Evaluation of Facility-based Intensified (Active) TB Case Finding (ICF) in Ghana – A Mixed Method Study

Mercy Adobea Baah

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Declaration

Evaluation Of Facility-Based Intensified (Active) Tb Case Finding (ICF) In Ghana- A Mixed Method

A thesis submitted in partial fulfilment of the requirement for the degree of Master of Science in Public Health

by

Mercy Adobea Baah

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LIST OF ABBREVIATIONS

ACF	Active Case Finding
AIDS	Acquired Immunodeficiency Syndrome
ANC	Antenatal Care
ART	Antiretroviral Therapy
CAD4TB	Computer-aided detection for Tuberculosis
CDR	Case Detection Rate
CNR	Case Notification Rate
CWC	Child Welfare Clinic
DHIMS	District Health Information Management System
DOT	Directly Observed Treatment Short course
DST	Drug Susceptibility Testing
DTBC	District TB Coordinator
GDP	Gross Domestic Product
GGE	Genera Government Expenditure
GHS	Ghana Health Service
HIO	Health Information Officer
HIV	Human Immunodeficiency Virus
ICF	Intensified TB Case Finding
IHD	Ischemic heart disease
ITBC	Institutional TB Coordinator
KIT	Koninklijk Instituut voor de Tropen
KII	Key Informant Interview
LMIC	Low-and Middle-Income Country
MDR-TB	Multi-drug Resistant Tuberculosis
MOH	Ministry of Health
NSP	National TB Strategic Plan
NTP	National TB Control Programme
NTLP	National TB and Leprosy Programme
OPD	Outpatient Department
PLHIV	People Living with HIV
RHDS	Regional Director of Health Services
REC	Research Ethics Committee
RTBC	Regional TB Coordinator
SDG	Sustainable Development Goal
SST	Sputum Sample Transport
TB	Tuberculosis
TPT	TB Preventive Therapy
TSO	Task Shifting Officer
WHA	World Health Assembly
WHO	World Health Organization

ABSTRACT

Background: Tuberculosis poses a major public health threat in Ghana. Of the total estimated incident cases (44,000) the country was able to notify only 29%. Ghana is implementing the Facility-based Intensified TB Case Finding (ICF) aimed at improving case detection. This study aims to determine the effectiveness of the ICF intervention in its performance on TB case detection in Ghana and proffer recommendations to improve the implementation of current and future interventions

Methodology: A retrospective longitudinal analysis of TB case notification rates, Ghana

Results: Results of the interrupted time series analysis of quarterly CNR for national showed a slight but significant decline in the trend of CNR overtime before the ICF intervention (Coefficient = -0.08, 95% CI -0.15 - -0.02) but did not show any significant change in level directly after and trend after the implementation of ICF over time. However, the Greater Accra and Western regions showed a significant increase in the trend of CNR after the implementation of ICF over time (Greater Accra: Coefficient = 0.13, 95% CI 0.01 - 0.26 and Western: Coefficient = 0.38, 95% CI 0.20 - 0.56)

Conclusion and Recommendation: Key challenges identified include lack of systematic screening, high attrition, poor documentation of screening activities, shortage of GeneXpert cartridge. The NTP, Ghana should adopt the quarterly implementation of ICF rather than an all-year-round implementation to make efficient use of the available resources in the phase of limited resources with close monitoring and supervision to prevent implementation fatigue as shown in the case of Tanzania.

Keywords: Tuberculosis, Case finding, Case detection, Screening, Case Notification Rate

Word Count: 12296

CHAPTER 1: BACKGROUND

Worldwide, Tuberculosis (TB) is an infectious disease that is a major source of illness and one of the leading causes of mortality(1). TB was the major cause of death from a single infectious agent until the coronavirus (COVID-19) pandemic, ranking ahead of HIV/AIDS. The bacillus Mycobacterium tuberculosis causes TB which usually affects the lungs (pulmonary tuberculosis) but can also affect other parts of the body (extra-pulmonary tuberculosis). The disease is spread through bacteria expelled into the air (e.g., by coughing) by people who are sick with TB. People who are more likely to become ill with TB are those with weakened immune systems, such as persons living with HIV, malnourished, diabetic, or tobacco users(1,2).

Of the ten million people who developed TB in 2020, only 5.8 million (58%) were diagnosed and notified, an 18% decline from 7.1 million diagnosed and notified in 2019. This implies over 4 million cases were missed while 1.5 million died (15%) in 2020 even though the disease is curable and preventable(1). The goal of the World Health Organization (WHO) to end the TB epidemic by 2035 will not be met unless these "missed persons are found (3). The "missed millions" of persons with active tuberculosis who are undetected or untreated can transmit the disease to others in their households and communities and are at risk of death and severe disease(4–7).

Global tuberculosis incidence has been slow to decline (2% annually) and 11% cumulative reduction between 2015 and 2020, more, than half of the 20% reduction milestone of the End TB Strategy (2015-2020), and at this rate, the WHO End TB Strategy targets of reducing TB incidence by 90% and deaths by 95% by 2035 are unlikely to be met. As a result, effective, evidence-based measures to improve tuberculosis diagnosis and treatment, as well as potentially minimize tuberculosis transmission, are needed urgently (2,4). To decrease the gap in case detection, the current WHO End TB strategy emphasizes the significance of early diagnosis, including universal drug susceptibility testing (DST) and screening systematically contacts and high-risk groups(8). A cure for infectious TB patients and a reduction in the risk of transmission result from early case diagnosis and high treatment success, thereby lowering the burden of TB(9)

Thus, a top priority for TB control worldwide is finding the missed TB cases and one of the key components identified for achieving this is Active Case Finding (ACF)(8,10). “Active case finding (ACF) is defined as the systematic identification and screening of people with presumptive TB symptoms, in a predetermined target group, using tests, examinations or other procedures that can be applied rapidly.” Active Case Finding (ACF) comprises provider-initiated screening both inside and outside the health facility even though the term is frequently used to refer to screening systematically and evaluating diagnosis of TB risk populations outside the health facility. High-risk groups who might not actively seek healthcare are the targets for ACF. While the population could gain from a decreased spread and burden of TB, which frequently affects the most economically productive members of the population, early diagnosis could help individuals by reducing morbidity, death, and economic costs(11).

