

Project Report

End Term Evaluation of The Awareness, Tradition and Innovation (ATI) TB Project in Kajiado County, Kenya.

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Definitions and Abbreviations

CHV	Community Health Volunteer
GeneXpert	The GeneXpert test is a molecular test for TB. GeneXpert diagnoses TB by detecting the presence of TB bacteria, as well as testing for drug resistance.
TIBU	TIBU is a Swahili word denoting “to medically treat”. TIBU is a digital solution dedicated to digitalizing sustainable lung health reporting and routine surveillance. It integrates a majority of program areas.
Tuberculosis (TB)	Chronic granulomatous inflammatory disease caused by Mycobacterium tuberculosis. It mostly affects the lung tissues but can affect any other body tissues resulting in extrapulmonary tuberculosis.





"In general, this project has helped us because we have received treatment in an easy way, it is not easy to get a doctor around this place. We have to go all the way to Lodari dispensary which is very far. Other times you will find that my child and I are sick, and that becomes even harder for both of us to go all the way." Rural Kajiado Patient Beneficiary

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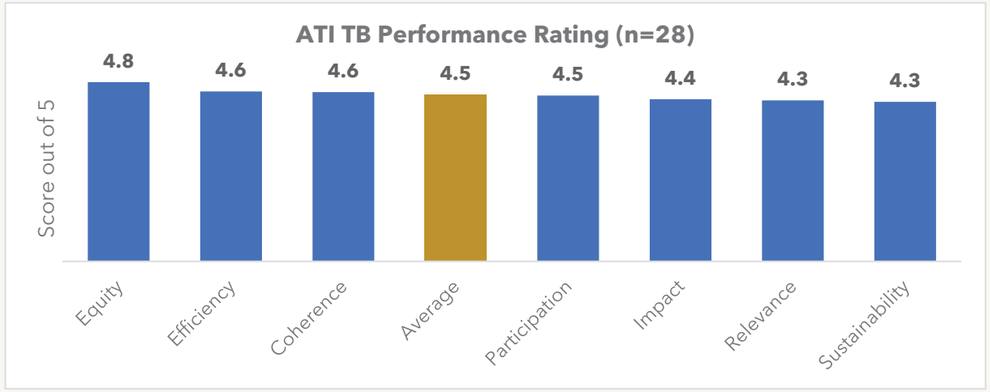
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Key Findings

Overall Rating



ATI TB Performance Rating

Highlights in Kajiado County

9 IN EVERY 10
TB cases in Kajiado County were pulmonary TB cases.

7 IN EVERY 10
persons diagnosed to have TB in Kajiado County are aged between 15 and 44 Years

15% Doubling of the proportion clinically diagnosed and a 15% decline in those bacteriologically confirmed.

17% 17% increase in linkage to care for those found positive.

2% 5%
Doubling of Extra-Pulmonary TB relapses from 2% to 5%.

Higher and rising incidence of TB (Pulmonary and Extra-Pulmonary) among the male residents of Kajiado.

9 IN EVERY 10
confirmed cases were linked to care.

ATI TB Project Highlights

1 IN EVERY 10
presumptive cases in the ATI TB project was positive for TB.

1 IN EVERY 2
positive cases in the ATI TB was identified through Active Case Finding.

1 IN EVERY 3
positive cases was aged between 25 and 34 years.

6 IN EVERY 10
positive cases in the ATI TB project were Male.

2 IN EVERY 3
positive cases in the ATI TB project were from Kajiado West (Rural Kajiado)

All positive cases in the ATI TB Project were linked to care/ started on treatment.

3%
The proportion of Drug Resistant TB cases in the project (3%) was thrice that of the County Level.



Executive Summary

Background

The Awareness, Tradition, and Innovation in combating Tuberculosis "ATI-TB" project was a one-year long project that sought to leverage existing practices, information, and attitudes on tuberculosis care in Kajiado County with a view to improving access to quality TB care, diagnosis, treatment adherence, care outcomes, and project implementation. This would be tenable through; a) decentralized active case finding and care; b) leveraging and integrating community systems and structures in TB care; c) use of GeneXpert Technology in TB diagnosis. The project was implemented in four of the five constituencies in Kajiado County: Kajiado Central, Kajiado North, Kajiado West and Kajiado East.

This end term evaluation was aimed at establishing and documenting the impact of the ATI TB project as well as implementation lessons learnt during the tenure of the project in Kajiado County.

Methodology

This evaluation adopted a mixed-methods approach to draw insights from the respective stakeholders and data repositories. Retrospective cohort analysis was applied for the quantitative part of the evaluation while key stakeholder insights on the impact of the project were sought through key informant interviews. Purposive sampling used to select 28 respondents and facilities for inclusion in the evaluation. The qualitative data collected organized and analyzed thematically in keeping with the Organization for Economic Co-operation and Development's Development Assistance Committee (OECD DAC) Network on Development Evaluation (EvalNet) framework using the Taguette software. The quantitative data was analyzed and reported using descriptive statistics, and measures of association.

Results

Most of the respondents were highly satisfied with the performance of the ATI TB project with a subjective rating of 4.5 out of 5. The project screened approximately 6498 people, sensitized approximately 16621 people, had 1348 presumptive cases and 137 positive cases, all of whom were linked to care. Majority of the cases were Pulmonary TB, with the males, and those aged between 25 and 34 being most affected.

At county level, approximately 112083 people were screened, yielding 2697 positive cases, 93% of whom were linked to care. There was a decline in the proportion that were bacteriologically confirmed and an increase in extrapulmonary TB relapses. The proportion of Drug Resistant TB cases in the project (3%) was thrice that of the County Level (1.1%).

The project enjoyed significant goodwill from the stakeholders but was limited in its delivery by operational factors e.g., frequent disruption of care due to shortage or lack of inputs, alongside other social and commercial determinants of health.

Conclusion

While Tuberculosis is preventable and treatable, it remains a major disease burden in Kajiado County, particularly amongst the youth and middle-aged populations. Improved diagnostic capacity through the GeneXpert technology coupled to active case finding, awareness creation and care provision in a culturally sensitive environment, all bear the potential of increasing access to timely, patient centered and accurate TB care for the population.

Continued capacity development among health workers, sustained and targeted sensitization and screening among vulnerable groups, strategic collaborations, alongside increased budgetary prioritization of health and TB care by government and partners can ensure that the gains in TB care are sustained. Further, Government investments remain critical to addressing social determinants of health that not only aggravate TB care but also the health system in general.



1. Introduction

1.1 Background

Tuberculosis tops the list of infectious disease killers globally and in Kenya. It is estimated that about a quarter of the world's population is infected with Mycobacterium tuberculosis hence at high risk of developing TB disease (1). It is a curable disease, and its disease burden can be reduced with improved access to diagnosis and treatment. According to a recent national prevalence survey, there was more than twice as much TB as previously estimated given the reported disease burden of 426 cases per 100,000 population in Kenya (2–4).

It is further estimated that about two thirds of the patients with TB symptoms in Kenya, including children, are yet to seek treatment. According to the report, 64% of TB patients had been detected, notified, and commenced on first line treatment whilst 36% were missed by the surveillance system. Additionally, the notified cases of Drug Resistant TB had increased by 50% between 2017 and 2018(5) while 805 of patients with drug resistant TB were not diagnosed in the earlier survey.

According to the Ministry of Health, the mortality rate of TB in Kenya (60/100,000) is more than triple the global average of 20/100,000(6). It is estimated that the mortality is higher amongst the HIV negative patients (39/100,000) compared to the HIV positive patients (22/100,000). This is in part due to the close follow-up and regular interphase of HIV patients with the health system, hence better outcomes. This high mortality rate is against the backdrop of an estimated 83% TB treatment success rate (2,7).

1.2 Tuberculosis in Kajiado County

In spite of data inconsistency, it is estimated that 0.02% of the population in Kajiado County were diagnosed to have TB in 2019/20. Further, the county has a HIV/AIDS prevalence rate of 4.7% (lower than the national average of 5.9%). Additionally, it has an estimated HIV/TB co-infection rate of 29%. Noteworthy, the HIV prevalence is higher among the women (6.6%) compared to the men (4%) indicating that women are more vulnerable to HIV infection than men in the County (8).

1.3 TB Diagnosis and Testing

Symptomatic screening of TB in the population has previously been based on four cardinal symptoms namely: cough of more than two weeks, fever, night sweats and weight loss. Unfortunately, this has been associated with the missing of more than 40% of TB cases (9). This has thus necessitated the expansion of the criteria to include any TB related symptom as follows - cough of any duration, night sweats, weight loss, fatigue, fever, and shortness of breath (6,9). Coupled with broader use of chest radiographs for all presumed TB cases, this further increases the screening yield for TB cases.

Further, conventional microscopy misses about 50% of TB cases but the use of GeneXpert increases the efficiency of diagnosis as it detects 78% of TB cases hence reducing the incidences of false negatives and false positives (4). It has thus been recommended as the first line diagnostic test for all presumed TB cases (6,9). With this strategy, there is potential to not only increase TB detection but also to ensure only those that meet the treatment threshold are commenced on treatment (6). There is however limited use of the technology across the country, particularly in the remote and rural settings.

1.4 Service Availability, Readiness and Utilization

It is notable that in most countries with a high burden of TB, private health providers remain a critical link to care and treatment yet are often not linked to the public health system (10–12).

Private sector healthcare utilization in Kenya is estimated at 41% with most of it being in lower tier facilities such as pharmacies and medical clinics (13,14). The TB prevalence report further estimates that a third of TB patients seek care in private facilities (9) and only 43% of all patients had access to a facility with adequate

diagnostic capacity or specimen transport (2). Noteworthy, only 42% of health facilities in Kenya offer TB diagnosis and treatment services. Of these, only 31% offered any form of diagnosis; 25% offered diagnosis by sputum microscopy assessment; and only 11% had rapid tests (15).

Further, as far as service readiness is concerned, the mean availability of TB services is at 67% and only 24% of the facilities provide any services to drug resistant TB patients. The TB services are more available in public primary facilities (98%) and least available in private medical clinics (12%); private facilities have an average of 15% (15). Private health facilities account for an estimated 48% of health facilities in the country with 37.1% being private for-profit facilities (14,16). Despite the presence of private health facilities at community level, majority were found to lack clear systems of linking patients to appropriate TB diagnosis and care (13) whilst the country has a robust referral system for linkage of decentralized public facilities to centralized TB diagnosis and care facilities (2).

These findings underscore the potential the private sector has in bridging the diagnostic and care gap in the fight against TB (9). This thus necessitates their capacity development, integration and involvement in TB care and reporting (9,17–19).

1.5 Patient Centered TB Care

Globally, there is consensus on the value of patient centered approaches to care and treatment of Tuberculosis with a view to improving adherence, and patient outcomes (20). Notably, patient centred approaches are premised on recognition and respect for individual and community health needs, values, preferences and expectations rather than disease (21).

This appreciation engenders a collaborative care approach and hence a coalition between the patient and the health worker that focuses on supporting the patient and communities, with dignity, to overcome the social economic, cultural, legal and psychological difficulties that can affect their response to the diagnosis and treatment of TB. This ensures that the treatment takes account of the social and personal circumstances of the person, and not just the immediate requirements of medical treatment (20–23).

Consequently, the patient centered approach to care helps mitigate against the individual, community, societal and system wide barriers to treatment adherence. The barriers include: the person's knowledge, attitudes and beliefs about the disease, the treatment and the health-care system; family experiences and beliefs; economic concerns (e.g., the ability of a patient to pay the costs associated with treatment); the health-care system's ability to support the patient; and available community resources to deal with the stigma and discrimination surrounding TB(24,25).

The World Health Organization End TB Strategy thus recommends the following measures to anchor patient centered TB care: a) Social support including information support, psychological support, material support where necessary, and companionship support; and b) a tailored package of treatment and adherence support including Community- or home-based treatment support, provided by health workers or trained lay providers (20).

The recommended decentralized care provided in smaller, ambulatory, non-specialized health-care centres closer to where a patient lives, often by trained community health workers or nurses, non-specialized doctors, community volunteers or TB treatment supporters not only improves access but may improve adherence except for patients with severe disease and significant comorbidities. Decentralized care is less disruptive to patients' lives, allowing them to access treatment, care and counselling conveniently with less cost. It may also allow them to continue to work (therefore lessening the financial burden of TB disease) and to remain with their families (26,27).

The WHO further recommends that Family-centered, integrated services in addition to standard TB services may be used in children and adolescents with signs and symptoms of TB and/or those exposed to TB to bolster access and adherence (20,28).

This available evidence lends basis to the evaluation of implementation of the ATI TB project that sought to improve access to patient centered TB care in the vast Kajiado County.

