Global Journal of
Health Science
(GJHS)

# Patient and Health System Factors Associated with Post Presentation Delay in Tuberculosis Diagnosis in Starehe Sub-County, Nairobi

Maureen A. Maloba, Evans Amukoye and Magu Dennis

IPRJB
INTERNATIONAL PEER REVIEWED
JOURNAL AND BOOK PUBLISHING

Global Journal of Health Sciences
ISSN 2519-0210 (Online)
Vol 11, Issue 1, No.5, pp 51 - 66, 2026

www.iprjb.org

# Patient and Health System Factors Associated with Post Presentation Delay in Tuberculosis Diagnosis in Starehe Sub-County, Nairobi

[1*] Maureen A. Maloba
Department of Environmental Health and Disease Control, Jomo Kenyatta University of Agriculture and Technology, Kenya
KEMRI Graduate School, Nairobi, Kenya

[2] Evans Amukoye
Centre for Respiratory Disease Research, Kenya Medical Research Institute, Kenya

[3] Magu Dennis
Department of Environmental Health and Disease Control, Jomo Kenyatta University of Agriculture and Technology, Kenya

**Article History**

***Received 16th January 2026***

***Received in Revised Form 19th February 2026***

***Accepted 24th March 2026***

How to cite in APA format:

Maloba, M., Amukoye, E., & Magu, D. (2026). Patient and Health System Factors Associated with Post Presentation Delay in Tuberculosis Diagnosis in Starehe Sub-County, Nairobi. *Global Journal of Health Sciences*, *11*(1), 51–66. https://doi.org/10.47604/gjhs.3689

**Abstract**

**Purpose:** Majority of TB patients seek care at an advanced stage of the disease. However, diagnosis is often not made at the first point of contact prolonging infectiousness and complicating treatment. Previous research has focused on delayed health care-seeking, while few studies have comprehensively assessed the full diagnostic pathway particularly in urban settings where health services are presumed better. This study aimed to assess the duration and factors contributing to TB diagnostic delay after initial contact with a healthcare provider in an urban subcounty in Nairobi, Kenya.

**Methodology:** A cross-sectional survey was conducted among TB patients on treatment in two health facilities within Starehe Sub County, Nairobi. Structured questionnaires were used to collect data on sociodemographic, health seeking behavior and accessibility. Descriptive analysis was done to understand the socio demographic characteristics. Bivariate and multivariate logistic regression were used to identify factors associated with the delay.

**Findings:** The median delay from initial contact to diagnosis was 14 days, with 52% of the respondents exceeding this period. In the analysis of post presentation diagnostic delay, lack of symptom improvement after initial medication remained statistically significant p= 0.03 (AOR = 3.73, 95% CI: 1.12–12.43). 92.5% of the study population were treated for alternative presumed conditions before receiving a TB diagnosis, indicating missed diagnostic opportunities. Both patient-level and health system factors contributed to prolonged TB diagnostic timelines in this setting, underscoring persistent gaps in timely case detection. Strengthening patient awareness alongside enhanced clinical suspicion, follow-up, and diagnostic pathways is essential to reduce delays in urban TB care.

**Unique Contribution to Theory, Practice and Policy:** The study findings highlight critical missed opportunities for timely TB diagnosis post initial care seeking. Tailored communication and targeted support for at risk groups may help address delays linked to underestimation of TB risk or overreliance on self-treatment. Strengthening provider capacity in TB suspicion and clinical follow up including routine reassessment of patients whose symptoms neither improve nor worsen is equally critical. Closing these gaps is essential to reduce missed opportunities within the health system.

**Keywords:** *Tuberculosis, Diagnostic Delay, Post-Presentation Delay, Missed Diagnosis*

**JEL Codes:** *I10, I12, I18*

## INTRODUCTION

Tuberculosis (TB) is among the leading causes of death from infectious diseases globally, and the leading infectious cause of mortality in Kenya. According to the 2019 report by the World Health Organization (WHO), approximately 10 million individuals worldwide develop TB each year, and up to 30% remain undiagnosed and untreated (World Health Organization, 2019). The End TB Strategy (2016-2035) for WHO envisions a future where TB is eliminated. Integrated and patient-centered care and prevention is one of the pillars of the strategy with emphasis on early diagnosis (WHO, 2015) as delays in diagnosis result in risk of transmission and disease progression, leading to reduced impact of TB interventions (Yimer et al., 2005). The Kenya TB prevalence survey showed that 67% of individuals with TB symptoms did not seek care, either because the symptoms were not severe or due to barriers preventing them from accessing healthcare (Masini et al., 2018). The TB patient pathway analysis conducted in Nairobi revealed that 20% of the population with respiratory symptoms preferred seeking care in informal private facilities. During initial care-seeking, only 40% of patients accessed TB diagnosis (Masini et al., 2017).

TB diagnostic delay is the interval between the first occurrence of TB related symptoms and the confirmation of a TB diagnosis. The delay is divided into: Patient delay and health system delay. Patient delay occurs between the first appearance of symptoms and first contact with a health provider. Health system delays take place between the first visit to a health care provider and the time of confirmed diagnosis. Although there is no universally accepted period of delay for TB diagnosis, Lambert & Van der Stuyft (2005), suggested that from a TB control perspective, delay should be within a period of 2 to 3weeks. In many high burden settings delays often surpass this timeframe. Diagnostic delays in Kenya and sub-Saharan Africa are often due to patients seeking care only when symptoms become severe or the disease is advanced (Mbuthia et al., 2018). This highlights the need for prompt diagnosis once individuals access healthcare as health system delays can result in undesirable outcomes.

### Statement of the Problem

Despite notable progress in reducing tuberculosis incidence and mortality, Kenya continues to experience a high TB burden, with an estimated prevalence of 426 cases per 100,000 population and mortality of 60 per 100,000 (National Tuberculosis, Leprosy and Lung Disease Program [NTLD-P], 2016). TB transmission is largely driven by individuals with undiagnosed pulmonary disease. Therefore, delays in diagnosis and treatment increase the risk of severe illness, mortality, and ongoing community transmission (Shiferaw & Zegeye, 2019). An untreated smear-positive TB patient can infect more than 10 people annually, underscoring the public health consequences of delayed diagnosis. While diagnostic delays have been widely studied in low- and middle-income countries, evidence from high-risk urban settings in Kenya, such as Nairobi, where care-seeking patterns, provider density, and diagnostic pathways differ markedly from rural areas remains limited. This gap constrains the ability of TB programs to design context-specific interventions that address missed opportunities within the urban health system.