With 226 cases per 100,000 people, the WHO African Region has the highest TB incidence rate(12). Ghana struggles with TB control activities like other countries in the African region with a significant burden of HIV/TB(13). In Ghana, 14,500 TB cases were reported annually on average in the years before and after the national prevalence survey conducted in 2013(13,14). As a result, to enhance case detection, several countries have adopted a range of strategies(15–17). A thorough evaluation of the Ghana National TB Program in 2013 brought to attention the need to increase access to TB prevention, treatment, care, and support services for key vulnerable populations, including PLHIV, children, diabetics, and miners or those exposed to silica is one of such(13,18). Facility-based active TB case finding (ICF) among OPD attendant as key populations for intervention was subsequently highlighted in the National TB Health Sector Strategic Plan for Ghana (NSP)(2015-2020)(13).

Ghana, with a population of over thirty-one million people of which the majority is urban (56.7%) is second to Nigeria as the most populous country in West Africa(19) (see Figure 1). The population age group comprises 37% (0-14), 60% (15-64) and 3% (above 65) of which 50% are males and 49.3% females. Ghana's HIV prevalence as of 2020 was 1.7 among the population age group of 15-49 which constitutes the working age group(20). Twenty-three percent (23%) of the population live below the poverty level with the poor mainly located in the Northern compared to the Southern Districts of Ghana(21,22). In Ghana, of children under-five years 20% are stunted whiles 10% are underweight increasing their risk to low immunity and infections(23). One of the key contributors to Ghana's economy is mining and it's a major economic activity in Ghana with most mining activities in the Southern part of Ghana(24). TB prevalence has been found to highest among miners (2.65%) compared to people involved in skilled labor (1.41%)(25).

Figure 10:Map of Ghana showing sixteen (16) administrative regions: Source Ghana Mission to the United States

The healthcare delivery system of Ghana is decentralized and organized at five levels namely: national, regional, district, and subdistrict and community, and five levels of healthcare system providers namely: health posts, health centers, and clinics, district, regional and tertiary hospitals. Throughout Ghana, healthcare varies with most hospitals, clinics, and pharmacies in the country located in urban areas which are well served while modern healthcare services are frequently absent from rural areas. To have healthcare, patients in these areas must either travel considerable distances or rely on traditional African medicine. At the respective clinics and hospitals, healthcare interventions packaged for each level are delivered. The Ministry of Health (MOH) and the Ghana Health Service (GHS) are primarily responsible for administering healthcare mostly provided by the government. The average amount spent by Ghana on its health infrastructure is six percent (6%) of its GDP(26).

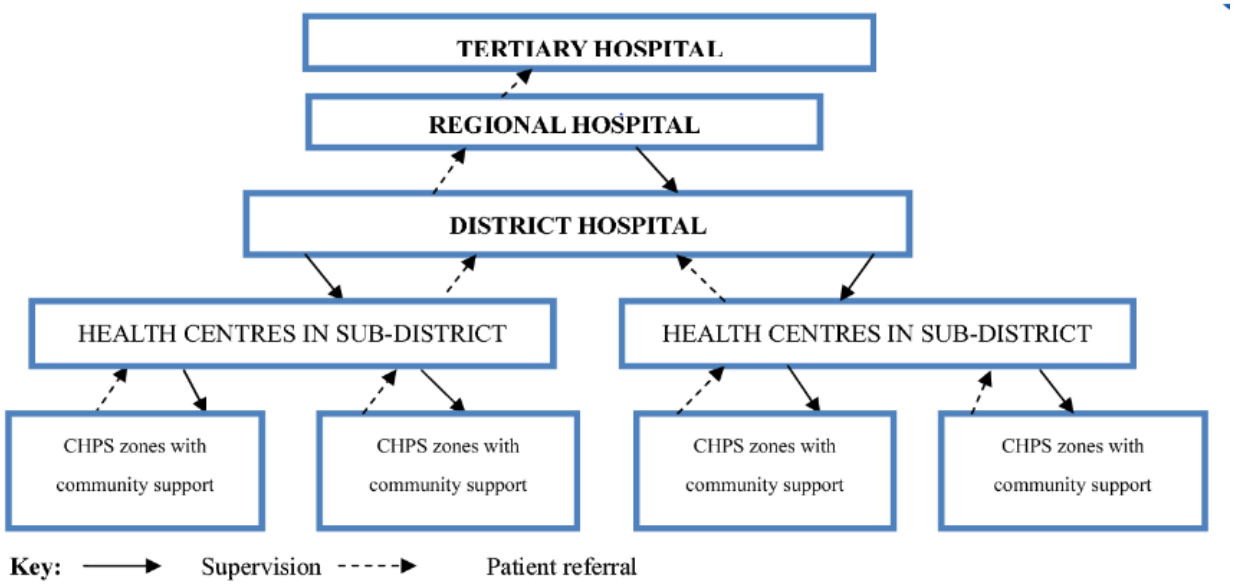

Figure 11:Healthcare delivery System of Ghana

Tuberculosis is among the top ten diseases that cause death in Ghana(27). Around 5% of all deaths in Ghana occur because of TB each year, and with an average 2.5% decrease in incidence, the disease's burden is slowly decreasing. The working-age population of Ghana is mainly affected by TB with a high incidence in the age group 15-44 (73%), and of those who have TB disease in a given year up to 70% don't receive TB treatment(28). The National TB Control Programme (NTP), Ghana is mandated by the GHS to provide leadership in response to the health sector's goal of achieving the End TB Strategy as part of efforts to reduce the TB burden (290/100,000) in Ghana through the implementation TB control activities at all levels of the healthcare delivery system including active TB case-finding interventions like ICF been implemented in all regions(13). To ensure a successful implementation of the intervention there is the need to evaluate and determine its effectiveness on the performance of TB case detection.