1.6 ATI TB Project

Awareness, Tradition, and Innovation in combating Tuberculosis "ATI-TB" is a project funded by the Italian Agency for Development Cooperation (AICS), started on 1st of July 2020. The Project was implemented in Kenya, in Kajiado County, more specifically in the rural areas of Kajiado North, East, West and Central and in the highly populated areas in Ngong, Kitengela, Rongai with a view to yielding the following outcomes:

a. Increased awareness and demand for TB care among the rural and urban population of Kajiado County
b. Increased screening, diagnosis and treatment of tuberculosis in the remote / hard to reach and rural areas of Kajiado County.
c. Increased screening, diagnosis and treatment of tuberculosis in the key urban populations of Kajiado County.
d. Increased knowledge of the area, availability, management of tuberculosis data in Kajiado County and increased knowledge of the results and effectiveness of the project.

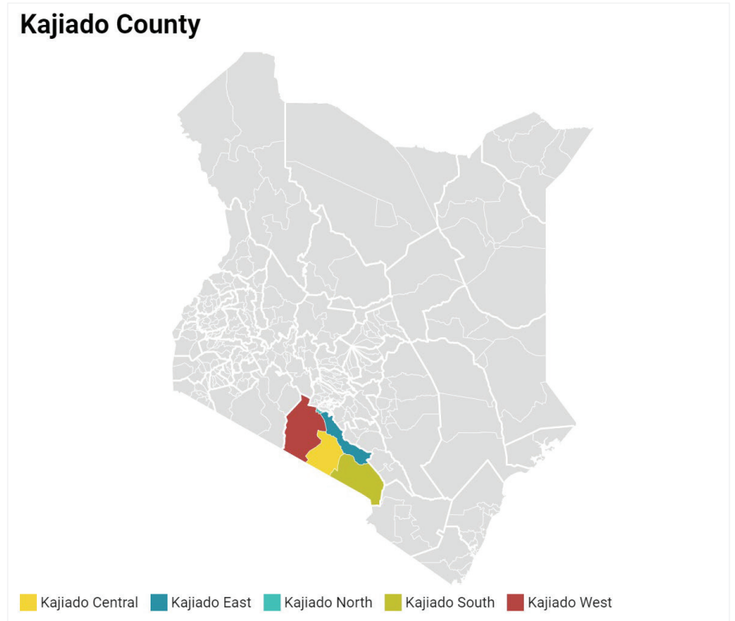


FIGURE 1: KAJIADO COUNTY

A baseline study conducted at the inception of the ATI TB project demonstrate a significant burden of tuberculosis among the men (6 in every 10 cases) and the youth (4 in every 10 cases) in Kajiado County (29). The findings of the assessment further suggested that inadequate information at individual, interpersonal and community levels was a significant barrier to access to quality TB care. The inadequate information was significantly fueled by cultural beliefs and practices. Additionally, stigma due to association with HIV and COVID-19; poverty; inadequate health facilities; poor social amenities (housing, roads, access to clean water, schools, electricity) further aggravated the poor access to TB care in the community.

The study recommended integration of sustained awareness creation in the project implementation; capacity development for health workers on GeneXpert technology; increased investments in more GeneXpert machines; improved social amenities and multisectoral collaborations as critical to sustainable implementation of the ATI TB project in Kajiado County.

1.7 Study Rationale and Justification

The end term evaluation was thus a culmination of the evaluation continuum, aimed at establishing the impact the project had in leveraging existing practices, information, and attitudes on tuberculosis care in Kajiado County with a view to improving access to quality TB care, diagnosis, treatment adherence, care outcomes, and project implementation. The findings will be critical in guiding the design, implementation and scale-up of future projects; and will provide policy relevant information pertaining to use of responsive, patient centred approaches in active TB case finding, and tuberculosis care in urban and rural settings.

1.8 Main Objective

To establish and document the impact of the ATI TB project as well as implementation lessons learnt during the tenure of the project in Kajiado County.

1.9 Specific Objectives

a. To establish and document the impact of project interventions on the tuberculosis case finding and care among the populations served by the project in Kajiado County;
b. To establish and document the impact of the project on the implementing partners and stakeholders; and
c. To establish and document the nature and success of implementation of the project with a view to drawing lessons on project implementation, scale-up and sustainability.



2. Methods

Study Design

This study was a retrospective cohort study among beneficiaries, stakeholders and implementers of the ATI project within Kajiado County. This evaluation adopted a mixed methods approach, using both qualitative and quantitative methods to draw insights from the respective stakeholders and data repositories.

Study Area and Site

The study was conducted in four of the five sub-counties in Kajiado County including Kajiado North, Kajiado East, Kajiado Central and Kajiado West.

Population, Sampling and Recruitment

The study population consisted of all ATI project beneficiaries, key community members, and county healthcare stakeholders in Kajiado County. The study adopted non-random sampling techniques in the selection of respondents.

Consequently, purposive sampling and snow-ball sampling were used to select twenty-eight (28) respondents from among the beneficiaries of the ATI project and key stakeholders with rich information about the communities, TB care and the ATI TB project. Table 1 provides a breakdown of the respondents.

Data Collection and Tools

Qualitative data was collected from the relevant stakeholders through key informant interviews using semi-structured interview guides. The interviews were conducted in the respondents' preferred languages, mainly Swahili, Maasai and English. Quantitative data was extracted from the project records. De-identified patient data was exported from the electronic medical record platform used for the project at the service delivery points and other secondary sources such as the National TB reporting (TIBU) platform. The latter informs the comparative analysis of TB care before and during the tenure of the project in Kajiado County.

TABLE 1: ATI TB END TERM RESPONDENTS

Respondent	Data Collection Strategy	Number
Government Representatives	Key Informant Interviews	4
Screened Patients	Key Informant Interviews	5
Patients on Treatment	Key Informant Interviews	8
Urban Community Representatives	Key Informant Interviews	2
Rural Community Representatives	Key Informant Interviews	2
Partner/ Health worker Representatives	Key Informant Interviews	2
Project Representatives	Key Informant Interviews	2
Community Health Volunteers	Key Informant Interviews	3

Data Management and Analysis

All interviews, upon obtaining informed consent, were audio recorded, transcribed, and translated as necessary. Recordings and transcripts were stored on the researcher's cloud storage systems and accessed only by the investigators.

The quantitative findings were analyzed using descriptive statistics, correlation analysis and inferential statistics. Hypothesis tests (Z-Tests) on proportions and means were applied to explore any differences in the project outcomes. Analysis of Variance (ANOVA) was used to compare outcomes before and during the tenure of the project.

The qualitative data was organized using Taguette Software. Further, the OECD DAC Evaluation Framework adopted for data collection and analysis guided the deductive thematic analysis of qualitative data collected. First level analysis and coding of the qualitative data was done through inductive/ open coding. Subsequent level analysis was done through deductive and axial coding with establishment of linkages in keeping with the defined OECD DAC Evaluation Framework. Further, the analysis adopted a flat coding frame with the respective codes having similar significance.

Validity and Reliability

Validation of the data collected was done through method triangulation of the responses from the interviews and data triangulation from different sources (secondary data) and different respondents. Further, the insights drawn from the transcripts of the interviews were reviewed with the participants for feedback hence bolstering credibility of the data collected. Quotes from the respondents were included verbatim to support the research findings. The research team maintained an audit trail of the research process with transparent description of the research steps taken from the start of the evaluation to the development and reporting of the findings.

ETHICAL CONSIDERATIONS

Ethical Approval

Ethical approval (SU-ISERC1476/22) for the research was sought from and granted by Strathmore University Ethics Review Committee; and subsequently used to seek for research approval (189358) from National Commission for Science, Technology and Innovation (NACOSTI).

Confidentiality

During the study, all respondents and informants were anonymized to ensure confidentiality and all the responses whether oral or written were kept confidential. For the web-based tools, data security measures including security by design principles and limited access modalities (to authorized research members) were employed to ensure confidentiality. All raw data was protected as confidential and available only to the research team.

Consent

The details of the study were explained to all respondents and potential participants of this study after which oral consent was sought to carry out interviews. At all settings of the study, the objectives were explained, and the study population informed that participation is: voluntary, may be withdrawn without any consequences, and that confidentiality of the participant would be assured.

Risks and Benefits

There were no physical risks associated with participating in this study. Further, the team ensured confidentiality for all the research participants, particularly for the patient beneficiaries. The research team informed the study participants that they may withdraw from the study at any time without incurring any personal loss, should they feel uncomfortable.

LIMITATIONS

We anticipated a language barrier while collecting data from the rural community members. To mitigate against this, we recruited and trained research assistants fluent in the local dialect of Ki-Maasai. Additionally, we translated the community and patients' interview guides into Ki-Maasai and Swahili.

Additionally, we anticipated data gaps at county level on some of the variables of interest that were captured in the project database but were not captured by the national repository, TIBU.

To ensure consistency in analysis, variables captured in both reporting platforms were used in the comparative analysis, while project specific variables were examined separately.

Incomplete data for some of the project variables such as demographic and outcome data limited in-depth analysis within the project data and the county level data.



3. Findings & Analysis

3.1 Situation analysis of TB Care in Kajiado County

This section provides a comparative summary of different aspects of active case finding and tuberculosis care in Kajiado County in the period predating the ATI TB project (2020) and during the project tenure (2021 to 2022).

Highlights in Kajiado County

- **9 in every 10 TB cases in Kajiado County were pulmonary TB cases.**
- **7 in every 10 persons diagnosed to have TB in Kajiado County are aged between 15 and 44 Years.**
- **Doubling of the proportion clinically diagnosed and a 15% decline in those bacteriologically confirmed.**
- **17% increase in linkage to care for those found positive.**
- **Doubling of Extra-Pulmonary TB relapses from 2% to 5%.**
- **Higher and rising incidence of TB (Pulmonary and Extra-Pulmonary) among the male residents of Kajiado.**

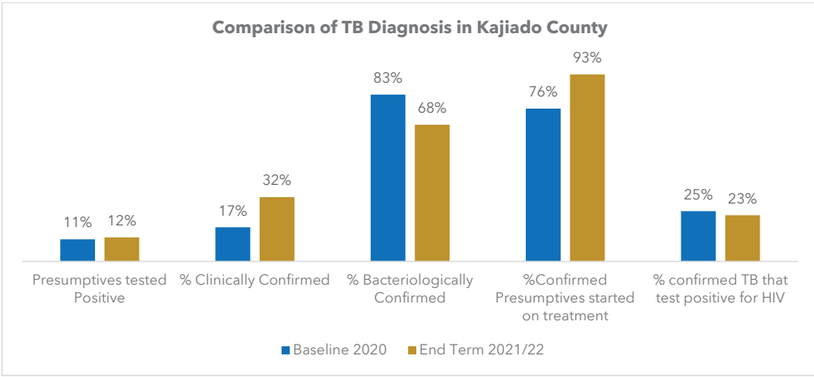


FIGURE 2: COMPARISON OF TB DIAGNOSIS IN KAJIADO COUNTY

At county level, the proportion of presumptives that were found to be positive for TB marginally increased from 11% at the base line to 12% at the end of the project period. **Among those confirmed to have TB, the proportion that was bacteriologically confirmed declined from 83% to 68%, while those clinically confirmed nearly doubled from 17% to 32% at the end of the period.**

"However, we face cartridge stock out very often but then this is a national problem and not a Kajiado problem." ***Project Staff***

Implication

The near doubling of those clinically diagnosed is likely due to the nationwide stockout of GeneXpert cartridges alongside the limited number of machines in the county.

This lends itself as an opportunity for increased resourcing of TB care as well as strengthening of supply chain systems for TB care and health in general in the county with a view to mitigating against disruption of care.

Commendably, the proportion of those that tested positive for TB were linked to care and commenced on treatment increased by 17% from 76% at baseline to 93% at the endline. There was a marginal decline in the proportion lost to follow up from 6% to 5.3%. Additionally, the proportion of patients co-infected with HIV had a marginal decline from 25% to 23% during the period. The improvements are likely due to the heightened awareness creation among the community, health workers and stakeholders on TB coupled to ongoing measures such as surveillance, and active case finding inter alia.