## LITERATURE REVIEW

In Low and Middle Income Countries (LMICs), individuals often seek healthcare only after symptoms persist and the disease has advanced (Liefooghe et al., 1997). The success of TB control program relies heavily on early diagnosis along with timely and effective treatment. In the initial phase of the disease, TB symptoms are not particularly specific and may be confused

with common infections such as common colds, malaria or the flu. Delay in case-finding remains prevalent in both developed and developing countries. In low prevalence countries the primary causes of delay include low index of suspicion among health workers, and inadequate infrastructure for TB control while in high prevalence countries delays are often linked to poor health-seeking behavior, limited TB awareness, and stigma (Eltayeb et al., 2020). In Kenya, there is heavy reliance for individuals with TB to voluntarily seek health care which further contributes to delays.

Delays result in a more severe illness state at the time an individual seeks care, which contributes to increased risk of complications, transmission and death. There are multiple factors associated with the delay in diagnosis and treatment initiation. According to the World Health Organization (WHO, 2007)**,** these factors include socioeconomic status, individual perception of TB, stigma, severity of TB, health personnel knowledge and responsiveness, and distance to health facilities.WHO recommends that the interval between symptom onset and case identification for TB suspects should not exceed 3 weeks.

One of the key factors contributing to diagnostic delays is the lack of accessibility to TB diagnosis services. A study conducted in Ethiopia supports this hypothesis, showing a notable increase in diagnosis delay among patients from rural regions as specialized services are mainly concentrated in urban areas (Laohasiriwong et al., 2016). Furthermore, there was a correlation between a greater distance patients have to travel to reach a health facility and delay in seeking medical attention. Many individuals, especially those in remote or marginalized areas, face barriers in accessing healthcare facilities that offer TB diagnostic services. These barriers can be due to factors such as geographical distance, limited transportation options, or inadequate healthcare infrastructure nearby. As a result, individuals may experience delays in diagnosis as they try to overcome these accessibility challenges. The lack of sufficient healthcare facilities in rural areas and the distance to urban areas significantly impacts the rate of TB diagnosis

The availability of TB diagnostic services plays a crucial role in reducing delays in diagnosis and treatment initiation. Limited availability of diagnostic facilities, a shortage of trained healthcare professionals, and inadequate laboratory infrastructure can contribute to long waiting times for diagnostic tests (Creswell et al., 2014). Patients may have to endure extended periods of uncertainty, anxiety, and potential disease transmission due to these gaps in availability of healthcare services. To address this challenge, investments should be made in expanding the availability of TB diagnostic services, increasing laboratory capacity, and ensuring an adequate supply of well-trained healthcare workers.

In LMICs including Kenya, Level 1 and Level 2 healthcare facilities are the entry points for patients seeking diagnosis and care. Public dispensaries are the first point of care for approximately 27% of patients in Kenya. However, most dispensaries (80%) do not perform microscopy, and instead refer patients to facilities that are equipped (Kenya Institute for Public Policy Research and Analysis [KIPPRA], 2021). In Ethiopia and the Philippines community health workers in the public sector initiate care for about one-third of the patients (World Vision, 2015). However, despite this finding, the community health workers lacked diagnostic equipment and only had screening equipment and the equipment for collecting sputum specimens. Although they have limited diagnostic equipment, Research in Kenya indicates that over 40% of TB patients seek care at lower-level facilities where only 39% of the facilities have the capacity for TB diagnosis (Masini et al., 2017).

Health Care worker's index of suspicion for TB is also a crucial factor. Under circumstances where patients seek care exhibiting TB symptoms, three-quarters of the patients are incorrectly

diagnosed (Kunjok et al., 2024). This is an indication of the health system not being sensitive to TB even when patients present symptoms, yet TB patients typically visit health facilities up to five times before diagnosis is made (Masini et al., 2017)**.** Disease screening is important for conditions with vague symptoms or non-symptomatic during the initial phase of the disease. Even though most diseases can be detected early, more emphasis is put towards early detection and treatment at a reasonable cost thus significantly changing the transmission and outcomes of the disease (Lönnroth et al., 2013). A study done in referral hospitals in Uganda showed that a high percentage of people presumed to have TB presented majorly with a chronic cough. Even though these individuals resided in a high TB burden setting, they missed TB diagnosis at the lower-level health facilities during their initial presentation. Even with the attempt to seek care given the chronic cough, at the first hospital visit, many of them were not evaluated for TB. A significant number of patients with TB were diagnosed at referral health facilities equipped with Genexpert (Muttamba et al., 2019).

Affordability is an important factor influencing the time to diagnose and treatment TB. The high costs of diagnostic tests and treatment can discourage individuals from seeking medical help or completing their treatment regimen (WHO, 2023; Tanimura et al., 2014). Health systems should implement policies to make TB services more affordable such as subsidizing diagnostic tests and medications, establishing health insurance schemes, or partnering with philanthropic organizations to provide financial support to TB patients. By addressing affordability, health systems can expedite diagnosis and treatment leading to better health outcomes for TB patients.

Another factor within the health system that contributes to delayed TB diagnosis is acceptability. Qualitative studies in East Africa by Juma et al. (2022) and Petros de Guex et al. (2023) highlight that socio-cultural stigma, religious beliefs and misinformation significantly delay TB diagnosis and treatment. Individuals, particularly those from cultural or religious backgrounds that stigmatize TB, might be hesistant to seek medical help or disclose their symptoms. This hesitation may be due to misinformation, fear of social exclusion, or the belief that TB is incurable or associated with personal or moral shortcomings. As a result, these individuals may postpone seeking medical attention and diagnosis, allowing the disease to progress, and potentially spread to others. Healthcare systems need to address this issue by promoting public awareness campaigns, offering culturally sensitive care, and creating a non-discriminatory environment for TB patients.