There are regional variations in TB Case notification rates (CNR). Variations in the existence of population at risk, transmission, and burden of disease could lead to regional variations in CNR(29–33). TB incidence is high in areas with high-risk populations such as people with HIV and among miners, migrants, males, elderly and malnourished termed as demographic and socioeconomic key populations(34–40). TB is regarded as a disease of poverty associated with the poor due to their socioeconomic status which makes them socially and economically disadvantaged(41–45). Other factors that influence subnational variations include the knowledge and awareness of TB by the population which influences their health-seeking behavior(46–51). Availability, and access to healthcare facilities where areas with better access to healthcare tend to have high TB notification rate and treatment quality and diagnostic services are associated with various performance indicators including CNR and the healthcare system's ability to detect and treat TB patients(52–56).

CHAPTER 2: PROBLEM STATEMENT, JUSTIFICATION AND OBJECTIVES

2.1 Problem Statement

Tuberculosis poses a major public health threat in Ghana and the prevalence is estimated at 290 per 100,000 population by the 2013 Nationwide TB Prevalence Survey indicating the national burden is four times higher than estimated by WHO (71 per 100, 000 population) with a case detection rate (CDR) of 20.7% and case notification rate (CNR) of 62.2 per 100,000 in 2013(13,57). According to the WHO 2021 Global TB report, TB incidence and mortality rates in Ghana in 2020 were 143 and 32 per 100,000 population respectively. Of the total estimated incident cases (44,000) the country was able to notify only 29%. This implies that 71% of cases remain unnotified and might be missed and thus may not be receiving proper treatment with an increased risk of severe illness and even mortality(12).

Findings of the nationwide cross-sectional population-based survey conducted by the NTP Ghana, in 2013 indicated that 21% of the 202 TB cases detected by the survey had sought care at public or private facilities but were undiagnosed as TB (57). At the health facility, TB cases are missed as a result of health care providers' low index of suspicion, failure to complete the TB diagnostic cascade, the use of less sensitive diagnostic tools such as smear microscopy, patient out-of-pocket expenses for TB diagnostics, diagnostics availability in facilities where care is sought by patients, and weak public-private collaboration(57–61). The survey also revealed that of the TB cases detected, about 60% would have been missed if only symptom screening had been used since only 40.6% had a chronic cough, and therefore to improve TB case detection, there is the need to revise existing screening criteria(57).

In 2015, based on the findings and recommendations of the 2013 prevalence survey, intensified TB case finding (ICF) was introduced by the NTP, Ghana which involves screening of all facility attendants for TB in 113 high incidence reporting district hospitals. Implementation of ICF in Ghana commenced with the development of the National TB Strategic Plan (2015-2020) with the identification of missed cases as its special focus which also led to a change in criteria for identifying presumed cases from cough of two weeks to any duration together with any other symptom of TB such as chest pain, fever, night sweat, or weight loss or irrespective of the existence of a TB symptom, an abnormal chest X-ray. In 48 selected hospitals, the TB program installed 48 digital X-ray machines with an automated computer-aided detection for tuberculosis (CAD4TB) system whiles 126 microscopy sites were upgraded as GeneXpert sites by installing 126 GeneXpert machines which have been used as the first-line TB test for all presumed TB cases since mid-2017(57).

The NTP, Ghana, before the implementation of the National Strategic Plan (NSP), (2015-2020), had successfully implemented three strategic plans to reduce the TB disease burden. Systems and infrastructure were put in place to improve quality access to more than 70% of the population and ensure TB control services are sustainable through the implementation of these strategic plans which addressed issues of quality of TB diagnosis and treatment in selected big cities, high- and low-incident geographic regions, key affected prisons populations, the problem of TB/HIV coinfection and multi-drug resistant TB (MDR-TB). This resulted in an increase in CNRs from 2007 (56.9 per 100,000 population) under Round 5 of the Global Fund grant when complete capacity was established to incorporate TB care and prevention into general health services but stagnated at an average CNR of 62.1 per 100,000 in 2013(13).

The NSP (2015-2020), sought to reduce the TB prevalence baseline of 290 per 100,000 population in 2013 by 20% in 2020, reduce the TB mortality baseline of 4 deaths per 100,000 population in 2012 by 35% in 2020, and without catastrophic cost due to TB- affected families, end the TB epidemic in Ghana by 2035 consistent with the Global TB Strategy in the post-2015 sustainable development goals (SDGs) endorsed by the WHA (World Health Assembly) 67 resolution on health. One of the main strategic interventions

identified under this plan is to improve health facility-based TB case finding for early detection and diagnosis(13). However, the TB case detection rate decreased steeply from 34% in 2019 to 29% in 2020 due to disruptions caused by the COVID-19 pandemic on TB diagnosis and treatment(1,12).

Currently, Ghana is implementing the Facility-based Intensified TB Case Finding (ICF) a shift from passive to active case finding (ACF) using superior screening algorithms and diagnostic tools aimed at improving case detection with an evidence-based WHO set of guidelines and recommendations on systematic screening for active TB which was piloted in Ghana in 2015 with gradual scale-up in all regions in 2016(11,13). It is widely acknowledged that relying solely on passive case findings, a system in which people with TB symptoms voluntarily present at health care facilities misses opportunities to diagnose TB and initiate treatment and in addition contributes to increased disease severity and mortality(15). A significant number of additional cases that would otherwise go undetected are detected through ACF in Ghana and other countries(9). Provider-initiated systematic screening for active TB and other facility-based interventions that combine features of improved and active case finding (ACF) approaches, on the other hand, are cost-effective and should be scaled up to meet global TB preventive and control targets(62).