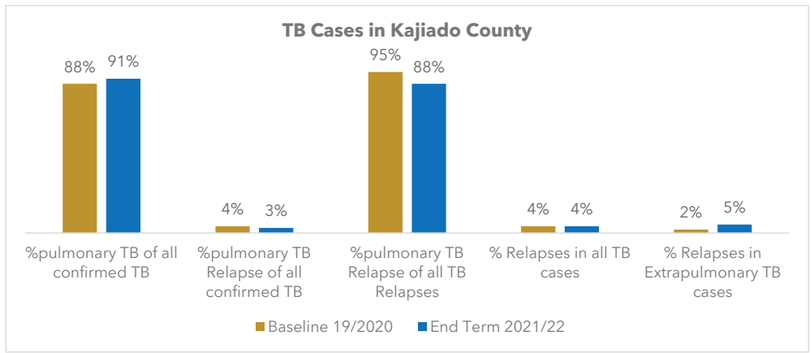


FIGURE 3: COMPARISON OF TB CASES AND RELAPSES IN KAJIADO COUNTY

During the project period in Kajiado, there was a marginal increase in the proportion of Pulmonary TB from 88% to 91%, thus the most dominant type of TB. While relapses remained at 4% during the period, the proportion of pulmonary TB relapses declined from 95% to 88%, while the extrapulmonary TB relapses more than doubled from 2% to 5%.

Implication

While the trend speaks to improved care and adherence for the Pulmonary TB, it also points to a significant need for heightened sensitization on Extra-Pulmonary TB, capacity development among health workers for improved diagnosis, care, and treatment for extra-pulmonary TB alongside improved adherence for respective patients.

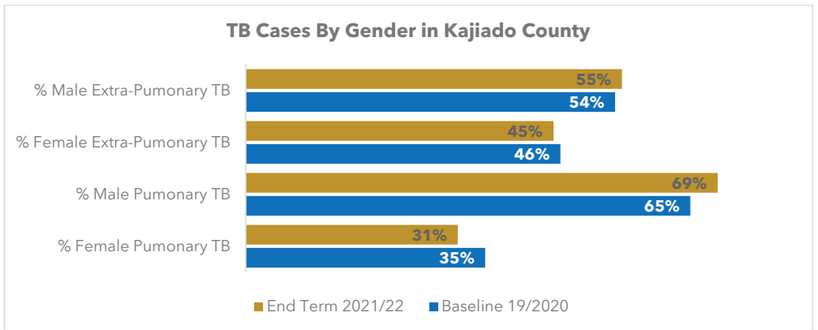


FIGURE 4: TB CASES BY GENDER IN KAJIADO COUNTY

The proportion of females with Pulmonary and Extra-Pulmonary TB declined during the period from 35% to 31%, and 46% to 45% respectively. Conversely, the proportion of males confirmed to have pulmonary and extrapulmonary TB increased from 65% to 69%, and 54% to 55% respectively.

Implication

The trend suggests a higher incidence of TB (All forms) among the males and a need for sustained sensitization, active case finding and care for all genders but more targeted to the males in Kajiado County.

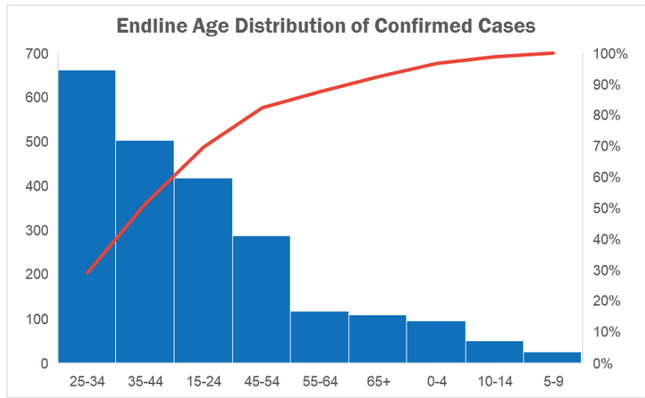


FIGURE 5: AGE DISTRIBUTION OF TB CASES IN KAJIADO

Approximately 70% of the confirmed TB cases in Kajiado County during the project period were aged between 15 and 44 years with those aged between 25 and 34 years bearing the greater disease burden of 30% of the cases.

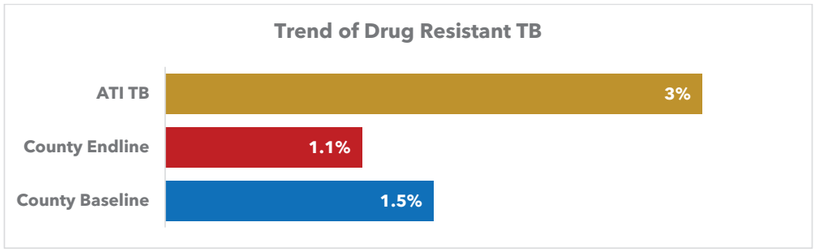


FIGURE 6: DRUG RESISTANT TB IN KAJIADO COUNTY

While the proportion of patients with Drug Resistant TB at county level declined from 1.5% in 2020 to 1.1% at the end of project period in 2022, the proportion within the Project Cohort doubled to 3% (triple that of the county) at the end of the project.

Implication

The higher number of Drug Resistant TB cases identified through the ATI TB project is likely due to the more aggressive Active Case Finding, the close follow-up and patient centred approaches adopted in the project.

Additionally, the decline in the county level proportions may be in part due to the limitations of under diagnosis and under reporting within the county system.

3.2 Evaluation

This section details out the findings of the evaluation in keeping with the OECD DAC analytic framework as modified to include Equity as a thematic consideration.

Subjective assessment of the thematic dimensions of the ATI TB project demonstrates a high level of satisfaction by the sampled stakeholders yielding an aggregate average of 4.5 out of 5 (n=28) as depicted in figure 7.

Notably, most stakeholders sampled ranked Equity highest (4.8 out of 5), followed by Coherence and Efficiency (4.6 out 5), Participation (4.5 out of 5), Impact (4.4 out of 5) and Sustainability at 4.3 out of 5.

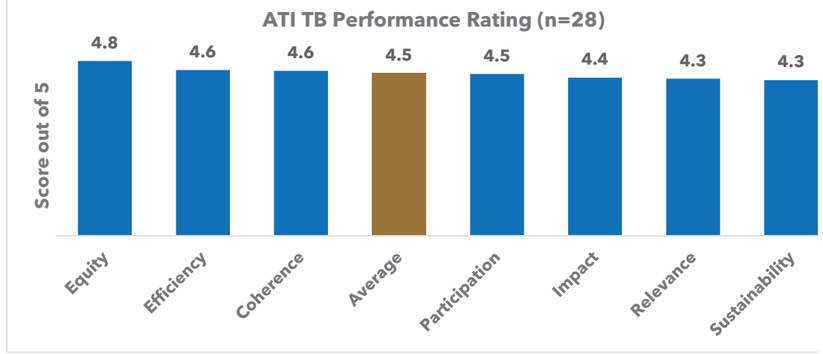


FIGURE 7: SUBJECTIVE RATING OF ATI TB PROJECT PERFORMANCE

3.2.1 Relevance

Relevance is the extent to which the intervention objectives and design respond to beneficiaries', global, country, and partner/ institution needs, policies, and priorities, and continue to do so if circumstances change.

The sampled respondents rated the project's attainment of this domain at 4.3 out of 5 indicating an above average level of satisfaction that may have been inspired by the following:

A. Improved Access to quality, responsive patient centred care

The majority of the stakeholders highlighted the project's value in improving access to quality, responsive and patient-centred TB care in Kajiado County. They noted that the care within the project was not only in keeping with recommended TB care guidelines but was also within their reach financially as it was rendered free of charge at point of care.

Further, through the medical camps and mobile clinics, the project brought quality TB Care close to the communities, more so the hard-to-reach rural areas within Kajiado County.

> *"One thing we maintained was privacy and give them firsthand services. We did not marginalize (discriminate) that this is a man or a woman; all of them were given equal services.* ***Project Staff***

> *"This project does not discriminate, it does not have any sort of tribalism, and it takes care of the needs of all people".* ***Urban Community Representative***

Notably, the respondents highlighted improved access to diagnostic services through the GeneXpert technology, integration of care with additional medical services provided beyond TB care such as antenatal and nutrition services, reduced congestion in existing public facilities, enhanced continuity of TB care through appropriate referrals, and collaboration between public and private care providers.

The care and sensitization on TB were also provided in a way that respected existing cultural norms, appropriately and significantly involved the communities and local leadership in the delivery of the services. Specifically, the home visits to patients, consistent patient follow-up, respect by the care givers and patient involvement in their care demonstrated the project's value for human dignity.

> *"At the end of the day they also do the home visits, when they do the home visit in a company of CHV, they do the screening and also after the screening they also refer the clients to the facility so that they can be able to initiate TPT".* ***Urban Community Representative***

> *"I received better services because the doctors used to pay me a visit once in a while and at times, they would make phone calls to check up on me."* ***Rural Patient Beneficiary***

> *"…they also do the follow up to ensure that the clients are taking their medication and also whenever there is a challenge, they also chip in so that they can be able to do the tracing of the treatment interrupter and also on top of it all also provide a package where by it helps the client and motivates the client."* ***Urban Community Representative***

> *"The patients appreciate the sense of respect they are accorded; you would often hear them say that 'this is my doctor' when they come for treatment, and they are really happy."* ***Urban Community Representative***

B. Delivery of Equitable and Affordable Care

The project was provided free of charge at points of care during the project's tenure. The scope of care included diagnostic services and treatment alongside nutritional support as deemed appropriate. These are services that would ordinarily be beyond the reach of most of the beneficiaries of the ATI TB project given their respective low-income contexts.

"Financially we have really benefited because hospitals are very far from where we live, but with this project near us we have saved on costs of transportation." Urban Patient Beneficiary

Further, most of the beneficiaries were populations found in the remote and rural areas of Kajiado, and those in informal settlements within Kajiado; all of whom are vulnerable populations by virtue of their socio-economic circumstances. The ATI TB project thus significantly alleviated the economic and geographical barriers to access to quality TB care among the beneficiaries in Kajiado county thus advancing equitable and affordable care.

"The poor, the differently abled, women and the ethnic minority are all treated and given the same services without any form of discrimination." ***Urban Patient Beneficiary***

"Patients have benefited because they receive treatment and medication without incurring any cost because they do not pay, and they have also had good relationship with the doctors." ***Community Representative***

C. Improved Active Case Finding and Care

The Mobile clinics (rural areas), Medical Camps (urban areas) and collaboration with Community Health Volunteers for referrals of presumptive cases engendered in improved and early diagnosis of TB cases during the tenure of the ATI TB project. This also facilitated improved adherence to care by the patients confirmed to have TB and commenced on treatment.

"I think for the TB patients, they've received support for follow up and also the food basket so they are able to adhere to drugs and also to get a good outcome after the treatment. So I think it has helped them to adhere to the drugs and also to be committed to come for their drugs at the clinic." ***County Government Representative***

D. Improved Awareness on TB care

The respondents agreed that the ATI TB project activities that embedded population sensitization, individual patient education and counselling as well as health worker education on TB care were instrumental in building stakeholder capacity and insight on TB. This bears the potential of ensuring sustainable behaviour change towards better health seeking practices.

"The other thing, a lot of awareness through trainings and empowering of health workers. You know people take CHW to be the lowest cadre but the impact hey have in the community is great. By educating them, they were empowered to do a greater job." ***Project Staff***

"In terms of advocacy that has gone across, community awareness, education, impacting knowledge on staff and other stakeholders, I'd say that probably that has been good." ***County Government Representative***

The respondents pointed out the following as critical impediments to the ATI TB meeting the population and policy needs with respect to TB care: a) Stigma which dissuades communities from seeking care, b) limited awareness among stakeholders on quality TB care, c) disruption of care due to limited availability and/ or stock outs of critical inputs such as GeneXpert Machines, test cartridges, and d) intermittency of the services provided through mobile clinics and medical camps.

3.2.2 Coherence

Coherence is the compatibility of the intervention with other interventions in a country, sector or institution.

The sampled respondents gave a high rating of 4.6 out of 5 for the project's delivery on this domain. The rating was partly due to the following considerations:

A. Improved access to quality care

The sampled respondents in the evaluation confirmed that the ATI TB project had improved access to quality TB care through Active Case Finding, improved diagnosis, provision of treatment, and patient follow-up to ensure compliance to treatment regimes.