Global Journal of Health Sciences
ISSN 2519-0210 (Online)
Vol 11, Issue 1, No.5, pp 51 - 66, 2026

www.iprjb.org

## Conceptual Framework

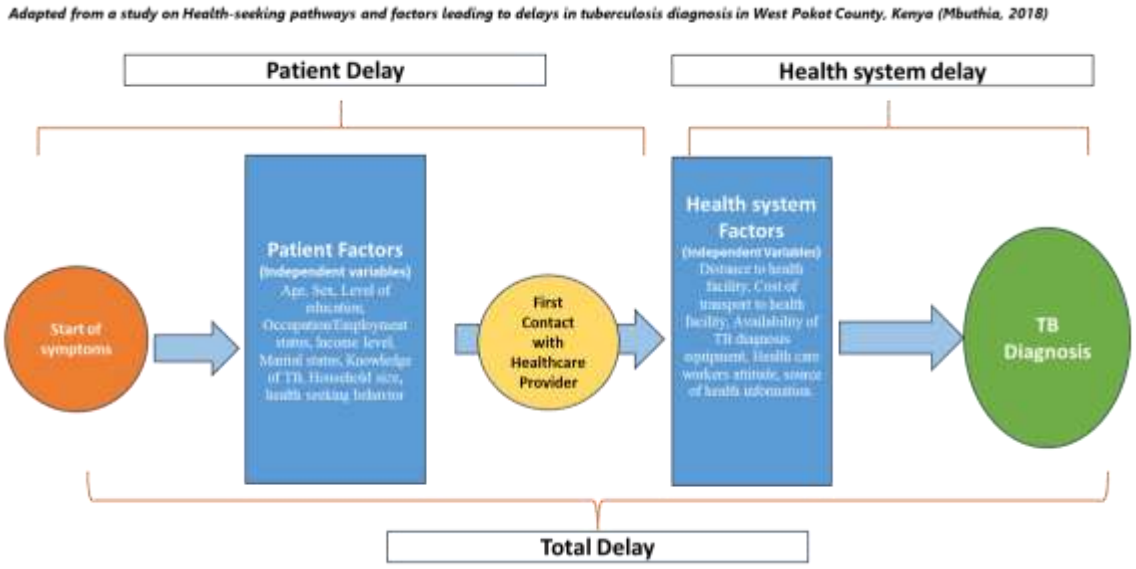


*Figure 1: Conceptual Framework*

## Research Gaps

Both patient and health system factors are associated with delays in the diagnosis and treatment of TB. These associations vary between countries and within countries. While many studies have examined TB diagnostic delays, evidence from Kenya remains limited especially in high-risk urban settings like Nairobi. This study aimed to address this gap by providing context specific evidence from an urban high-risk area to inform strategies for TB service delivery improvements.

## METHODOLOGY

The study design was cross-sectional, with a quantitative approach conducted among TB Patients on treatment at Rhodes and Loco health centers in Starehe Sub- County, Nairobi. Eligible participants were individuals aged 12 years and above who provided informed consent with assent and parental consent obtained for minors while those too ill or unwilling to participate were excluded. A final sample size of 106 was derived using Cochran's formula and finite population correction based on 148 TB cases recorded at the two facilities. Participants at each facility were selected through probability proportional to size allocation and systematic sampling. Data was collected through structured interviewer administered questionnaires programmed in Kobo Toolbox with interviews conducted by trained research assistants in participants' preferred languages to reduce bias and misinterpretation. The questionnaire captured patient-level, care-seeking, and diagnostic pathway factors. Descriptive statistics summarized participant characteristics, while chi-square tests and Monte Carlo simulations assessed associations; variables with $p < 0.20$ were included in multivariable logistic regression to identify predictors of diagnostic delay. Ethical approval and research approval was obtained from KEMRI SERU (SERU 4898), NACOSTI, and the Nairobi County Health Department, and confidentiality was ensured throughout the study.

Global Journal of Health Sciences
ISSN 2519-0210 (Online)
Vol 11, Issue 1, No.5, pp 51 - 66, 2026
www.iprjb.org

## RESULTS

### Sociodemographic Characteristics of Study Participants

A total of 106 TB patients were included in the study. Most participants were male (74.5%) and within the productive age group (25- 44 years) as shown in table 1. The majority had primary or secondary education and engaged in informal employment with a big proportion of respondents earning below KES 15000 per month. Over 80% of respondents lived in one or 2 room houses with small household sizes (≤4 members).

**Table 1: Distribution of Sociodemographic Characteristics of Study Participants n=106**

| Variable | Category | Frequency N | Percentage % |
|---|---|---|---|
| Sex | Male | 79 | 74.5 |
| | Female | 27 | 25.5 |
| Age | below 14 | 1 | .9 |
| | 14 - 24 | 11 | 10.4 |
| | 25 - 34 | 39 | 36.8 |
| | 35 - 44 | 37 | 34.9 |
| | 45 - 60 | 12 | 11.3 |
| | Above 60 | 6 | 5.7 |
| Marital status | Married | 34 | 32.1 |
| | Single | 40 | 37.7 |
| | Divorced | 23 | 21.7 |
| | Widowed | 1 | 0.94 |
| | Other | 8 | 7.56 |
| Household members | ≤4 | 87 | 82.1 |
| | ≥5 | 19 | 17.9 |
| Rooms in dwelling | ≤2 | 82 | 77.4 |
| | ≥3 | 24 | 22.6 |
| Employment Status | Unemployed | 17 | 16.0 |
| | Formal employment | 34 | 32.1 |
| | Informal employment | 52 | 49.1 |
| | Student | 3 | 2.8 |
| Education Level | Primary | 40 | 37.7 |
| | Secondary | 45 | 42.5 |
| | Tertiary | 21 | 19.8 |
| Monthly Income | Below KES15000 | 62 | 58.5 |
| | KES15000 - 50000 | 37 | 34.9 |
| | Above 50,000 | 7 | |

### The Patient Care Seeking Pathway

Media and health care providers were the main sources of TB information, with Cough being the most reported initial symptom. Although over half of respondents had prior awareness of TB, only 29% suspected TB before diagnosis.