Similarly, in ten facilities in Accra, Ghana, implementation of an enhanced provider-initiated TB screening strategy in one year resulted in an extra 1,300 TB cases. Therefore, systematic coverage at 100 facilities is estimated to result in nearly 13,000 additional TB cases assuming a similar case detection rate(13). However, results of a study on the yield of screening strategy among target groups using provider-initiated TB case finding in the outpatient department (OPD) of healthcare facilities in Ghana indicated a similar trend in case notification in the region of intervention and control(63). While there is much evidence of the effectiveness of ACF in the community(62,64–68), there is little evidence of its effectiveness at the health facility in other low- middle-income countries (LMICs) like Ghana(61,69,70).

2.2 Justification

As a key component of its post-2015 End TB strategy, the WHO has emphasized: "patient-centered care for all persons with TB"(71). A relevant model for evaluating patient retention over successive stages of care needed to reach a satisfactory outcome is the TB care cascade (also known as the care continuum). The cascade aids in quantifying gaps in the delivery of care and identifying areas where the quality of care could be enhanced. The TB care cascade model describes the stages with steps and gaps for people with active TB in which a step refers to the number of people who get to the point of care while the gap is the number of people with poor outcomes measured as the differences between steps (Fig. 1)(72). The main gaps identified are people with active TB in the population who are unable to access health facilities and a TB diagnostic test (Gap 1), those who are not successfully diagnosed but access locations where diagnostic tests are available (Gap 2), and those who are successfully diagnosed but do not get registered in treatment (Gap 3), those who do not achieve treatment success but start therapy (Gap 4), and those who die or have a TB recurrence within a year but finish therapy (Gap 5)(73).

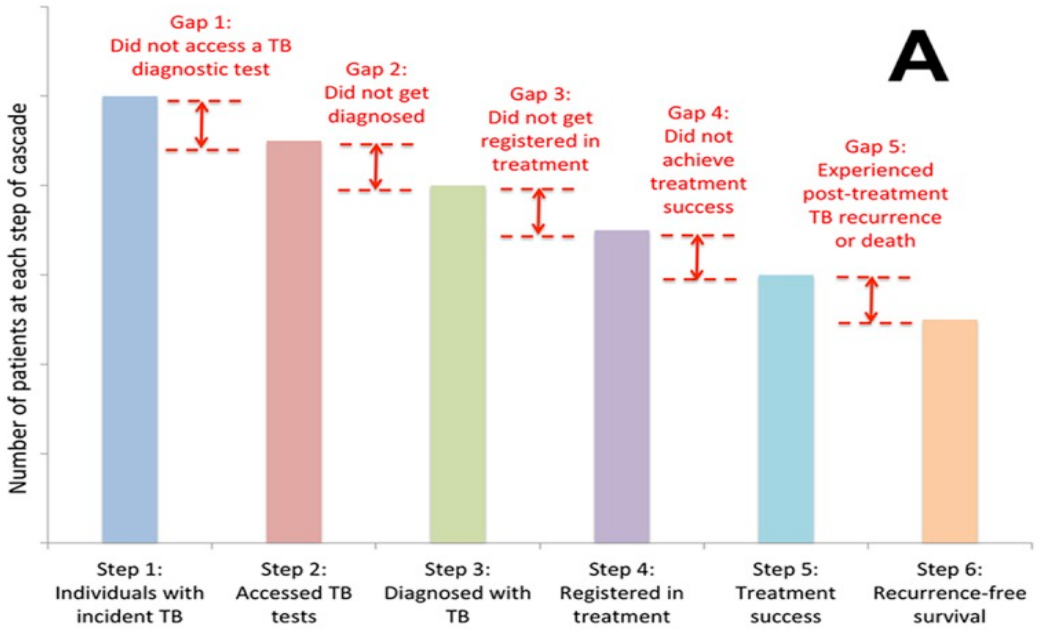

Figure 12: Generic Model of a TB Care Cascade showing steps and gaps(72)

Understanding who is missed by existing case-finding efforts and how to reduce the time it takes for those who are eventually detected is necessary for addressing the case-finding gap. People with TB in the community may not be assessed or have to access a TB test because for several reasons such as due to distance or other limitations, they may not have access to TB services, and even if resources are available, they may not seek treatment for their symptoms and lastly, health care providers (HCP) may fail to recognize their symptoms as TB-related and commence proper examination even if they seek treatment(73). The ICF intervention seeks to address the case finding gap (Gap 1) identified in the care cascade through health facility active case finding which also targets high-risk groups such as household contacts and people living with HIV (PLHIV) highlighted as one of the possible interventions for addressing gaps with loss of patients in the care cascade (72). The scope of this study focuses on Gap1; however, we assume that if this gap is addressed more people are likely be to be identified which can improve the other gaps in the care cascade as well (Gaps 2-5).

So far, the intervention has not been evaluated to determine its effectiveness in its performance in improving TB case detection in Ghana. Therefore, this study was done to determine if the intervention is achieving its objective of increasing TB case detection by identifying the missed cases and making recommendations where necessary for decision-making to address the challenges identified to improve the implementation of the ICF intervention using the evidence generated. This will also contribute to improving case detection and reducing the TB disease burden in Ghana by 2035 in line with the End TB Strategy.