"They have responded very well because they have always ensured that I have access to the TB drugs for the whole six months with close supervision to ensure I don't stop taking them". ***Rural Patient Beneficiary***

B. Alignment to policy and best practice

The ATI TB project ensured alignment to global and national best practice and priorities with respect to championing Active Case Finding of TB, increasing Bacteriological confirmation over Clinical diagnosis of TB, enhancing strategic collaboration through Public Private Mix (PPM) in TB care. This was through proactive TB screening and testing, the use of GeneXpert technology in diagnosis, a tailored patient-centric service design and delivery, engagement of Community Health Workers and engagement of public and private sector collaborators in TB care in Kajiado,

"All the staff for the project have been trained by the county TB coordinator and subcounty TB coordinator on guidelines that are in use here in Kenya which refers to WHO or Global Fund." ***Project Staff***

"Yeah, so now this project is also in line with national strategic plan whereby we aim at getting cases; diagnosing of TB, getting more patients on treatment as much as possible, reaching to the community to ensure we get the missed TB in the community." ***County Government Representative***

"Yes, because they are using the same guidelines from the National TB program and also, we are following the principles". ***County Government Representative***

C. Collaboration

The respondents highlighted the value of strategic collaborations established during the tenure of the project towards improving TB care in Kajiado County. These included partnerships with state actors such as the County and National Government representatives (County Government of Kajiado, Department of Health; TB coordinators alongside the National Tuberculosis, Leprosy and Lung Disease Program (NTLD-P)), nonstate actors such as implementing partners like Zam Zam, and community leaders.

"During the initial stages the government gave us hot spot areas and we had specific people from the hotspot areas that we communicated with so that they would gather the people and on the day they want us to go they would do the mobilization and first screening, then when we go we do a thorough screening and testing." Project Staff

3.2.3 Effectiveness

Effectiveness is the extent to which the intervention achieved, or is expected to achieve, its objectives, and its results, including any differential results across groups.

ATI TB Project Highlights

- 1 in every 10 presumptive cases in the ATI TB project was positive for TB.
- 1 in every 2 positive cases in the ATI TB was identified through Active Case Finding.
- 1 in every 3 positive cases was aged between 25 and 34 years.
- 6 of every 10 positive cases in the ATI TB project were Male.
- 2 in every 3 positive cases in the ATI TB project were from Kajiado West (Rural Kajiado)
- All positive cases in the ATI TB Project were linked to care/ started on treatment.
- The proportion of Drug Resistant TB cases in the project (3%) was thrice that of the County Level.

A. Increased screening, diagnosis, and treatment of tuberculosis in the remote / hard to reach, rural and urban areas of Kajiado County.

The sampled respondents were in agreement that the ATI TB project had not only improved access to TB care among the urban areas but had also significantly improved access in the remote and hard to reach regions of the county.

"The urban communities at least had some access although the population was very high and the one machine was not enough. So when we added the machine at Zamzam it eased the burden." ***Project Staff***

"So, we could go very far to do screening and testing on site which was beneficial to the communities. It relieved them of coming from rural to the urban to get healthcare and that eased expenditure on transport." ***Project Staff***

The respondents also pointed out that the project had improved treatment adherence among the patients found to be positive in both urban and rural regions of Kajiado County as all who were found to be positive were started on treatment.

"I am so happy because through this project I have never gone short of drugs which has always been my top priority." ***Rural Patient Beneficiary***

"I was able to get my drugs for the entire six months and there was no day I missed the drugs." ***Urban Patient Beneficiary***

The figure 8 depicts the trends of screening, referral and case confirmation in Kajiado County during the tenure of the project.

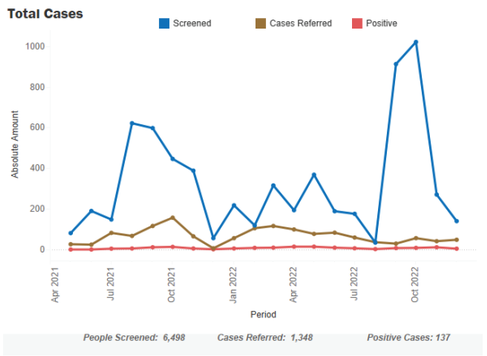


FIGURE 8: SUMMARY OF PROJECT STATISTICS IN KAJIADO COUNTY

Approximately 6498 members of the public were screened, 1348 presumptive cases referred for testing and 137 confirmed to be positive for TB through GeneXpert testing. Annex 2 provides the breakdown of the Presumptive and Confirmed cases by Age, Geographical Distribution and Gender.

Presumptive Cases

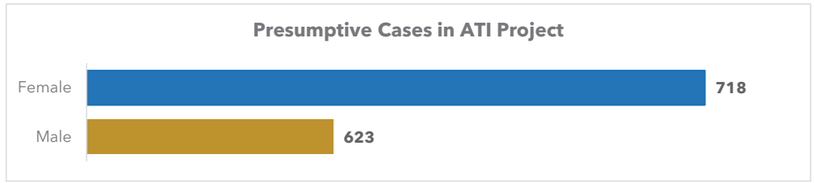


FIGURE 9: PRESUMPTIVE CASES BY GENDER IN ATI TB PROJECT

The incompleteness of data notwithstanding, majority of the presumptive cases (approximately 53.5%) were females while 46.5% were male from the 1341 who had complete data as in figure 9. Further, as shown in figure 10, majority of the presumptive cases were from Kajiado West (61%), followed by Kajiado North (24%), then Kajiado East (11%), Kajiado South (2%) and Kajiado Central (2%).

Presumptives by Sub-County of Origin

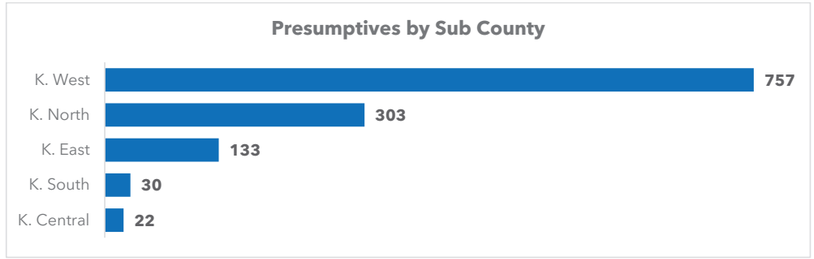


FIGURE 10:GEOGRAPHICAL DISTRIBUTION OF PRESUMPTIVE CASES IN ATI TB PROJECT

Approximately 30% of all presumptive cases were aged between 25 and 34 years as shown in figure 11. Further, the population aged between 15 and 44 years accounted for close to 65% of the presumptive TB cases in the ATI TB project in Kajiado county between 2021 and 2022.

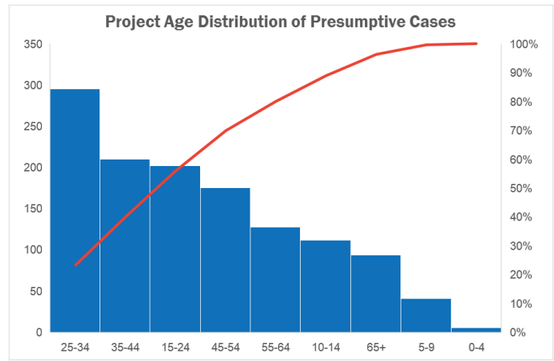


FIGURE 11: AGE COMPOSITION OF PRESUMPTIVE CASES IN ATI TB PROJECT Confirmed Cases

"It has responded to their needs because if you see the number of positives we have gotten, more than a hundred. It is a big number and three-quarters of that comes from the rural areas so it's really a boost for them." ***Project Staff***

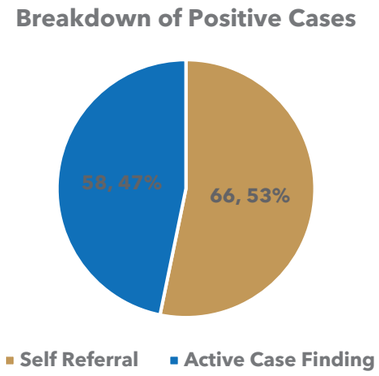


FIGURE 12: ACTIVE CASE FINDING VS SELF REFERRALS

Notably, 10.2% of the presumptive cases were found to be positive upon GeneXpert testing. Comparative proportions of the positive cases from the valid data were from Active Case Finding (47%) through the outreaches and referrals by Community Health Volunteers, while Self-referred patients, walk-ins, accounted for 53% of the positive cases.

Hypothesis tests (Z-Tests) on proportions on mode of referral yields a p-value of 0.0003418 which is less than the significance level of 0.05, hence we can conclude that there is a statistically significant difference between the positivity across the different modes of referral i.e., Active Case Finding (CHV and Outreaches) and Self Referrals (Walk -Ins) in ATI TB project in Kajiado County. See annex 3.

"ATI-TB project team has been able to supply several GeneXpert machines in public hospitals for the sake of screening." ***Patient Beneficiary***

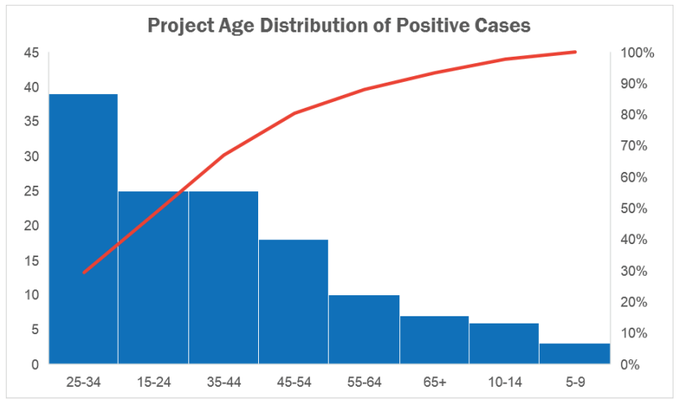


FIGURE 13: AGE DISTRIBUTION OF THE POSITIVE CASES IN ATI TB PROJECT

Approximately 30% of the positive cases were aged between 25 and 34 years while those aged between 15 and 44 years accounted for 70% of all the positive cases during the project tenure.

Highlight

- **It is notable that these age groups with the highest positive cases are often at the peak of their economic productivity.** This implies potential economic loss at household, society, county and national level if cases are not diagnosed early or optimally managed and preventive measures instituted.

Hypothesis tests (Z-Tests) on proportions on the different age groups (0-4, 5-9, 10-14, 15-24, 25-34, 35-44, 45-54, 55-64, and 65+) yields a p-value of 0.2854, which is higher than the significance level of 0.05. We can thus conclude that there is no statistically significant difference in the positivity rate among the different age groups within the population.

Positive Cases by Sub-County

"One of the priorities of the county government is to conduct outreaches in far places that are far from the facilities that cannot access healthcare services So through their medical camps they have helped meet the priorities of the county government." ***County Government Representative***

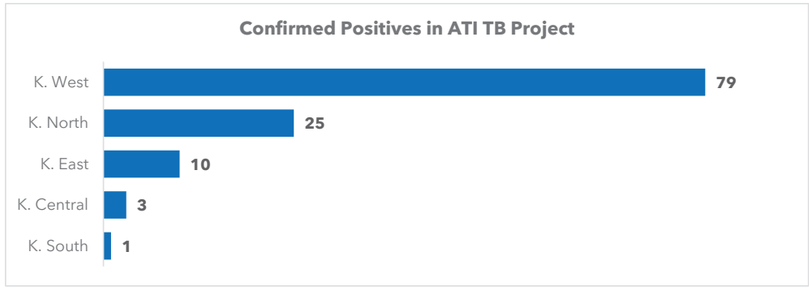


FIGURE 14: GEOGRAPHICAL DISTRIBUTION OF POSITIVE CASES IN ATI TB PROJECT

Majority of the confirmed cases were from rural Kajiado West (67%), followed by Kajiado North (21%), then Kajiado East (8%), Kajiado Central (3%), and Kajiado South (1%). Notably, despite the project's scope not including Kajiado South, some of the positive cases were from Kajiado South implying an existing unmet need there.

Further analysis via Z tests on proportions on regional distribution (Urban and Rural) yields a p-value of 0.4552 which is greater than the significance level of 0.05, hence the conclusion that the difference in the positivity among those in the rural and urban areas in Kajiado County was not statistically significant. Notably, the project activities were mainly targeted at the rural regions.

Confirmed Cases by Gender

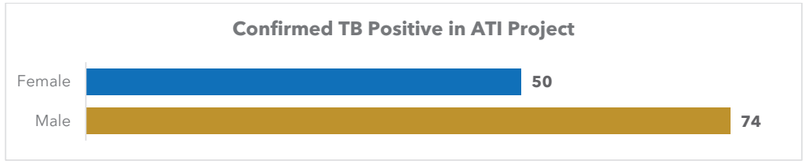


FIGURE 15: CONFIRMED POSITIVE CASES IN ATI TB PROJECT

Additionally, majority (59.7%) of the confirmed cases were males and 40.3% were females. The median age of the male patients was 35 years (Range between 9 and 74 years) while among the female patients, it was 29 years (range between 7 and 70 years).

Hypothesis tests (Z-Tests) on proportions on gender yielded a p-value of 0.001721 which is less than the significance level of 0.05, hence showing that the difference in positivity among males and females in ATI TB project in Kajiado County was statistically significant.