Most participants reported short travel times and low transport costs to reach health facilities. 93.4% of respondents reported taking medication prior to TB diagnosis predominantly antibiotics and painkillers. More than half experienced no improvement in symptoms following initial medication. Notably, three quarters of respondents were not informed of the possibility

Global Journal of Health Sciences
ISSN 2519-0210 (Online)
Vol 11, Issue 1, No.5, pp 51 - 66, 2026
www.iprjb.org

of TB at first contact and over half required more than two healthcare visits before diagnosis. TB-related counselling was reported by most of respondents with majority being Satisfied with information received. Diagnosis was mostly done at public facilities, as shown in table 2; figures 2 – 4. Most participants reported high satisfaction with TB related services including provider support, waiting times, and treatment costs.

**Table 2: Participant TB Care Pathway, and Service Experience**

| Variable | Category | Frequency N | Percentage % |
|---|---|---|---|
| Source of health information | Health provider | 27 | 25.5 |
| | CHP | 16 | 15.1 |
| | Family or friends | 18 | 17.0 |
| | Media | 45 | 42.5 |
| Prior Awareness of TB | Yes | 63 | 59.4 |
| | No | 43 | 40.6 |
| First Symptoms Experienced | Cough | 86 | 81.0 |
| | Fever | 6 | 5.7 |
| | Fatigue | 5 | 4.7 |
| | Night sweats | 4 | 3.8 |
| | Weight loss | 5 | 4.7 |
| Suspected TB Prior to Diagnosis | Yes | 31 | 29.2 |
| | No | 75 | 70.8 |
| Medication prior to diagnosis | Yes | 99 | 93.4 |
| | No | 7 | 6.6 |
| Type of medication taken | Antibiotics | 59 | 55.7 |
| | Cough Syrup | 8 | 7.5 |
| | Painkillers | 25 | 23.6 |
| | Malaria Drugs | 4 | 3.8 |
| | Traditional Drugs/Concoctions | 2 | 1.9 |
| | Antihistamine | 1 | 0.9 |
| | None | 7 | 6.6 |
| Time to reach public facility | ≤ 60 minutes | 100 | 94.3 |
| | > 60 minutes | 6 | 5.7 |
| Time to reach TB treatment facility | ≤ 60 minutes | 95 | 89.6 |
| | > 60 minutes | 11 | 10.4 |
| Cost of transport to TB treatment facility | ≤ KES 100 | 94 | 88.7 |
| | > KES 100 | 12 | 11.3 |
| Number of hospital visits before diagnosis | 2 or less | 45 | 42.5 |
| | more than 2 | 61 | 57.5 |
| Initially informed of TB possibility | Yes | 26 | 24.5 |
| | No | 80 | 75.5 |
| Patient Questions Answered | Yes | 101 | 95.3 |
| | No | 5 | 4.7 |
| Provider Support | Yes | 102 | 96.2 |
| | No | 4 | 3.8 |

Global Journal of Health Sciences
ISSN 2519-0210 (Online)
Vol 11, Issue 1, No.5, pp 51 - 66, 2026
www.iprjb.org