2.3 Objectives

2.3.2 General Objective

- To determine the effectiveness of the ICF intervention in its performance on TB case detection in Ghana by comparing trends of TB case notifications before and after the implementation of ICF, to identify challenges with the implementation of ICF, and proffer recommendations to improve the implementation of current and future interventions

2.3.2 Specific Objectives

- To compare trends of TB case notifications at the national and regional levels before and after the implementation of the ICF intervention
- To identify challenges with the implementation of the ICF intervention in Ghana
- To proffer recommendations to improve current implementation and future interventions

CHAPTER 3: METHODOLOGY

3.1 Study Area and Design

Ghana is the study area with focus on the initial ten old administrative regions namely: Ashanti, Brong-Ahafo, Central, Eastern, Greater Accra, Northern, Upper East, Upper West, Volta and Western for this study. This is because the implementation of ICF began with the initial ten (10) administrative regions before the addition of the six (6) new administrative regions in 2020. However, the Brong-Ahafo region in the old ten administrative regions is represented by the Bono region in the new sixteen (16) administrative regions from 2020 to 2021. Whiles, there is much data on TB case notifications before and after the implementation of ICF in the ten administrative regions, there is little data on TB case notifications for the newly created six (6) administrative regions before and after the implementation of ICF.

This study is a retrospective longitudinal analysis of TB case notification rates at national and regional levels. A mixed method study using secondary data analysis of aggregated national and disaggregated regional level data on TB case notifications (all forms) and key informant interviews (KIIs) of national and regional level managers were employed to conduct the study. To assess the performance of the ICF intervention, an eleven-year trend analysis of TB cases notified between 2010 and 2021 was conducted to determine a change in cases detected with a focus on periods before and after implementation of the intervention. Whiles a review of TB screening data was conducted within the same period to determine the yield (diagnosed TB) by region using data generated at the facility level. In addition, key informant interviews of national and regional managers in their professional capacity on the implementation of ICF were conducted to identify challenges with the implementation of the intervention and make recommendations based on the findings to improve the implementation of ICF in Ghana.

3.2 Data Collection

Data for the analysis composed of TB cases notified quarterly and regionally from 2010 to 2021 as well as screening conducted during the period of implementation of the intervention. TB cases notified comprise all forms of TB reported within the period which includes both bacteriologically confirmed and clinically diagnosed (new and relapse, previously treated and previous treatment history unknown). Screening data comprises the total number of attendants screened, presumed to be TB, tested, diagnosed, and initiated treatment at the various units of the health facility such as General OPD, ART clinic, Antenatal care (ANC) clinic, Contacts of TB cases, Wards and other units specified by the health facility. Both data on TB cases notified and screening conducted were extracted from the District Health Information Management System II (DHIMS2) of the GHS for reporting all service data for government and private health facilities. However, programmatic data on TB cases notified between the period 2010 to 2013 from the NTP database was obtained since these periods are not completed in the DHIMS2. Data on TB cases notified, and screening reported in the DHIMS2 is generated through routine surveillance of case-finding activities recorded in various surveillance tools provided by NTP at the health facility and captured in the DHIMS2 either by a Health Information Officer (HIO), Institutional TB Coordinator (ITBC) or District TB Coordinator (DTBC) who have been trained by the GHS.

Table 1: List of Variables

No.	Variable	Name	Description
1.	Outcome variable	TB Case Notification rate (CNR)	All forms of TB cases diagnosed and reported per 100,000 population
2.	Continuous variable	Time	Quarterly and yearly
3.	Binary variable	Pre-intervention	Before the implementation of the ICF intervention (2010-2014) (pre=0)

		Post-intervention	After the implementation of the ICF intervention (2015-2021) (post=1)
4.	Output variables	Number screened	Total number of attendants screened at the OPD of the various units using the symptom-based screening tool
		Number presumed	Total number of attendants presenting with symptoms and eligible for laboratory examination
		Number tested	Total number presumed or eligible for which laboratory examination was conducted
		Number diagnosed	Total number of bacteriologically confirmed and clinically diagnosed cases
		Number on treatment	Total number diagnosed initiated treatment

3.2 Key Informant Interview (KIIs)

A semi-structured interview using a structured questionnaire (see Annex 1) was conducted with national and regional level managers as key informants (KIs) in their professional capacity to obtain their views on the implementation of ICF and identify challenges with the implementation based on the results of the secondary data analysis. Participants for key informant interviews were selected based on the results of the secondary data analysis to include the best and low performing regions. Five (5) KIIs were conducted, and participants were purposefully selected from the Brong-Ahafo, Greater Accra, Northern, Volta and Western regions due to good knowledge of them in their professional capacity. Information obtained from interviews with KIs was used to triangulate the findings of the study using the results of the regression analysis of national and regional level data and TB screening data. Information from KIIs was analyzed using a deductive approach through thematic analysis with the interview guide to arrange the transcripts to obtain a summary of the analysis.

3.4 Data Analysis

An interrupted time series analysis was conducted using a linear regression model by inputting data of yearly and quarterly national and regional CNR generated from the NTP and the DHIMS2 database into Stata software to quantify the change in the trend over time after the implementation of the intervention to check whether it was statistically significant. The analysis was done both at the national and regional levels. Data for the new sixteen (16) regions was aggregated to ten (10) regions to obtain the same population before and after the implementation of ICF. TB case notification rate (all forms) which was the outcome variable of interest was calculated as the total number of all forms of TB notified for the period divided by the population for the given period per 100,000 population. Covariates included time in terms of quarterly and yearly as continuous variables whiles binary variables were the pre-intervention period (quarters before the implementation of the ICF intervention coded as zero), and post-intervention (quarters after the implementation of the ICF intervention coded as 1). Descriptive analysis of trends of TB screening data comprising screened, tested, and bacteriologically confirmed (yield) and initiated on treatment which indicates the TB care cascade was used to inform trends of regional TB case notification rates. This was to determine if the results of the regression analysis could be triangulated to assess the effectiveness of the implementation of the intervention at the regional level based on the performance of the screening strategy which can in turn influence the trend over time. Subnational trends over time with program data on screened, tested, and bacteriologically confirmed was triangulated to contextualize the study findings in addition to information from KIIs.