Regression analysis (Annex 3.3) demonstrates that gender and mode of referral were the statistically significant variables with higher odds (91%) of being positive if male, and 186% if self-referral.

Rifampicin Resistance and Extrapulmonary Involvement in ATI TB

3% of the patients with complete data who were confirmed to have TB in ATI TB were also found to have Rifampicin Resistance. Additionally, 6% of the confirmed positive cases had extrapulmonary involvement.

The difference in proportions between the Drug Resistant cases in ATI TB and the County is deemed statistically significant given the p value of 0.01272 from the Z test. Annex 3.1.

Pearson's Correlation Analysis among the positive TB cases demonstrates a moderate positive correlation between a) Extrapulmonary TB involvement and Active Case Finding (0.377; p=0.0000057); and referral by CHVs (0.391; p=0.0000023); and b) Rifampicin Resistance, and Extrapulmonary TB involvement (0.602; p=7.105e-15), referral by CHVs (0.529; p=2.99e-11), and Active Case Finding (0.519; p=8.14e-11). See Annex 3.2

Implication

Active case finding increases the likelihood of identification of drug resistant and extrapulmonary TB.

B. Increased awareness and demand for TB care in Kajiado County

All the respondents sampled lauded the ATI TB project for improving awareness and understanding of Tuberculosis amongst the different stakeholders. The sensitization sessions at group and individual level during the screening, testing and treatment helped demystify misconceptions on the cause, spread and treatment of Tuberculosis.

"….it (ATI TB Project) has really assisted us because… it has created more awareness especially in these areas where they have been holding the medical camps and they have also been taking the opportunities to offer health talks concerning TB. ***Urban Community Representative***

"…sensitization was done effectively and now people already know that having TB is not a big problem, TB is treatable and when you get one or two symptoms just visit the nearest facility and get tested." ***Partner Representative***

"My brother and I have tested positive for TB just recently, but we began taking drugs immediately and we have never stopped taking them because we understand the moment you stop taking them you begin a fresh." ***Patient Beneficiary***

The project also trained the health workers including community health volunteers on Tuberculosis, Active Case Finding, testing modalities for TB and available treatment options. This improved the capacity of the health workers to better identify, link, manage and follow up patients with TB.

"...at the end of the day…. the healthcare worker will be in a position to shed some light on other issues and…we have also been in a position to refer these clients to where they can be able to get the assistance." ***Community Representative***

"Since you have educated the CHVs in the community, they will keep on educating the residents about TB since they are still in the community." ***Community Health Volunteer***

The ATI TB Project sensitized a total of 16621 individuals within Kajiado County and held 14 training sessions for the health workers and community leaders.

FIGURE 16: BREAKDOWN OF SENSITIZATION MODES IN THE ATI TB PROJECT

"The ones who have been educated have the knowledge with them so it will remain with them." *Rural* ***Patient Beneficiary***

A majority (41%) of the sensitizations were through mobile clinics (rural areas), and schools (36%), while 17% were through medical camps (urban areas) and 6% through outreaches to farms in Kajiado County as depicted in figure 15.

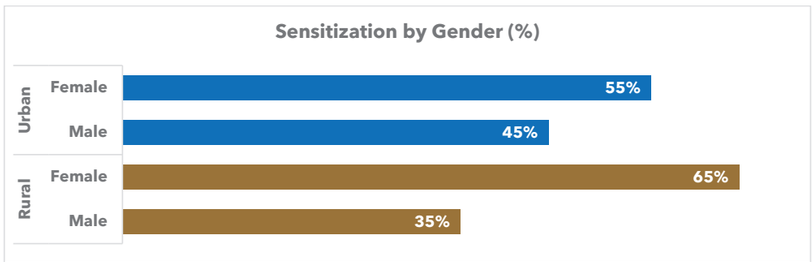


FIGURE 17: GENDER DISTRIBUTION OF THE INDIVIDUALS SENSITIZED

70% of the individuals sensitized through the outreaches were from the rural regions, while 30% were from urban regions of Kajiado. Majority were females, 55% in urban areas and 65% in the rural areas.

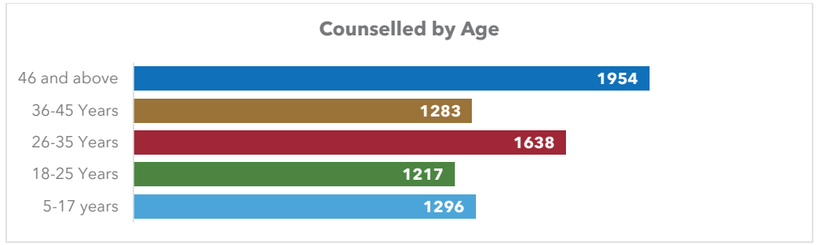


FIGURE 18: AGE DISTRIBUTION AMONG THE SENSITIZED INDIVIDUALS

Majority (26%) of those counselled on TB were aged above 46 years, followed by those between 26 and 35 years (22%).

As depicted in Figure 18, the project team facilitated 14 trainings which had an average pretest score of 71% and a post test score of 89% hence a net improvement of 18%. For the Pretest, the range of scores were between 54% and 89% while for the post test, the range was between 80% and 97%.

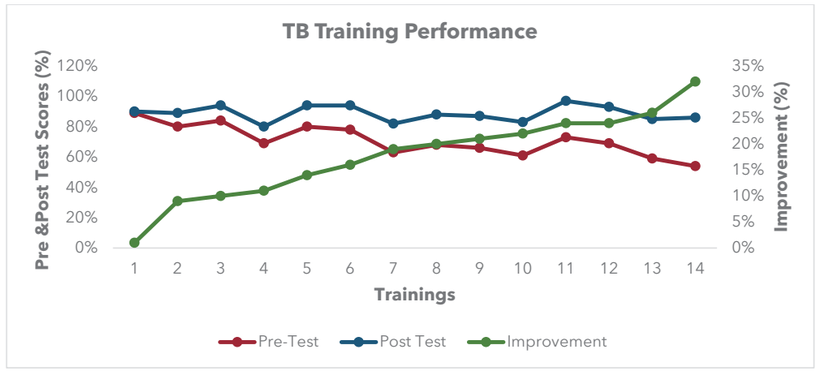


FIGURE 19: PERFORMANCE OF THE TRAINEES

3.2.4 Effciency

Efficiency is the extent to which the intervention delivers, or is likely to deliver, results in an economic and timely way.

The sampled respondents gave a high rating of 4.6 out of 5 for the project's delivery on this domain. The rating was partly due to the following considerations:

A. Efficiency in Diagnostics, Technology and Treatment

The respondents noted that the project enhanced efficient use of existing resources (human, technological and financial) within the project sites in Kajiado County. This was through integration of TB services with other critical primary care services such as Reproductive, Maternal, Newborn and Child Health services, targeted screening among the populations deemed vulnerable in Kajiado County, improved diagnostic capacity for existing care providers, improved linkage of care through patient and sample referrals as deemed appropriate, resource redistribution through TB outreaches inter alia.

> *"I have seen lots of benefits together with the clients because there was a time somebody could be referred for sputum sample collection in places like Ngong in order to be tested for TB. That was time consuming, and he or she could get lost along the way. But nowadays immediately you go to any hospital in Kajiado west be it Ewaso health center, Chongoria health center, Endasupi health center, Mosro, sputum samples are taken and even if there is no GeneXpert in that facility, I will go pick the samples and bring them to Oltepesi."* ***Rural CHV.***

These interventions engendered in swift turnaround times for TB diagnosis and care. It also reduced indirect costs (forgone opportunities and incomes for the patients and care givers) and non-medical costs (such as transport costs) related to seeking for TB diagnosis and care.

> *"GeneXpert machine has also made sure we receive results of the screening as fast as possible."* ***Urban Patient Beneficiary.***

> *"In terms of our culture and traditions we have not been affected in any way, there are those people who do not like going to the hospital and you find them coming here because they are attended to very fast and get to go back home."* ***Rural Patient Beneficiary***

> *"And they no longer need to travel to Nairobi or distant places to get the machines for TB testing, everything is now done in Oltepesi in a very simple and cost-effective way." Rural* ***Patient Beneficiary***

> *"…immediately a positive case is confirmed we call and notify the lab technician who collected the sample and also send a copy of the lab request form via WhatsApp for identification purposes and treatment is commenced."* ***Project Staff***

B. Efficiency in the Health Workforce

Clarity in role allocation among health workers alongside integration of care were noted as important features of the ATI TB project that ensured efficient and fairly optimal use of the limited yet essential health workforce.

> *"If you look at human resources, it was efficient because instead of having someone who deals with only TB, we have a nurse doing both TB and others like HIV tests"* ***Project Staff 1***

> *"The other thing that works well is the Link with CHVs and health workers in dispensaries to mobilize and then to have people to screen and sensitize so this one works very well."* ***Project Staff 2***

This efficiency was noted to be further enhanced by internal processes that guide the screening process with a view to minimizing wastage during the screening and care process.

So we usually urge the doctors and sample collectors to try and be strategic in selecting the patients to be tested to avoid wasting cartridges. ***Project Staff 2***

"We have a clinical officer, an educator a counsellor, Nurse and those are enough to conduct medical camps because we were not screening the entire population." ***Project Staff 1***

Limitations

A. Low Yield

The low yield of positive cases was noted as a significant threat to efficiency given the high cost of inputs for GeneXpert testing.

"These commodities are very expensive. One cartridge cost 3,000 shillings and you may collect 40 samples and non is positive." ***Project Staff 1***

"I think there are some gaps which we should look into like how to do quality screening on active case finding to get these presumptive cases because we think we've been using a lot of cartridges and the yield is very low." ***County Government Representative***

B. Intermittency of Care

Some respondents decried **the intermittency of care occasioned by limited services and facilities** which the mobile clinic model may not adequately resolve.

"…One challenge that I can point out is the fact that we get these services through mobile clinics on rare occasions, we would recommend that this inactive health facilities in Kajiado be furnished and the ATI-TB team be allowed to operate in here." ***Rural Patient Beneficiary***

"…the dispensaries do not fully operate during the week and sometimes we don't find health workers around." ***Rural Patient Beneficiary***

3.2.5 Equity

Equity is the absence of unfair, avoidable or remediable differences among groups of people, whether those groups are defined socially, economically, demographically, or geographically or by other dimensions of inequality (e.g., sex, gender, ethnicity etc.)

The ATI project aimed at total inclusivity. No one was discriminated against due to age, gender, geographical location, disability or financial capability. This is clear by the rating given 4.8/5.

Gender and Age inclusiveness

The respondents felt that the project included people of all genders and ages. This is evident by the sensitization done in selected schools. This inclusion was paramount as childhood TB diagnosis follow-up is currently a challenge in the country.

"The integration of children and adolescents was also a best practice because childhood TB is an area we are struggling, not just as a county but as a country because of the challenges of diagnosis and the requirement of follow-up" ***County Government Representative***

"Currently we are doing screening. We have asked teachers that if they identify children who are coughing, we go there and screen and test those who can produce sputum." ***Project Staff***

Economic inclusiveness

Responses from the key informants painted a picture of financial disparity among the residents of Kajiado county. The presence of malnourished children indicated that some residents could barely afford proper meals.

People of low socioeconomic status prioritize basic needs (food, clothing and shelter) over their health. Offering free TB services, therefore, improved the residents' health-seeking behavior. The food incentives given to those that tested positive also motivated them to comply with the treatment.

"They have done a really good job, especially because the malnourished children have really been taken care of, and infants when the project first came, they are the ones who received treatment first." ***Patient Beneficiary***

" The project has also saved the community huge amounts of finances spend on buying drugs by giving us drugs for free. All we need is bus fare to enable us to visit the mobile clinics mounted by the ATI TB project team" ***Rural Patient Beneficiary***

"Because you are offering these services for free without charging anyone" ***Patient Beneficiary***

"TB diagnosis project is free then they give drugs for free to all patients and I can say people are benefitting more because they do not give anything other than the sample to be tested so as to get basic treatment" ***Government Representative***

Stigma reduction

Through the integration of TB testing with other services, there was a notable increase in the number of screenings after sensitization. This was important as Presumptive cases suffer from stigma seeing into it the association of TB with poverty, Covid -19 and HIV Co-infection. The lack of segregation of presumptive cases also minimized potential stigmatization.

The ATI project also ensured the sensitization of all residents about TB and all the potential causes to clear all the speculations regarding the disease. By so doing, most residents agreed to be tested for TB.

This intervention aimed to improve treatment adherence.