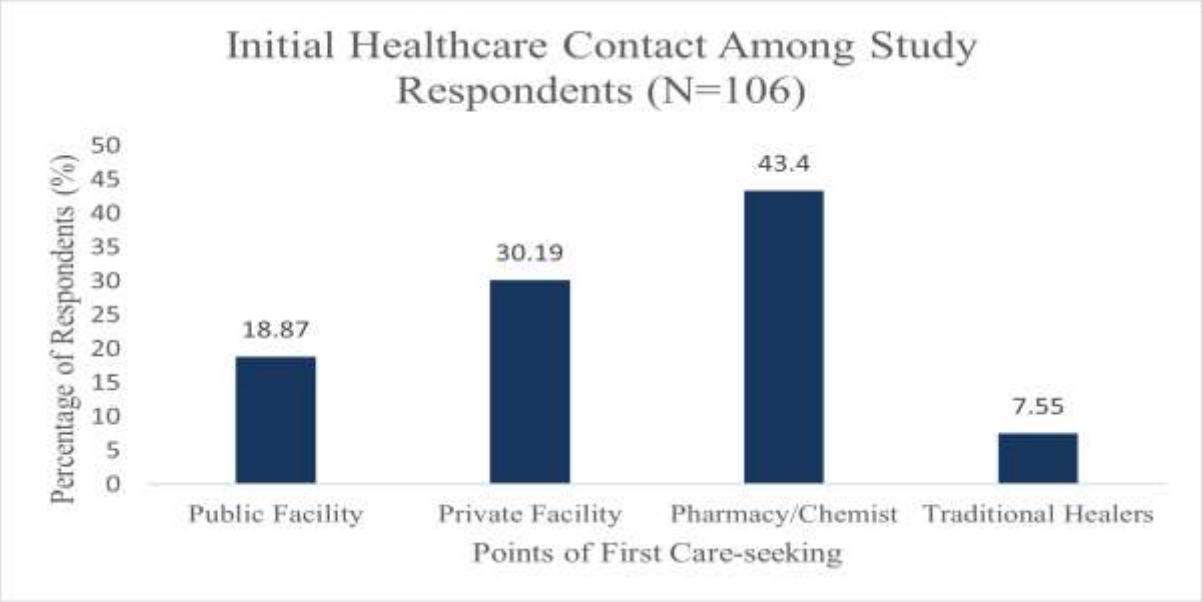


*Figure 2: Initial Point of Care for Symptoms*

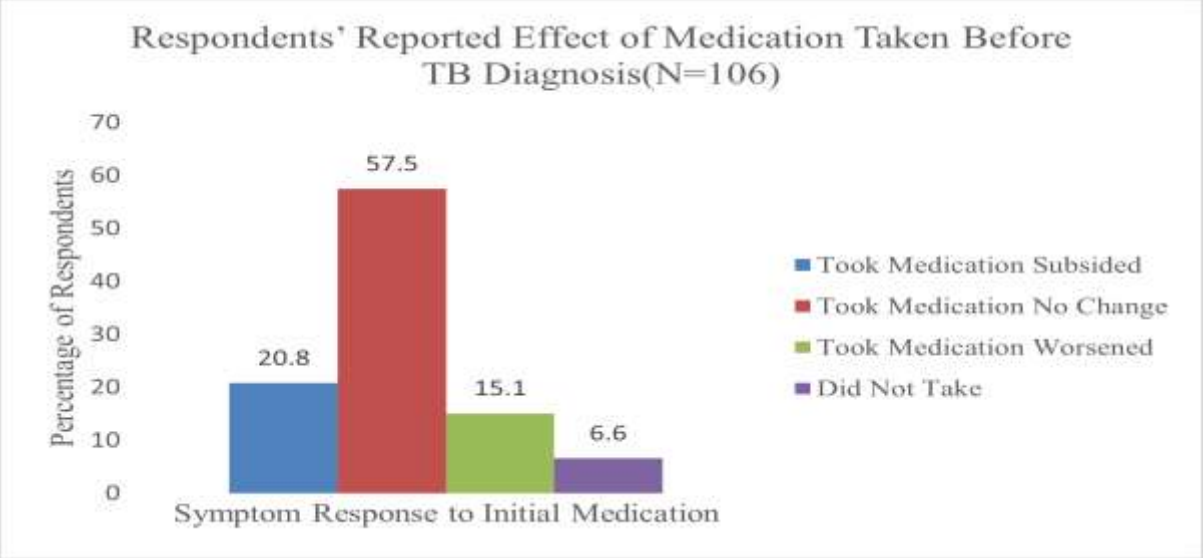


*Figure 3: Response to Initial Medication Taken Prior to TB Diagnosis*

Global Journal of Health Sciences
ISSN 2519-0210 (Online)
Vol 11, Issue 1, No.5, pp 51 - 66, 2026
www.iprjb.org

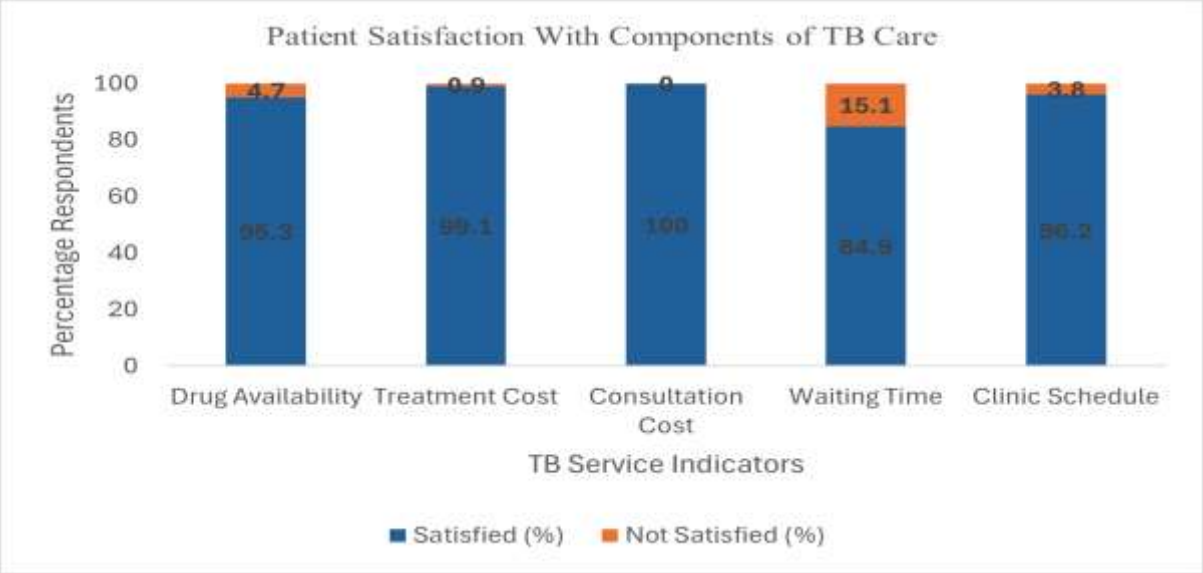


*Figure 4: Satisfaction with TB Services across Key Indicators (n = 106)*

**Duration of Post-Presentation TB Diagnostic Delay**

The median time from first contact with a health provider to confirmed TB diagnosis was 14 days (IQR: 2-30 days) with delays ranging from 0 to 378 days. Using a cut-off of more than 14 days, 52% of participants experienced post-presentation diagnostic delay.

**Factors Associated with Post-Presentation TB Diagnostic Delay (Bivariate Analysis)**

In bivariate analysis, education level was significantly associated with post-presentation diagnostic delay (p= 0.012), with a higher proportion of delay observed among respondents. 81% of respondents with tertiary education experienced delays compared to 44% secondary and 45% with primary level. Variables that showed notable trends with p-values < 0.20 were subjected to logistic regression analysis. These included marital status (p= 0.08).71% of married respondents experiencing delays compared to 43% unmarried respondents. Delay was also observed more (86%) among those earning above KES 50,000, with a p-value of 0.139. Although not statistically significant (p=0.145), delays were more common among respondents whose symptoms did not change after initial medication (59%), compared to those whose symptoms worsened (44%) or subsided (36%). Delay was also more common among those with two or fewer hospital visits before diagnosis (60%), compared to those who visited three or more times (46%) p = 0.151). In terms of access, 55% of respondents who spent KES 100 or less on transport experienced delays compared to 33% among those who spent more than KES 100 (p= 0.172). Delays were also more frequent among those who took more than 60 minutes to reach a public health facility (83%), compared to those who travelled less than an hour (50%) p=0.112.