3.5 Ethical considerations

A waiver was requested from the KIT Research Ethics Committee (REC) to conduct the study. The study does not involve individual patient's data and any harmful procedure for which informed consent was required. Data used for the study was also obtained with permission from the NTP. The data for the analysis was aggregated and fully anonymized without the use of personal identifiers to be traced back to individuals to maintain confidentiality. Participants for key informant interviews were interviewed in their professional capacity only without the use of personal identifiers to be traced back to individual participants and interviews was conducted with confidentiality and stored safely in a computer accessible to only the principal investigator.

CHAPTER 4: RESULTS

4.1 Descriptive Analysis

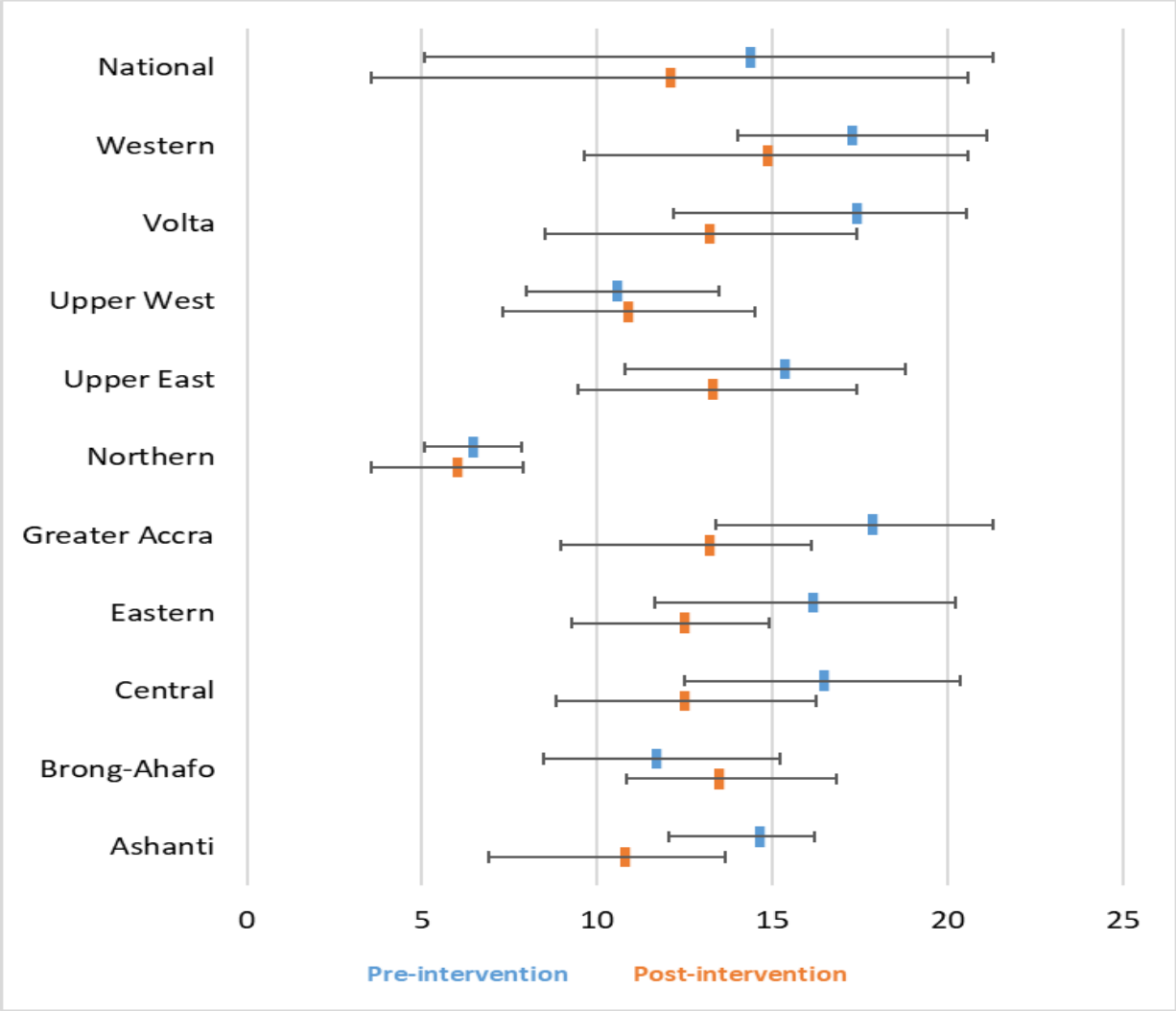

Figure 13:National and Regional quarterly CNR before (2010-2015) and after (2016-2021) ICF implementation

The national quarterly CNR before the implementation of ICF shows an average of 14 per 100,000 population and a lowest and highest CNR (5 and 21 per 100,000 population respectively) compared to an average CNR of 12 per 100,000 population with a lowest and highest CNR (4 and 17 per 100,000 population respectively) after the implementation of ICF (2016-2021). The Greater Accra region reported the highest average CNR than national (18 per 100, 000 population) and a highest CNR same as national (21 per 100,000 population) before the implementation of ICF compared to an average CNR also higher than national (13 per 100,000 population) and a highest CNR (16 per 100,000 population) below that of national after the implementation of ICF. This was followed by the Western region with an average CNR higher than national (17 per 100,000 population) and a highest CNR same as national (21 per 100,000 population) before the implementation of ICF compared to an average CNR more than national (15 per 100,000 population) and a highest CNR same as national (21 per 100,000 population). The Volta region was next with an average CNR higher than national (17 per 100,000 population) and a highest CNR same as national