"So, whether there was a physically disabled person, an old man or a child they were treated the same with equity. So, let me just say there was equity. Say the physically challenged, the children for example this old man and the young man have all been served equitably. So, there is equity, there is nobody who has been segregated, all of them are served the same." ***Rural community informant***

"Yes, they were given priority, definitely the vulnerable ones that is the women, the women who came with children were given priority especially when we went to the interior Maasai land, they were the people who we looked for. We gave first priority." ***Partner Representative***

Service access and availability

The Project made the services available to rural most inaccessible places. This was achieved through the collaboration of the already ongoing county outreaches, mobile clinics, training of CHVs and involvement of local leaders.

"So, we could go very far to do screening and testing on site which was beneficial to the communities. It relieved them of coming from rural to the urban to get healthcare and that eased expenditure on transport." ***Project Staff***

"Like, you know, it goes even into where the community is. The challenge we are currently facing as a county in the TB program is of course access. Some communities are still deep down inside there, the rural areas, the geographical accessibility, so I think that is the biggest way it has responded to the needs of the Community by going into the community, reaching them there." ***County Government Representative***

"For the county government, it has really helped since we went deep into the rural areas. You will notice that most of the positive cases were from the rural areas, and we reached the unreachable" ***Project Staff***

Despite the project's effort at total inclusivity, some of the participants felt that it was not fully so.

Geographical inclusivity/ Inaccessibility

Some respondents felt that the project did not cover the entire county and felt the was a need for proper planning to target all the sub counties.

"If another project comes, such areas should be considered. Coverage of the whole county because this time only a few sub counties were considered." ***County Government Representative***

3.2.6 Impact

Impact is the extent to which the intervention has generated or is expected to generate significant positive or negative, intended or unintended, higher-level effects.

The sampled respondents gave a high rating of 4.4 out of 5 for the project's delivery on this domain.

While the project primarily sought to improve Active Case Finding for TB, and improve stakeholder awareness on TB care, **it resulted in other non-TB care related effects including improved nutrition of patient beneficiaries, improved financial protection for the vulnerable poor, improved access to other health services such as Antenatal Care and primary care services for the remote population, economic empowerment in the communities and environmental management awareness.**

A. Holistic Care and Nutritional Support

"After the patient's sample is tested and turns out to be positive then the project provides them with food and follow ups are made to check whether the patient is taking drugs or not". ***County Government Representative***

"I have been on drugs for six months and have also received a food package for the entire time as a patient on dugs". ***Rural Patient Beneficiary***

B. Integrated Health Care Services

So that is the addition, there is at least something else they do as they work on TB and I'd say it is the outreaches for immunization. ***Rural Community Representative***

"…reaching out to patients in their villages and offering them drugs not only for TB but also for other diseases and in this way, patients and the local communities benefit the most." Rural ***Patient Beneficiary***

"This project opened up more link facilities to have TB drugs." ***Project Staff***

"Other than TB, they were doing mobile clinics of which you can't go to a small town like … Osubuko as an example, …they'd go and treat other diseases let's say hypertension, … they would go with drugs other than the TB drugs ….". ***Partner Representative***

C. Elevated need for more Government investments in Health Systems Strengthening

"..I can give like some facilities in the west whereby you find that it is a dispensary, it has only a nurse, no other clinician, no one else apart from maybe that nurse, they really expressed themselves and they challenged the county to ensure that at least each and every facility should have at least one or two or three health care workers so that if one is on leave, the facility is not closed and also if maybe one is unwell, the other one can act …". ***Urban Community Representative***

D. Environment Management

"Environmentally, they have taught the residents that its airborne and so they should improve on the aeration, in relation to this even the manyattas have been well ventilated after the awareness." Community Health Volunteer

'In terms of environment, we have been urged to keep our environment clean to curb diseases and from this training i have seen great difference compared to the times i was not keen on taking care of the environment.' ***Urban Patient Beneficiary***

'We have been taught a lot concerning the environment, for example the dust that we can see now, is brought about by the strong winds caused by the cutting down of trees. We were therefore taught that if you cut down one tree ensure that you have replaced that one by planting more trees.' ***Urban Patient Beneficiary***

E. Boost to Self Confidence and Freedom of Expression

"It has created awareness such that people can express themselves without fear." ***Community Health Volunteer***

F. Sustained Human Capital Development

"We have also received food packages and this has enabled our children to avoid hunger and be able to go to school." ***Rural Patient Beneficiary***

*"…Finances and the same is channeled to better the education of their children". C****ounty Government Representative***

"We empowered people with motorbikes to transport the samples." ***Project Staff***

"…this has boosted the education of our children because they are healthy and the finance that we save from buying drugs allows us to take them to private schools for quality education." ***Urban Patient Beneficiary***

3.2.7 Sustainability

Sustainability is the extent to which the net benefits of the intervention continue or are likely to continue.

One of the recommendations of the baseline study conducted at the inception of the ATI TB project was the integration of sustained awareness creation in the project implementation. For any project to be sustainable, multiple things must work synergistically to ensure continuity. According to the respondents interviewed, Improved quality of care, strategic collaborations, ownership by the community and Motivated and empowered healthcare workers were some of the things that they felt would either enhance or deter sustainability.

With a rating score was 4.3/5, there is a very high possibility of the project's sustainability.

Sustainability for any project is very crucial. The ATI project's main objective was to establish and document the impact of the ATI TB project and the implementation lessons learnt during the period of the project in Kajiado

County. It also sought to ascertain if the intervention would result in sustained practices around TB Awareness, Education, Screening and actual uptake of TB treatment for positive cases.

Improved quality of TB care

The respondents felt that the project had resulted in an improved quality of TB care in the county. The addition of Gene Expert machines, Increased number of healthcare workers, rural area interventions, integration of TB testing with other services and setting up permanent healthcare centers for TB projects were some of the reasons respondents believed could lead to sustained TB intervention in the county.

> *"We would recommend that this inactive health facilities in Kajiado be furnished and the ATI-TB team be allowed to operate in here."* ***Patient beneficiaries***

> *"It is also important to point out that this project has worked well with CHVs who are members of the public to facilitate excellent service delivery."* ***Patient beneficiaries***

Collaboration

Through collaboration and strategic partnerships with National programs, county government and private hospitals, the respondents strongly feel that the effects of the intervention will continue.

> *"They have partnered with public facilities and they agreed that they will leave us with one GeneXpert machine and the county government has also been supplying cartridges for free they also supply the same to private facilities so i think the benefits of the project will not end"* ***Partner representatives.***

> *"There is this support you gave in the form of GeneXpert machine and even after you are gone, the machine will still be serving the whole community In Kajiado West and that is sustainability."* ***Rural community Representative***

> *"Good collaborations that we are having with the county and other facilities so that once our commodities are over or there's a shortage of them, we can be able to borrow from each other".* ***County government representative.***

> *"Due to the collaboration from the national program an also from the county, I think the sustainability due to that collaboration it will continue".* ***County government representative.***

> *"The Impact will last. Because now the county government will now step in and the areas that WF has been doing outreaches, now the county government will now be conducting the same activities in the same areas".* ***County Government Representative***

> *"So, matters finances I'd say, TB was initially a government funded project, so the government provides for the basics that is the cartridges and the falcon tubes. So, the only thing that the donor required to supply was the GeneXpert, biosafety cabinet and now sensitization."* ***Partner Representative***

> *The project has fostered stronger public private collaboration. "May be now like the facility they have used like Zamzam that one it has created a good relationship between the public sector and the private sector."* ***County Government Representative***

Ownership by community

The respondents noted that the involvement of the local community in the project while respecting and maintaining their cultural beliefs and practices would further aid in the continuity of the project's interventions.

> *"The project respected the culture. There was learning, most of the time they would come and enter into the community and homes and request to do the screening and their culture notwithstanding, the residents would agree and they would even be taught on how to live with and prevent the spread of TB"* ***Rural Community Representative.***

> *" The project delivered care and services that respected our values and in my own opinion this project services have been the best compared to any other"* ***Patient Beneficiary.***

> *"This project has also respected the socio-cultural liberty of the community and has always endeavored to unite the community and not bring any form of divisions and differences"* ***Patient beneficiary.***

> *"The very beginning when the project was being implemented it's the chief who went around informing people, therefore leaders have been involved."* ***Rural Community Representative***

Motivated and empowered healthcare workers

The Project empowered the CHVs and other healthcare providers to sensitize, identify and refer the presumptive cases. They were also educated on how to test and manage TB patients.

> *"However, the staff have been trained on TB, sample collection and how to deal with TB patients so all the activities that we do that are supported by the government will continue: that is tests and the treatment"* ***Project Staff***

> *"Since you have educated the CHVs in the community, they will keep on educating the residents about the tb since they are still in the community"* ***Community Health Volunteer***

Improved awareness

Through the sensitization across various groups by counsellors and educators, the knowledge imparted will lead to lasting awareness of the signs and symptoms of TB. Moreover, the trained CHVs will also ensure health education continuity.

> *"There are some effects that will last. like health education."* ***Project Staff***

> *"I'm also sure that those who have been educated; some champions will also continue after the project. The aspect of education is sustainable"* ***County Government Representative***

Though most respondents thought the project intervention was sustainable, some had a different opinion and feared that sustainability was not feasible. Some foreseeable challenges are financial and operational sustainability and social-cultural sustainability.

A. Political Sustainability

Weak county governance, Government Bureaucracies, inadequate staffing, and poor collaboration are just some barriers to care mentioned by the respondents that could deter the continuity of the interventions started by the ATI project.

> *"This project has supported the existing governance to deliver on its mandate, but we have witnessed some laxity from our leadership because if they cannot deliver on bursary promises we expect then not to deliver on matters health"* ***Patient Beneficiary***

> *"Well, the challenges were mainly supplies from the government because you see the donors did not have access to things like the falcon tubes and cartridges, we depended mainly on the government."* ***Partner Representative***

"Also, in terms of diagnosis, with the GeneXpert machine, I'm sure the government can be able to get commodities to use. Human resource and health operation maintenance, that one the sustainability is lower because unless we have another donor picking up and employing the staff to continue running the logistics, the sustainability is lower" ***County Government Representative***

B. Financial & Operational Sustainability

Technology failure, Stock out of commodities, long distance to be covered, few GeneXpert machines, shortage of staff, High indirect medical costs-Travel and Cost of giving care were some of the reasons cited by the respondents as possible hindrances to sustainability.

"Where we had the lapse was provision of cartridges and falcon tubes. One they are not produced in the country. Unless from the government side, they improve themselves so that these equipment are available locally." ***Project Staff***

"We normally run online but in April this year, the machine could not transmit the results online, so we called someone to come and do what we call the calibration of the machine, and they said the project needs to buy a new model of the machine to assist in the transmission of the results." ***County Government Representative***

"When there is a medical camp, they use the CHV to mobilize but do not include their budget for the subcounty staff, subcounty TB coordinator or facility staff so that they are included in the TB screening" ***County Government Representative***

"However, we face cartridge stock out very often but then this is a national problem and not a Kajiado problem. Sometimes we try to fix it by ordering by ourselves cartridges so we have a small stock of cartridges that we can use if really everything here is ran out" ***Project Staff***

"I think it's an area where we'll have a challenge because when you exit, we'll find that either the support for the mobile and the medical camp some facilities may not be manageable unless now we do a proper planning for every facility" ***County Government Representative***

"This is because of the activities here are supported by the donor. When the money is gone it will be difficult to continue with these activities." ***Project Staff***

C. Sociocultural Sustainability

Cultural Rigidity, Stigma, mistrust and Interclan discrimination were highlighted as a challenge that could hinder the continuity of the interventions.

"The only challenge we have is that of clannism whereby if you do not come from my clan then I won't attend to you" ***Patient Beneficiary***

"Not everybody would be willing to help and speak on behalf of a sick patient sometimes you have to take matters on your own hands come out and seek help." ***Patient Beneficiary***

3.2.8 Participation

The sampled respondents gave a high rating of 4.5 out of 5 for the project's delivery on this domain. Majority of the respondents noted that the project had significantly allowed for participation of the stakeholders in the design, and implementation of the interventions.

Notably, the following were involved: county and community leadership, traditional healers, patients, health workers, public and private sector collaborators inter alia. This engendered in goodwill from the stakeholders and ownership by the communities and their leadership.