Global Journal of Health Sciences
ISSN 2519-0210 (Online)
Vol 11, Issue 1, No.5, pp 51 - 66, 2026
www.iprjb.org

**Table 3: Chi-Square Analysis of Factors Associated with Delay in TB Diagnosis**

| Variable | Category | Delayed N (%) | Not delayed N (%) | X2 | p value |
|---|---|---|---|---|---|
| Sex | Male | 43 (54) | 36 (46) | 0.804 | 0.370 |
| | Female | 12 (44) | 15 (56) | | |
| Marital Status | Married | 24 (71) | 10 (29) | 7.013 | 0.080 |
| | Unmarried | 31 (43) | 41 (57) | | |
| Education Level | Primary | 18 (45) | 22 (55) | 8.865 | **0.012*** |
| | Secondary | 20 (44) | 25 (56) | | |
| | Tertiary | 17 (81) | 4 (19) | | |
| Monthly Income | ≤ KES 15000 | 29 (47) | 33 (53) | 3.927 | 0.139 |
| | 15,000 - 50,000 | 20 (54) | 17 (46) | | |
| | ≥ KES 50,000 | 6 (86) | 1 (14) | | |
| Prior TB | Yes | 31 (49) | 32 (51) | 0.447 | 0.500 |
| Awareness | No | 24 (56) | 19 (44) | | |
| Perceived Severity | Yes | 35 (53) | 31 (47) | 0.092 | 0.762 |
| of TB | No | 20 (50) | 20 (50) | | |
| First symptoms | Cough | 44 (51) | 42 (49) | 4.569 | 0.353 |
| | Fever | 5 (83) | 1 (17) | | |
| | Fatigue | 1 (20) | 4 (80) | | |
| | Night sweat | 2 (50) | 2 (50) | | |
| | Weight loss | 3 (60) | 2 (40) | | |
| Initial point of care | Public facility | 11 (55) | 9 (45) | 2.900 | 0.415 |
| | Private facility | 20 (63) | 12 (37) | | |
| | Chemist | 21 (46) | 25 (54) | | |
| | Traditional healer | 3 (38) | 5 (62) | | |
| TB Suspicion | Yes | 13 (42) | 18 (58) | 1.738 | 0.187 |
| | No | 42 (56) | 33 (44) | | |
| Informed of TB | Yes | 11 (42) | 15 (58) | 1.266 | 0.260 |
| possibility | No | 44 (55) | 36 (45) | | |
| Symptom response | Improve | 8(36) | 14 (64) | 3.859 | 0.145 |
| to initial | No Change | 40(59) | 28 (41) | | |
| medication | Worse | 7(44) | 9(56) | | |
| Number of hospital | ≤2 | 27 (60) | 18(40) | 2.062 | 0.151 |
| visits | ≥3 | 28 (46) | 33(54) | | |
| Transport cost | ≤100 | 51(55) | 43(45) | 1.866 | 0.172 |
| | ≥101 | 4(33) | 8(67) | | |
| Time to public | ≤60mins | 49(49.5) | 50(50.5) | 3.435 | 0.114 |
| facility | ≥60mins | 6(85.7) | 1(14.3) | | |
| Diagnostic facility | Public facility | 36(49) | 37(51) | 2.570 | 0.277 |
| | Private facility | 5(83) | 1(17) | | |
| | Community screening | 14(52) | 13(48) | | |

*Note.* * p* < .05, **Bold,** indicates statistically significant

Global Journal of Health Sciences
ISSN 2519-0210 (Online)
Vol 11, Issue 1, No.5, pp 51 - 66, 2026
www.iprjb.org

**Multivariate Analysis of Factors Associated with Delay in TB Diagnosis**

Table 4 below shows the results of the logistic regression of variables associated with health system delay. In independent analysis marital status and education level were significantly associated with health system delay. Married individuals had higher odds of experiencing delay compared to the unmarried (OR = 3.174, 95% CI: 1.326–7.598, $p$ = 0.009). Lower education level was protective towards delay as those with primary (OR = 0.193, 95% CI: 0.055–0.675, $p$ = 0.01) and secondary (OR = 0.188, 95% CI: 0.055–0.649, $p$ = 0.008) level were less likely to delay compared to respondents with tertiary education.

After adjusting for potential confounders in multivariate analysis, symptom response to initial medication remained significantly associated with health system delay. Patients whose symptoms did not change after taking initial non-TB medication had over three times odds of delay compared to those who experienced an improvement and those whose symptoms worsened (AOR = 3.730, 95% CI: 1.119–12.427, $p$ = 0.032)

**Table 4: Crude and Adjusted Odds Ratios for Factors Associated with Delay in TB Diagnosis**

| Variable | Category | OR(CI) | P | AOR(CI) | P |
|---|---|---|---|---|---|
| Marital status | Married | 3.174(1.326 - 7.598) | **0.009*** | 2.856(0.912 - 8.945) | 0.072 |
| | Unmarried | Ref | | Ref | |
| Education level | Primary | 0.193(0.055 - 0.675) | **0.01*** | 0.22(0.042 - 1.160) | 0.074 |
| | Secondary | 0.188(0.055 - 0.649) | **0.008*** | 0.247(0.05 -1.228) | 0.065 |
| | Tertiary | Ref | | Ref | |
| TB Suspicion | Yes | 0.567(0.243 -1.323) | 0.19 | 1.706(0.648 - 4.487) | 0.279 |
| | No | Ref | | Ref | |
| Response to initial medication | No Change | 2.500(0.925 - 6.754) | 0.071 | 3.730(1.119 - 12.427) | **0.03*** |
| | Worsen | 1.361(0.365 - 5.072) | 0.646 | 2.858(0.624 - 13.094) | 0.176 |
| | Improve | Ref | | Ref | |
| Number of hospital visits before diagnosis | ≤2 | 1.768(0.810 - 3.859) | 0.153 | 1.750(0.702 - 4.364) | 0.23 |
| | ≥3 | Ref | | Ref | |
| Cost of transport | ≤100 | 2.372(0.668 - 8.421) | 0.181 | 2.785(0.709 - 10.935) | 0.142 |
| | >101 | Ref | | | |
| Time to the nearest public facility | ≤60mins | 0.200(0.23 – 1.174)) | 0.148 | 0.150(0.012 -1.822) | 0.137 |
| | >60mins | Ref | | | |

***Note.*** * p* < .05, Bold, indicates statistically significant predictors.

**Discussion**

Over half of respondents experienced a post presentation delay exceeding 14 days, which is concerning given TB's infectious nature and the tendency for patients to present at an advanced stage of the disease. The wide range in number of days suggests substantial variation in factors contributing to the delay. The median delay was notably shorter than that reported in a study

conducted in Isiolo County, Kenya, where the average health system delay was 27.6 days (Kunjok et al., 2021). The shorter delay likely reflects better diagnostic capacity and health system readiness in the urban setting. Similar findings in Zimbabwe showed shorter delays in higher-level urban facilities due to improved availability of diagnostic services, highlighting systemic inefficiencies as dominant contributors to delay in rural settings (Takarinda et al., 2015).