(21 per 100,000 population) before the implementation of ICF compared to an average CNR also higher than national (13 per 100,000 population) and highest CNR lower than national (17 per 100,000 population) after the implementation of ICF (see Figure 13)

The Northern region on the other hand reported the lowest average CNR (6 per 100,000 population) and a highest CNR (8 per 100,000 population) below national but same as before and after the implementation of ICF. Next was the Upper West region with an average and highest CNR (10 and 13 per 100,000 population respectively) below national before the implementation of ICF compared to an average and highest CNR (11 and 15 per 100,000 population respectively) also below national after the implementation of ICF. Similarly, the Brong-Ahafo region was next with an average and a highest CNR (12 and 15 per 100,000 population respectively) below national before the implementation of ICF compared to an average CNR (13 per 100,000 population) higher than national and highest CNR (17 per 100,000 population) below national. However, the Ashanti region was one of the regions with the lowest average and a highest CNR (11 and 14 per 100,000 population respectively) below national after the implementation compared to an average CNR (14 per 100,000 population) same as national and a highest CNR (16 per 100,000 population) below national prior to the implementation of ICF (see Figure 13).

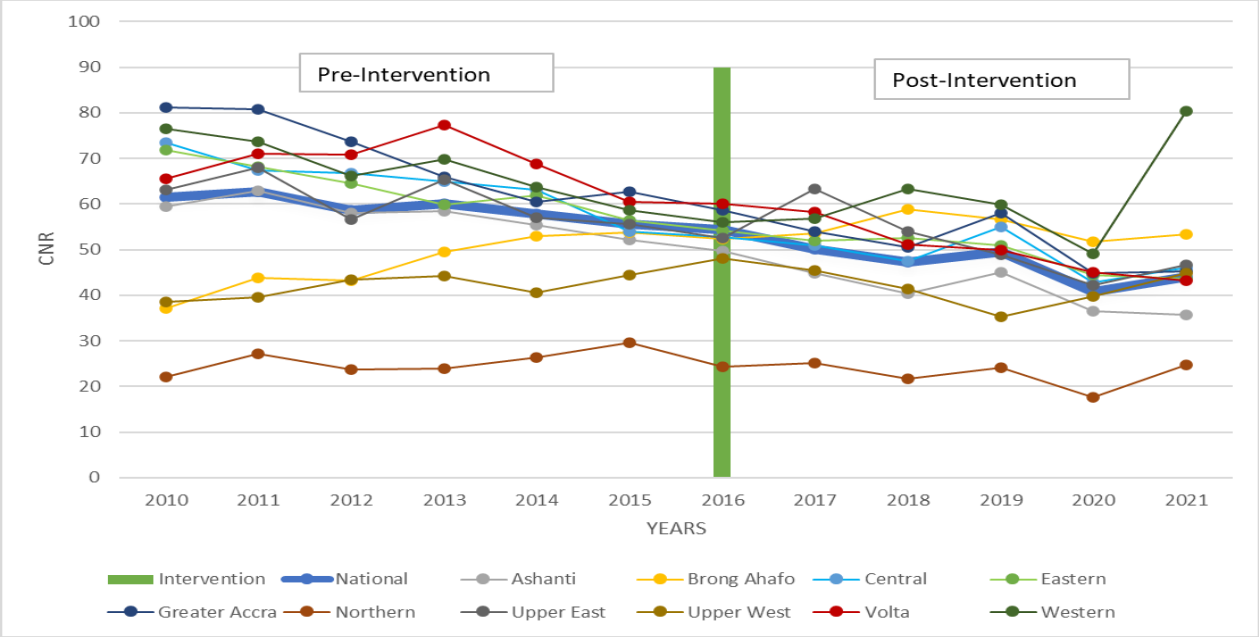

Figure 14: National and Regional Yearly CNR (2010-2021)

The national trend of yearly CNR shows a downward trend before and after the implementation of ICF with the highest CNR (63 per 100,000 population) recorded in 2011 before the implementation of ICF whiles the lowest (41 per 100,000 population) was after the implementation of ICF in 2020. However, there was a slight increase in 2019 but declined steeply again in 2020 and slightly increased again in 2021. Likewise, regional trend of CNR shows a similar trend as national with some regional variations in CNR before and after the implementation of ICF. There was a decreasing trend in CNR for all regions before and after the implementation of ICF except for the Brong-Ahafo and Upper West regions which showed an increasing trend before and after the implementation of ICF. However, CNR for these two regions showed a declining trend after the implementation of ICF over time with the highest increase in CNR for the Brong-Ahafo region seen in 2018 (59 per 100,000 population) whiles the Upper West region recorded the highest increase in 2016 (48 per 100,000 population) after the implementation of ICF.

The Western region on the other hand showed an increase in the trend of CNR over time after the implementation of ICF with the highest increase seen in 2021 (80 per 100,000 population) compared to a highest CNR (76 per 100,000 population) in 2010 before the implementation of ICF. However, the Greater Accra region recorded the highest CNR (81 per 100,000 population) in 2010 before the implementation of ICF compared to a highest CNR (59 per 100,000 population) in 2016 after the implementation of ICF. Similarly, the Volta region recorded the highest CNR (77 per 100,000 population) in 2013 before the implementation of ICF compared to after the implementation of ICF (60 per 100,000 population) in 2016. There was however an increase in CNR for the Ashanti, Central, Greater Accra and Northern regions in 2019 like national and a decline in CNR for all regions in 2020 like national except for the Upper West region which an increase in CNR after the implementation of ICF. The Northern region recorded the lowest CNR before and after the implementation of ICF (22 and 18 per 100,000 population respectively) in 2010 and 2020 respectively followed by the Upper West region (38 and 35 per 100,000 population respectively) in 2010 and 2019 respectively.