"It was a teamwork. We worked together as a whole team, the partners, the donors, everything went smoothly. Everyone was involved, actively involved." ***Partner Representative.***

"What we tried is that through the involvement of the village elders and the CHVs to get access to the communities without being seen as intruders or outsiders. Also, employing local staff helped." ***Project Staff***

"….that bearing in mind in Kajiado the most dominant are the Maasais and they really considered that and they ensured that some of their staff are people from the region whereby they will be able to shed more light according to the culture of the dwellers and the residents so that they can ensure that they preserve the cultures and also to ensure that they don't go contrary to what maybe the residents don't expect them to do." ***Urban Community Representative***

"We have been involved at every stage of this project, and we have been trained as well." ***Urban Patient Beneficiary***

"Yes local leaders were involved. For them to get into the community, they must have passed through the local leaders and doctors, sat down and outlined the activities they intended to do and how they intend to do them." ***Rural Community Representative***

I have been involved in every stage of the whole process and the doctor ensures that I am fully aware of everything that is going on. ***Urban Patient Beneficiary***

"…every time this project plans to visit our regions, we are informed in advance so that we can prepare to come out to receive this treatment together with drugs. So we feel as patients (that) we are part of the process all along..." ***Urban Patient Beneficiary***

"And when I'm speaking about the informal, they were also engaging even the traditional healers, bearing in mind Kajiado, we have a percentage whereby people also do seek services from the traditional healers and herbalists." ***Urban Community Representative***

However, a few respondents felt that more community and government engagement and participation was necessary if the project were to achieve its full potential in a cost-effective manner.

"I am so happy because of the training that we have received on how to take care of the environment and I would also love to see community leaders being involved in this project." Rural Patient Beneficiary.

"… we had serious challenges with schools during Covid; the whole of 2021 and the first half of 2022. I would go ask the MOH and we write a letter and we go to Ministry of Education (MOE), but with the letter or not he would not allow us in." ***Project Staff***

"Involvement of health care workers in their activities and in their budget. The school selection: Liaising with the subcounty government to pinpoint schools that will yield results and also there were some areas that the project did not reach." ***County Government Representative***

"Failure to bring everyone on board. It has really costed us somehow and if the program continues, if we be keen on that aspect and engage everyone and bring everyone on board, to me I think it will yield." ***Urban Community Representative.***



4. Recommendations

A. Continued Sensitization

In order to effectively influence behaviour change with respect to health seeking attitudes and practices among the communities in Kajiado, targeted and sustained sensitization by all stakeholders is essential. This will likely engender in lower stigma and discrimination, limited misinformation, early diagnosis and treatment and ultimately, better health outcomes in the long run.

"It is important to have more sensitization done by members of the community since some of them are quite resistant and also continue educating people about TB." ***Health Worker***

"I would recommend that people get screened regularly because sometimes people cough for a long duration of time and they are not aware that they have TB, but by the time its detected it already too late because at the time they have severe weight loss, night sweats and the like, but once its detected early I don't think that it would get to that point because, the longer it takes to detect the worse it gets, and then you find that so many other people been have infected in that process." ***Health Worker***

B. Targeted Screening among vulnerable groups

Given the high TB cases among the males, the youth and those from rural areas, there is need for sustained yet targeted screening among these vulnerable groups. These can be facilitated in collaboration with both government and non-state actors in TB care.

Additionally, there is need for targeted awareness creation, screening and adherence support for Extra-Pulmonary TB and Drug Resistant TB among the communities and strengthening health worker capacity to screening for, diagnose, treat and follow up patients with Extra- Pulmonary TB and Drug Resistant TB.

C. Integrated Data Management

There is need for strengthening data management for TB care at both project and county level, with alignment of tools to policy and project objectives, integration of reports, periodic data audits, and sustained capacity development among data managers and project teams. These efforts are likely to improve the quality and integrity of data and can better inform planning and decision making at both county and project level.

"What I notice is that there is TIBU which is a national platform which collects all the data gathered by each county but then data reported on TIBU and data reported on physical papers they don't match." ***Project Staff***

"They needed to have strengthened their monitoring and evaluation because if you monitor very well and with good indicators you will be at a better place to achieve the results." ***County Government Representative***

D. Continuous Capacity Development

Build capacity of health workers in in TB care, the use of the GeneXpert technology (testing and maintenance), data management and reporting and sustain the knowledge and skill transfer through periodic refresher trainings.

E. Stronger Collaboration with Government Stakeholders

The project team and other partners in TB care in the county should pursue and foster strategic collaborations with the national and county government teams. This ensures alignment, engagement and government ownership of interventions which is likely to strengthen political goodwill and improve overall TB care, surveillance, and outcomes. Additionally, this aligns with the global best practice of Public Private Mix in TB care.

"Involvement of health care workers in their activities and in their budget. The school selection: Liaising with the subcounty government to pinpoint schools that will yield results and also there were some areas that the project did not reach." ***County Government Representative***

F. Strengthen collaboration with nonstate partners for synergy

Leverage and establish collaborations with other partners in TB care for synergy such as other implementing partners and private health providers. This has the potential of harnessing efficiency in resource use as well as increasing the reach of services to the vulnerable.

"Even if things are applied to the letter the results might not be the same. What I find a little bit difficult would be at times communication. Sometimes we are told of a positive case and we need to do contact tracing and sometimes we are told very late or we are told on days we are not going to that outreach areas." ***Project Staff***

G. Collaboration with Community Health Volunteers

Empower and engage the Community Health Volunteers through targeted training for Active Case Finding at community level given their potentially close contact with the communities at household level.

H. Broaden geographical cover of the services

There is need for broadening the geographical scope of TB care coverage across Kajiado County, particularly to improve access in the remote and hard to reach regions. This can be through establishing, and adequately staffing and equipping facilities in these regions; strengthening sample networking/ referral for facilities that do not have diagnostic capacities, targeted outreaches inter alia.

"If another project comes, such areas should be considered. Coverage of the whole county because this time only a few sub counties were considered." ***County Government Representative***

I. Increased Government Investment in TB care in Kajiado County

The limited number of GeneXpert Machines (3) in the entire county alongside the few facilities (most ill equipped and understaffed) that are sparsely situated across the vast county, compounded by weak supply chain systems necessitate heightened investments in the health system in Kajiado. This requires increased allocations to health by the county government alongside donor funding from partners.

"We would recommend that this inactive health facilities in Kajiado be furnished and the ATI-TB team be allowed to operate in here." ***Patient Beneficiary***

"Enough health workers be employed in our local dispensaries so that they help in creating awareness about TB." ***Patient Representative***

J. Increased investment in strengthening infrastructure and social amenities in Kajiado County

There is need for advocacy for increased investments in social amenities and infrastructure in Kajiado County by the National and County Governments in collaboration with partners. These include improved road networks, provision of affordable and decent housing for the indigent, adequate school infrastructure, provision of clean water, electricity and internet connectivity, inter alia.

5. Conclusion

While Tuberculosis is preventable and treatable, it remains a major disease burden in Kajiado County, particularly amongst the youth and middle-aged populations. Improved diagnostic capacity through the GeneXpert technology coupled to active case finding, awareness creation and care provision in a culturally sensitive environment, all bear the potential of increasing access to timely, patient centered and accurate TB care for the population.

Unfortunately, while the urban and rural communities are not entirely ignorant on TB, lack of information on appropriate practices and available services threatens access to quality TB care in Kajiado County. Additionally, there is limited skilled capacity for GeneXpert services, few GeneXpert machines, few health facilities and weak supporting infrastructure in the county.

While some socio-cultural and economic factors such as poverty, misconceptions, poorly ventilated housing and nomadic lifestyle have been shown to aggravate TB spread, stigma and delayed care; other factors such as community engagement, community health volunteers, traditional healers have significant potential of improving awareness and care for TB patients in Kajiado.

Continued capacity development among health workers, sustained and targeted sensitization and screening among vulnerable groups, strategic collaborations, alongside increased budgetary prioritization of health and TB care by government and partners can ensure that the gains in TB care are sustained. Further, Government investments remain critical to addressing social determinants of health that not only aggravate TB





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Annex 1: Indicator Matrix

Indicator	Baseline	2019-2020	ATI End Term	Target (by end project – July 2022)	Means of Verification	Comment
Reduction of TB Prevalence in Kajiado County	320/100.000 per year	126/100.000 per year	126/100.000 per year	-50%	Tibu/MOH	Source: AWP 20/21. In the absence of a more recent population prevalence survey during the project tenure, we retain the prevalence captured at baseline hence no captured change. Additionally, the county prevalence cannot be fully attributed to the interventions within ATI TB.
Reduction of TB Incidence in Kajiado County	150/100.000 per year	550/100.000	93/ 100,000 (-83%)	-40%	Tibu/MOH	Population 1117846 (AWP 20/21) Given the 2697 cases notified over 1 year 7 months, this translates to a reduction that is twice the set target. Notably, the county incidence cannot be fully or solely attributed to the interventions within ATI TB. Given the likely nationwide underreporting of TB cases, we suppose that service disruptions related to the COVID-19 pandemic, political transitions in 2022, shortage of inputs partly account for the performance.
Increased number of TB cases notified	Annual Case notification WHO	3042 1521 per year	County: 1692 per year (11%) ATI TB: 87 per Year	40%	Tibu / WHO	Cases over 1 year 7 months: County: 2697 ATI TB: 137 While there was an 11% increase in the notified cases at county level, the performance is below the set target of 40%. Service disruptions related to the COVID-19 pandemic, political transitions in 2022, shortage of inputs partly account for the performance.
Increased knowledge among target group	Baseline	-	16621	70%	WF internal tests run	Total number sensitized by Educators. There was no county wide baseline data hence no plausible comparison. However, 16621 individuals were sensitized through the project

Indicator	Baseline	2019-2020	ATI End Term	Target (by end project – July 2022)	Means of Verification	Comment
Increased request for TB services	Baseline	-	County Screened: 112083 Positive: 2697 ATI TB: Screened: 6498 Positive: 137	50%	Tibu/MOH	There was no documented county wide baseline data hence no plausible comparison. However, 112083 at county level and approximately 6500 individuals were sensitized through the project. Additionally, approximately 2700 and 140 patients were confirmed to have TB during the project period at county and project level respectively.
More 75% of suspect cases found in rural areas	10%	-	ATI TB Presumptives: 76% of ATI TB Presumptives from Rural Sub counties.	85%	WF Research/ Tibu/MOH	The project performance was at 76% against the target of 85% of presumptives identified in the rural areas. All except Kajiado North are considered Rural Subcounties. Service disruptions related to the COVID-19 pandemic, political transitions in 2022, shortage of inputs partly account for the performance.
More 75% of TB testing in rural areas	10%	62%	ATI TB Presumptives: 76% of ATI TB Presumptives from Rural Sub counties.	85%	WF Research/ Tibu/MOH	The project performance was at 76% against the target of 85% of presumptives identified in the rural areas. All except Kajiado North are considered Rural Subcounties. Service disruptions related to the COVID-19 pandemic, political transitions in 2022, shortage of inputs partly account for the performance.
More 75% of TB treatment in rural areas	5%	3042 (100%)	ATI TB Positive from Rural: 79%	75%	WF Research/ Tibu/MOH	The project surpassed the set target of 75% of positive cases in rural areas given the performance of 79% at the end of the project.
Increased TB cases referred by CHVs or traditional healers	10%	145/3042 (4.7%)	County: 5.1% of the positive cases ATI TB: 66/137 48%	40%	WF Research/ Tibu/MOH	Within the Project, 48% of the positive cases were referred by CHVs compared to the 40% target. The entire county had a lower rate of 5.1%.
100% increase of TB screening in target schools	0%	-	1783	100%	WF Research/ Tibu/MOH	There was no appropriate documented county wide baseline data hence no plausible comparison. However, 1783 individuals were screened in schools and farms.
More 40% of TB testing in urban areas	750/year	62%	1898/ year	1.050/year	WF Research/ Tibu/MOH	3005 over 1.5833 years The performance (1898) significantly exceeded the set target of 1050/year.

Indicator	Baseline	2019-2020	ATI End Term	Target (by end project – July 2022)	Means of Verification	Comment
More 40% of TB treatment in urban areas	700/year	3042 (100%)	County: 22% (374/year) (592) ATI TB: 21% (16/ year)	980/year	WF Research/ Tibu/MOH	The performance of 374/year was below the target of 980/year from the urban areas. At County level, 592 (22%) of the cases were from Kajiado North, while in ATI TB cases 25 cases (21%) were from Urban Kajiado (North) over 1.5 years. Service disruptions related to the COVID-19 pandemic, political transitions in 2022, shortage of inputs, and stigma partly account for the performance.
Increased TB cases referred by CHVs or traditional healers	10%	145/3042 (4.7%)	County: 5.1% of the positive cases ATI TB: 66/137 48%	30%	WF Research/ Tibu/MOH	The project performance (48%) exceeded the set target of 30%. At county level, the performance was way below the 30% target at 5.1%.