Multiple factors shaped the respondents' health-seeking journeys. In univariate analysis, being married was significantly associated with delay, possibly reflecting household responsibilities interfering with timely follow-up. Education level also showed significant associations in univariate analysis; those with tertiary level education were more likely to delay. This could be explained by the tendency of more educated individuals to explore multiple care options, including self-treatment, thereby delaying diagnosis. This finding contrasts with studies in Ethiopia and Uganda that linked higher education with shorter delays (Buregyeya et al., 2014), (Yimer et al., 2005).

Previous studies have shown that shorter distances and lower transport costs reduce diagnostic delays. Yimer in Ethiopia, Mutamba in Uganda, and Kenya's patient pathway analysis all identified transport barriers as key contributors (Yimer et al., 2005), (Masini et al., 2017), (Muttamba et al., 2019). In this study, shorter travel time to public facilities was linked to lower odds of delay, consistent with prior findings. However, those incurring lower transport costs to a public facility were more likely to experience delays, possibly due to nearby facilities lacking diagnostic capacity or personal factors such as stigma or low risk perception. Although these findings were not statistically significant, they point to an important gap worth exploring. Qualitative research could help unpack these underlying behavioral and systemic barriers.

While more than half of patients initially sought care at pharmacies and private facilities, the majority of diagnoses were made at public health facilities. Although the type of facility was not significantly associated with delay, those diagnosed in private settings were more likely to experience delays, consistent with literature suggesting variability in TB diagnostic capacity outside the public sector. This highlights a gap in early detection at first points of contact and the need to strengthen TB screening capacity across all entry points in the health system. Among the respondents 25.5% of respondents were diagnosed through community screening initiatives, highlighting the value of active case-finding strategies in reaching individuals who may not seek care promptly.

The number of hospital visits before diagnosis showed an important trend though not statistically significant, with those visiting two or fewer times having higher odds of delay. This shows patients were not adequately assessed during early encounters. Individuals with mild nonspecific symptoms may not have been prioritized for TB investigations. Multiple visits reflect persistent care-seeking behavior driven by symptom severity or worsening illness, ultimately facilitating diagnosis. This points to the need for stronger symptom screening and clinical suspicion at all facility levels.

The majority of respondents received initial treatment for their symptoms before receiving a TB diagnosis, suggesting earlier diagnoses that did not identify TB. More than half, 64%, reported no improvement in symptoms following the medication. The effect of this medication was significantly associated with delay, individuals whose symptoms did not change had 3.7 times higher odds of delay in multivariate analysis. This suggests a potential misdiagnosis and mismanagement and the need for better clinical guidance at the initial point of care.

The key significant predictors of health system delay for this study were marital status, education level, and lack of symptom change following initial medication. These findings point to a complex interplay between individual behavior, care quality at the point of first contact, and facility-level readiness. Interventions aimed at improving TB literacy, strengthening private sector engagement, and enhancing provider decision-making in response to persistent symptoms are needed to help reduce diagnostic delays.

### Study Limitations

Several limitations existed in this study. The sample size was relatively small**,** which may have limited the power to detect statistically significant associations. The study was conducted in a single urban sub-county, potentially limiting generalizability to other settings where health system infrastructure, patient behavior, and diagnostic timelines may differ. Additionally, cross-sectional design limits the ability to establish causal relationships. Recall bias may also have affected responses related to timelines and prior care-seeking behavior. Lastly, the study relied solely on quantitative methods; Future research should consider qualitative approaches to better understand patient decision-making and health provider behavior. Future research should also consider larger, multicenter studies to compare urban and rural contexts and capture a broader range of system- and patient-level factors influencing delay

## CONCLUSION AND RECOMMENDATIONS

### Conclusion

This study reveals that post presentation delay in TB diagnosis remains a significant challenge in urban Kenya. Delays were significantly associated with marital status, education level and lack of change in symptoms after initial medication, suggesting missed diagnostic opportunities during early patient- provider interactions. While many participants sought care at pharmacies and private facilities, most diagnoses were at public facilities emphasizing gaps in TB suspicion and diagnostic capacity at initial points of care. These findings underscore the need to strengthen TB screening, timely referral and diagnostic services across all levels of care especially during initial consultation.

### Recommendations

Based on the findings, targeted communication strategies are needed for married individuals and those with higher education to promote early TB testing and reduce reliance on self-medication and underestimation of TB risk. Strengthening community-based interventions through existing social support can further promote awareness and timely care-seeking. Community health education and provider training should emphasize the importance of prompt TB investigations. This should include reinforcing clinical suspicion of TB and importance of clinical judgement over prolonged use of nonspecific therapies.

Private and lower-level facilities should be equipped with diagnostic tools or linked to functional referral networks. Referral systems, patient follow up mechanisms and diagnostic turnaround times should be optimized particularly in private sector settings. Public-private mix (PPM) strategies can support standardization of practices and reduce fragmentation in diagnostic pathways.

### Source of Funding

The study was self-funded. No external funding was received to support the study.

## REFERENCES

Buregyeya, E., Criel, B., Nuwaha, F., & Colebunders, R. (2014). Delays in diagnosis and treatment of pulmonary tuberculosis in Wakiso and Mukono districts, Uganda. *BMC Public Health, 14*, Article 586. https://doi.org/10.1186/1471-2458-14-586

Creswell, J., Sahu, S., Blok, L., Bakker, M. I., Stevens, R., & Ditiu, L. (2014). A multi-site evaluation of innovative approaches to increase tuberculosis case notification: Summary results. *PLOS ONE, 9*(4), e94465. https://doi.org/10.1371/journal.pone.0094465

Eltayeb, D., Pietersen, E., Engel, M., & Abdullahi, L. (2020). Factors associated with tuberculosis diagnosis and treatment delays in Middle East and North Africa: A systematic review. *Eastern Mediterranean Health Journal, 26*(4), 468–479. https://doi.org/10.26719/emhj.19.079

