as more serious or have more comorbidities prompting care. The lack of increased care-seeking among the wealthiest was surprising. In many health domains higher SES is associated with greater care utilization(33–36); the absence of that pattern here suggests that more affluent Kenyans with mild TB symptoms may opt to self-manage or perceive symptoms as less severe(12). In our education result lower care-seeking among those with some secondary schooling contrasts with assumptions that knowledge alone drives behavior. Indeed, other studies in Sub-Saharan Africa have found that TB-related knowledge does not always translate into prompt care-seeking(37). We also observed that marital support significantly boosts care-seeking, consistent with literature showing that social support networks often encourage health service use(38,39). Occupation had no clear effect, unlike some reports from high-burden settings where informal work and travel can impede clinic visits(40,41).

These findings have implications for policy and practice. First, TB outreach and awareness campaigns should particularly target groups identified as underutilizing care. Young adults and men, for instance, may benefit from male-friendly case finding (e.g. workplace screening, extended clinic hours), as advocated in recent Kenyan initiatives(31). Education campaigns might need to address not just knowledge but also attitudes and perceived barriers, since higher knowledge did not guarantee care-seeking. The strong effect of marital status suggests interventions that engage family networks (spouses, kin) could amplify care-seeking. Importantly, although we did not find classic socioeconomic inequalities (like lower care-seeking in poorer groups), the absolute gap in care-seeking is large. The majority of symptomatic individuals ( $\approx 84\%$ ) still did not seek formal care, pointing to sustenance of broad-based TB control efforts.

## **Conclusion**

In conclusion, our study, based on the Kenyan National TB survey, shows that health-seeking for TB symptoms is shaped less by household wealth than by demographics and social factors. It highlights vulnerable subgroups (men, unmarried, less-educated) for whom intensified outreach may improve early TB detection. Continued use of high-quality, representative data and advanced modeling will be essential to monitor trends and tailor TB programs to these findings. Strengthening community engagement and reducing stigma remain crucial for ensuring that all symptomatic Kenyans, regardless of age, gender or wealth, promptly access TB diagnosis and care.

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**Conflict of Interest**

No conflict of interest reported.

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