Legend:

Target not Met	Unclear target/ Incomplete Data	Target Met or expedited



Annex 2: Descriptive Statistics

TABLE 3: ATI TB PROJECT DESCRIPTIVE STATISTICS

Variable	Description	Presumptive Cases			Positive Cases		
		Self-Referral	Active Case Finding	Total	Self-Referral	Active Case Finding	Total
Gender	**Male**	233	390	623	37	37	74
	Female	281	437	718	29	21	50
	Sub Total	**514**	**827**	**1341**	**66**	**58**	**124**
		Valid Data 1341/1350			**Valid Data 124/137**		
Sub County	**K. West**	428	329	757	52	27	79
	K. East	3	130	133	3	7	10
	K. North	47	256	303	11	14	25
	K. Central	0	22	22	0	3	3
	K. South	1	29	30	0	1	1
	Sub Total	**479**	**766**	**1245**	**66**	**52**	**118**
		Valid Data 1245/1350			**Valid Data 118/137**		
Age	**0 to 4**	3	3	6	0	0	0
	5 to 9	18	23	41	2	1	3
	10 to 14	43	69	112	3	2	5
	15 to 24	97	105	202	14	7	21
	25 to 34	116	178	294	18	19	37
	35 to 44	81	129	210	12	11	23
	45 to 54	58	117	175	9	8	17
	55 to 64	42	86	128	5	5	10
	65+	32	62	94	3	3	6
	Sub Total	**490**	**772**	**1262**	**66**	**56**	**122**
		Valid Data 1262/1350			**Valid Data 122/137**		

Annex 3: Statistical Tests

3.1. Hypothesis (Z) Tests

A. Gender

```
# Create a vector of the observed positives for gender
x = c(male = 80, female = 55)
# Total number of presumptives
n = c(male = 624,female = 718)

# Perform the proportion test
result = prop.test(x, n,correct=FALSE)

# Print the test statistic and p-value
print(result$statistic)
print(result$p.value)
result
```

```
X-squared
  9.82603
[1] 0.001720593

        2-sample test for equality of proportions without continuity correction

data:  x out of n
X-squared = 9.826, df = 1, p-value = 0.001721
alternative hypothesis: two.sided
95 percent confidence interval:
 0.01894600 0.08426092
sample estimates:
    prop 1     prop 2
0.12820513 0.07660167
```

B. Age

```
observed = c(
    "0-4" = 0,
    "5-9" = 3,
    "10-14" = 6,
    "15-24" = 25,
    "25-34" = 39,
    "35-44" = 25,
    "45-54" = 18,
    "55-64" = 10,
    "65+" = 7
)
total_sample = c(
    "0-4"= 6,
    "5-9"= 41,
    "10-14"= 112,
    "15-24"= 202,
    "25-34"= 295,
    "35-44"= 210,
    "45-54"= 175,
    "55-64"= 128,
    "65+"= 94
)

# Perform the proportion test
result = prop.test(observed, n=total_sample,correct=FALSE)

# Print the test statistic and p-value
print(result$statistic)
print(result$p.value)
result
```

```
X-squared
  9.71744
[1] 0.2854206

        9-sample test for equality of proportions without continuity correction

data:  observed out of total_sample
X-squared = 9.7174, df = 8, p-value = 0.2854
alternative hypothesis: two.sided
sample estimates:
     prop 1     prop 2     prop 3     prop 4     prop 5     prop 6     prop 7
0.00000000 0.07317073 0.05357143 0.12376238 0.13220339 0.11904762 0.10285714
     prop 8     prop 9
0.07812500 0.07446809
```


C. Mode of Referral (Self-Referral, Active Case Finding)

```
# Create a table of observed frequencies and sample size for mode of referral
observed = c(acf=58,walk_in=66)
total_sample = c(acf=827,walk_in=514)
# Perform the proportion test
result = prop.test(observed, n=total_sample,correct=FALSE)

# Print the test statistic and p-value
print(result$statistic)
print(result$p.value)
result
```

```
X-squared
 12.82626
[1] 0.000341789

        2-sample test for equality of proportions without continuity correction

data:  observed out of total_sample
X-squared = 12.826, df = 1, p-value = 0.0003418
alternative hypothesis: two.sided
95 percent confidence interval:
 -0.09202596 -0.02451736
sample estimates:
    prop 1     prop 2
0.07013301 0.12840467
```

D. Geographical Region (Urban vs Rural)

```
observed = c(urban=27,rural=98)
total_sample = c(urban=303,943)
# Perform the proportion test
result = prop.test(observed, n=total_sample,correct=FALSE)

# Print the test statistic and p-value
print(result$statistic)
print(result$p.value)
result
```

```
X-squared
0.5576281
[1] 0.4552175

        2-sample test for equality of proportions without continuity correction

data:  observed out of total_sample
X-squared = 0.55763, df = 1, p-value = 0.4552
alternative hypothesis: two.sided
95 percent confidence interval:
 -0.05234358  0.02271411
sample estimates:
    prop 1     prop 2
0.08910891 0.10392365
```

E. Drug Resistant TB

```
result = prop.test(x, n,alternative = "greater",correct=FALSE)

# Print the test statistic and p-value
print(result$statistic)
print(result$p.value)
result
```

```
X-squared
 4.993431
[1] 0.01272185

        2-sample test for equality of proportions without continuity correction

data:  x out of n
X-squared = 4.9934, df = 1, p-value = 0.01272
alternative hypothesis: greater
95 percent confidence interval:
 -0.004491429  1.000000000
sample estimates:
    prop 1     prop 2
0.03225806 0.01045166
```

3.2. Pearson's Correlation Test

row	column	cor	p
<chr>	<chr>	<dbl>	<dbl>
Age..ys.	Sex..M.F.	0.197723531	2.152086e-02
Age..ys.	Subcounty.of.origin	0.250663780	3.364273e-03
Sex..M.F.	Subcounty.of.origin	0.025032106	7.732033e-01
Age..ys.	Known.extrapulmonary.involvement.of.TB	0.071535226	4.096599e-01
Sex..M.F.	Known.extrapulmonary.involvement.of.TB	0.131302393	1.290171e-01
Subcounty.of.origin	Known.extrapulmonary.involvement.of.TB	0.033370461	6.986672e-01
Age..ys.	Referred.by.CHV..village.chieves..traditional.healers	0.033623450	6.986482e-01
Sex..M.F.	Referred.by.CHV..village.chieves..traditional.healers	0.014860140	8.641741e-01
Subcounty.of.origin	Referred.by.CHV..village.chieves..traditional.healers	-0.053416141	5.353012e-01
Known.extrapulmonary.involvement.of.TB	Referred.by.CHV..village.chieves..traditional.healers	0.390976521	2.315329e-06
Age..ys.	Identified.by.active.case.finding..ACF.	0.008600856	9.211339e-01
Sex..M.F.	Identified.by.active.case.finding..ACF.	-0.037755339	6.637416e-01
Subcounty.of.origin	Identified.by.active.case.finding..ACF.	-0.063822720	4.587317e-01
Known.extrapulmonary.involvement.of.TB	Identified.by.active.case.finding..ACF.	0.376823230	5.661722e-06
Referred.by.CHV..village.chieves..traditional.healers	Identified.by.active.case.finding..ACF.	0.955301836	0.000000e+00
Age..ys.	Rifampicin.resistance.detected	0.116224139	1.794666e-01
Sex..M.F.	Rifampicin.resistance.detected	0.104972901	2.256334e-01
Subcounty.of.origin	Rifampicin.resistance.detected	0.122450009	1.540189e-01
Known.extrapulmonary.involvement.of.TB	Rifampicin.resistance.detected	0.602252257	7.105427e-15
Referred.by.CHV..village.chieves..traditional.healers	Rifampicin.resistance.detected	0.529128102	2.988809e-11
Identified.by.active.case.finding..ACF.	Rifampicin.resistance.detected	0.519045397	8.139578e-11

3.3. Regression Analysis

```
#Best fitted model
step(fullModel, direction="backward")
```

```
Start:  AIC=688.96
GeneXpert.result ~ Sex..M.F. + Subcounty.of.origin + age.bins +
    referral_mode

                    Df Deviance    AIC
- age.bins           8   674.01 682.01
- Subcounty.of.origin  1   664.98 686.98
<none>                 664.96 688.96
- Sex..M.F.          1   674.90 696.90
- referral_mode      1   688.82 710.82

Step:  AIC=682.01
GeneXpert.result ~ Sex..M.F. + Subcounty.of.origin + referral_mode

                    Df Deviance    AIC
- Subcounty.of.origin  1   674.01 680.01
<none>                 674.01 682.01
- Sex..M.F.          1   683.73 689.73
- referral_mode      1   697.31 703.31

Step:  AIC=680.01
GeneXpert.result ~ Sex..M.F. + referral_mode

                Df Deviance    AIC
<none>              674.01 680.01
- Sex..M.F.      1   683.73 687.73
- referral_mode  1   699.73 703.73

Call:  glm(formula = GeneXpert.result ~ Sex..M.F. + referral_mode, family = binomial(link = "logit"),
    data = paolo_final)

Coefficients:
        (Intercept)            Sex..M.F.M  referral_modewalk-in
            -3.1521                0.6476                1.0518

Degrees of Freedom: 1155 Total (i.e. Null);  1153 Residual
Null Deviance:      708.5
Residual Deviance: 674  AIC: 680
```

```
best_fit <- glm(formula = GeneXpert.result ~ `Sex..M.F.` + referral_mode, family = binomial(link = "logit"),
    data = paolo_final)
```

```
# Extract the coefficients from the model
coefs <- coef(best_fit)

# Calculate the odds ratios
odds_ratios <- exp(coefs)
```

```
# Loop over the odds ratios and print them using sprintf
for (i in 2:length(odds_ratios)) {
  name <- names(coefs)[i]
  odds_ratio <- odds_ratios[i]
  percentage_change <- (odds_ratio - 1) * 100
  message <- sprintf("The odds ratio for %s is %.3f which represents %.2f%%.", name, odds_ratio,percentage_change)
  print(message)
}
```

```
[1] "The odds ratio for Sex..M.F.M is 1.911 which represents 91.09%."
[1] "The odds ratio for referral_modewalk-in is 2.863 which represents 186.27%."
```

Implication

Sex and Referral mode are the only significant factors.
The odds of being positive is 65% higher if you are a male compared with a female.
The odds of being positive is 105 % higher if you are a walk-in client as compared to one recruited through Active Case Finding.

Annex 4: Outreaches

FIGURE 20: PEOPLE SENSITIZED BY EDUCATOR

	Rural		Urban		TOTAL
	F	M	F	M	
Jul-21	150	61	147	157	515
Sep-21	126		86	108	436
Oct-21	404	229	234	123	990
Nov-21	416	232	352	369	1,369
Dec-21	91	58	35	16	200
Jan-22	243	117	81	70	511
Feb-22	415	228	230	97	970
Mar-22	100	60	46	43	249
Apr-22	168	116	85	122	491
May-22	123	76	48	55	302
Jun-22	378	201			579
Nov-22	275	88	130	75	568
Dec-22	248	99	0	0	347
Jan-23					0
	4,517	2,476	1,664	1,341	9,998

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FIGURE 21: MOBILE CLINICS & MEDICAL CAMPS

	NO.OF FEMALE	NO.OF MALE	TOTAL
Jul, 2021	297	218	515
Aug, 2021	321	167	488
Sep, 2021	212	224	436
Oct, 2021	638	352	990
Nov, 2021	768	601	1,369
Dec, 2021	126	74	200
Jan, 2022	324	187	511
Feb, 2022	645	325	970
Mar, 2022	146	103	249
Apr, 2022	253	238	491
May, 2022	171	131	302
Jun, 2022	378	201	579
Jul, 2022	276	215	491
Aug, 2022	221	122	343
Sep, 2022	388	225	613
Oct, 2022	288	157	445
Nov, 2022	405	163	568
Dec, 2022	248	99	347
Jan, 2023			0
	6,105	3,802	9,907

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FIGURE 22: INDIVIDUALS SCREENED IN SCHOOLS & FARMS

	NO.OF FEMALE	NO.OF MALE	TOTAL
Jul, 2021	297	218	515
Aug, 2021	321	167	488
Sep, 2021	212	224	436
Oct, 2021	638	352	990
Nov, 2021	768	601	1,369
Dec, 2021	126	74	200
Jan, 2022	324	187	511
Feb, 2022	645	325	970
Mar, 2022	146	103	249
Apr, 2022	253	238	491
May, 2022	171	131	302
Jun, 2022	378	201	579
Jul, 2022	276	215	491
Aug, 2022	221	122	343
Sep, 2022	388	225	613
Oct, 2022	288	157	445
Nov, 2022	405	163	568
Dec, 2022	248	99	347
Jan, 2023			0
	6,105	3,802	9,907

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Add QR Code for link to data tools









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