Enos, M., Sitienei, J., Ong'ang'o, J., Mungai, B., Kamene, M., Wambugu, J., et al. (2018). Kenya tuberculosis prevalence survey 2016: Challenges and opportunities of ending TB in Kenya. *PLOS ONE, 13*(12), e0209098. https://doi.org/10.1371/journal.pone.0209098

Finnie, R. K. C., Khoza, L. B., Van den Borne, B., Mabunda, T., Abotchie, P., & Mullen, P. D. (2011). Factors associated with patient and health care system delay in diagnosis and treatment for TB in sub-Saharan African countries with high burdens of TB and HIV. *Tropical Medicine & International Health, 16*(4), 394–411. https://doi.org/10.1111/j.1365-3156.2010.02718.x

Juma, B. M., Nzioki, J. M., Kibiti, C., & Shaikh, M. (2022). Socio-cultural factors associated with patient delay in commencement of anti-TB drugs among TB patients in Kwale County, Kenya. *African Journal of Health Sciences, 35*(4), 469–474. https://doi.org/10.4314/ajhs.v35i4

Kenya Institute for Public Policy Research and Analysis. (2021). *An assessment of healthcare delivery in Kenya under the devolved system.* https://kippra.or.ke/wp-content/uploads/2021/02/an-assessment-of-healthcare-delivery-in-kenya-under-the-devolved-system-sp19.pdf

Kunjok, D. M., Mwangi, J. G., Kairu-Wanyoike, S., Kinyua, J., & Mambo, S. (2024). Spatial epidemiology of tuberculosis diagnostic delays, healthcare access disparities, and socioeconomic inequities in Nairobi County, Kenya. *PLOS Global Public Health, 4*(1), e0003320.

Lambert, M. L., & Van der Stuyft, P. (2005). Delays to tuberculosis treatment: Shall we continue to blame the victim? *Tropical Medicine & International Health, 10*(10), 945–946. https://doi.org/10.1111/j.1365-3156.2005.01485.x

Laohasiriwong, W., Mahato, R. K., Koju, R., & Vaeteewootacharn, K. (2016). Delay for first consultation and its associated factors among new pulmonary tuberculosis patients of Central Nepal. *Tuberculosis Research and Treatment, 2016*, Article 4583871. https://doi.org/10.1155/2016/4583871

Liefooghe, R., Baliddawa, J. B., Kipruto, E. M., Vermeire, C., & De Munynck, A. O. (1997). From their own perspective: A Kenyan community's perception of tuberculosis. *Tropical Medicine & International Health, 2*(8), 809–821. https://doi.org/10.1046/j.1365-3156.1997.d01-380.x

Lönnroth, K., Corbett, E., Golub, J., Godfrey-Faussett, P., Uplekar, M., Weil, D., & Raviglione, M. (2013). Systematic screening for active tuberculosis: Rationale, definitions and key considerations. *The International Journal of Tuberculosis and Lung Disease, 17*(3), 289–298. https://doi.org/10.5588/ijtld.12.0797

Masini, E., Hanson, C., Ogoro, J., Brown, J., Ngari, F., Mingkwan, P., et al. (2017). Using patient-pathway analysis to inform a differentiated program response to tuberculosis: The case of Kenya. *The Journal of Infectious Diseases, 216*(Suppl. 7), S714–S723. https://doi.org/10.1093/infdis/jix376

Mbuthia, G. W., Olungah, C. O., & Ondicho, T. G. (2018). Health-seeking pathway and factors leading to delays in tuberculosis diagnosis in West Pokot County, Kenya: A grounded theory study. *PLOS ONE, 13*(11), e0207995. https://doi.org/10.1371/journal.pone.0207995

Muttamba, W., Ssengooba, W., Kirenga, B., Sekibira, R., Walusimbi, S., Katamba, A., et al. (2019). Health-seeking behavior among individuals presenting with chronic cough at referral hospitals in Uganda: Missed opportunity for early tuberculosis diagnosis. *PLOS ONE, 14*(6), e0217900. https://doi.org/10.1371/journal.pone.0217900

National Tuberculosis, Leprosy and Lung Disease Program. (2016). *Annual report 2016.* Ministry of Health, Kenya. https://nltp.co.ke/reports/annual-reports/

Petros de Guex, K., Augustino, D., Mejan, P., Gadiye, R, Massong, C., Lukumay, S., … Thomas, T. A. (2023). Roadblocks and resilience: A qualitative study of the impact of pediatric tuberculosis on Tanzanian households and solutions from caregivers. *Global Public Health, 18*(7), 1–15.

Shiferaw, W. S., & Zegeye, A. M. (2019). Delay in tuberculosis diagnosis and treatment in Ethiopia: A systematic review and meta-analysis. *BMC Health Services Research, 19*, Article 232. https://doi.org/10.1186/s12913-019-4056-7

Takarinda, K. C., Harries, A. D., Nyathi, B., Ngwenya, M., Mutasa-Apollo, T., & Sandy, C. (2015). Tuberculosis treatment delays and associated factors within the Zimbabwe national tuberculosis programme. *BMC Public Health, 15*, Article 29. https://doi.org/10.1186/s12889-015-1437-7

Tollefson, D., Ngari, F., Mwakala, M., Gethi, D., Kipruto, H., Cain, K., et al. (2016). Under-reporting of sputum smear-positive tuberculosis cases in Kenya. *The International Journal of Tuberculosis and Lung Disease, 20*(10), 1334–1341.

World Health Organization. (2007). *Global tuberculosis control: Surveillance, planning, financing.* WHO Press.

World Health Organization. (2015). *Implementing the end TB strategy: The essentials.* https://iris.who.int/handle/10665/206499

World Health Organization. (2019). *Global tuberculosis report 2019.* https://iris.who.int/handle/10665/329368

World Health Organization. (2023). *Global tuberculosis report 2023.* https://www.who.int/publications/i/item/9789240083851

World Vision International. (2015). *Ethiopia's community health workers.* https://www.wvi.org/sites/default/files/CHW%20Profile%20Ethiopia.pdf

Yimer, S., Bjune, G., & Alene, G. (2005). Diagnostic and treatment delay among pulmonary tuberculosis patients in Ethiopia: A cross-sectional study. *BMC Infectious Diseases, 5*, Article 112. https://doi.org/10.1186/1471-2334-5-112