4.2 Statistical Analysis

Table 2: Results of Interrupted Time series analysis

Multivariate analysis using a linear regression model		
	B	**95% Confidence Interval**
National		
Intercept	15.29***	14.4 - 16.17
Time (quarters)	-0.08**	-0.15 - -0.02
Intervention	0.28	-2.24 – 2.81
Time * Intervention	-0.02	-0.10 - 0.07
Ashanti		
Intercept	15.76***	14.77 - 16.76
Time (quarters)	-0.11**	-0.18 - -0.04
Intervention	1.34	-1.43 - 4.12
Time * Intervention	-0.07	-0.17 - 0.03
Brong-Ahafo		
Intercept	9.11***	7.86 - 10.36
Time (quarters)	0.21	0.11 - 0.29
Intervention	4.12*	0.62 - 7.61
Time * Intervention	-0.20**	-0.33 - -0.08
Central		
Intercept	18.82***	17.37 - 20.27
Time (quarters)	-0.21***	-0.31 - -0.11
Intervention	-2.05	-6.08 - 1.98
Time * Intervention	0.09	-0.06 - 0.23
Eastern		
Intercept	18.31***	17.19 - 19.44
Time (quarters)	-0.19***	-0.27 - -0.11
Intervention	-0.78	-3.91 - 2.34
Time * Intervention	0.05	-0.06 - 0.16
Greater Accra		
Intercept	21.40***	20.17 - 22.63

Time (quarters)	-0.30***	-0.38 - -0.21
Intervention	-2.42	-5.85 - 1.01
Time * Intervention	0.13*	0.01 - 0.26
Northern		
Intercept	5.65***	4.96 - 6.34
Time (quarters)	0.06*	0.01 - 0.11
Intervention	1.46	-0.45 - 3.38
Time * Intervention	-0.09*	-0.16 - -0.02
Upper East		
Intercept	16.60***	14.91 - 18.29
Time (quarters)	-0.11	-0.23 - 0.01
Intervention	4.04	-0.67 - 8.74
Time * Intervention	-0.09	-0.26 - 0.07
Upper West		
Intercept	9.73***	8.23 - 11.23
Time (quarters)	0.06	-0.05 - 0.16
Intervention	4.28*	0.11 - 8.46
Time * Intervention	-0.15	-0.29 – 0.00
Volta		
Intercept	17.91***	16.35 - 19.46
Time (quarters)	-0.05	-0.16 - 0.06
Intervention	4.14	-0.20 - 8.47
Time * Intervention	-0.19*	-0.35 - -0.04
Western		
Intercept	19.59***	17.77 - 21.41
Time (quarters)	-0.21**	-0.33 - -0.08
Intervention	-11.29***	-16.36 - -6.21
Time * Intervention	0.38**	0.20 - 0.56

Legend
* = p<0.05
** = p<0.01
*** = p<0.001

Results of the interrupted time series analysis of quarterly CNR for national showed a slight but significant decline in the trend of CNR over time before the ICF intervention (Coefficient = -0.08, 95% CI -0.15 - -0.02) but did not show any significant change in level directly after the implementation of ICF and trend after the implementation of ICF over time. Similarly, the Ashanti, Central, Eastern, Greater Accra and Western regions like national showed some slight decline in CNR over time before the implementation of ICF which was statistically significant (Ashanti: Coefficient = -0.11; Central: 95% CI -0.18 - -0.04, Eastern: Coefficient = -0.21, 95% CI -0.31 - -0.11, Greater Accra Coefficient = -0.19, 95% CI -0.27 - -0.11 Coefficient = -0.30, 95% CI -0.38--0.21 and Coefficient = -0.21, 95% CI -0.30 - -0.11 respectively) except for the Northern region that showed a slight but significant increase in CNR over time (Coefficient = 0.06, 95% CI 0.00 - 0.11) prior to the ICF implementation. However, these regions did not also show any significant change after the implementation of ICF except for the Greater Accra and Western regions which showed a significant increase in the trend of CNR after the implementation of ICF over time (Greater Accra:

Coefficient = 0.13, 95% CI 0.01 - 0.26 and Western: Coefficient = 0.38, 95% CI 0.20 - 0.56) compared to before the implementation of ICF (see Table 2)

The Volta region on the other hand showed a significant decline in the trend of CNR after the implementation of ICF over time (Coefficient = -0.19, 95% CI -0.35 - -0.04) whiles the Western region showed a significant decline in CNR directly at the level after the implementation of ICF (Coefficient = -11.29, 95% CI -16.36 - -6.21). The Upper East region is the only region that did not show any significant change in the trend of CNR before and after implementation of ICF. In addition, the Brong-Ahafo and Upper West regions are the only regions that showed a significant increase in CNR directly at the level after the implementation of ICF (Brong-Ahafo: Coefficient = 4.12, 95% CI 0.62 - 7.61 and Upper West: Coefficient = 4.28, 95% CI 0.11 - 8.46) (see Table 2).

4.3 Results of TB Screening (Care Cascade) (2017-2021)

Table 3: Summary of National and Regional Annual average percentage of TB care cascade report showing percentage screened, presumed, and tested (2017-2021)

	Percentage Screened out of Total OPD attendants			Percentage Presumed out of Total screened for TB			Percentage of Tested out of Total Presumed TB		
Region	Mean	Minimum	Maximum	Mean	Minimum	Maximum	Mean	Minimum	Maximum
Ashanti	1%	1%	2%	15%	13%	18%	80%	75%	88%
Bono	5%	1%	11%	12%	2%	26%	61%	9%	99%
Central	13%	0%	20%	12%	7%	28%	52%	34%	83%
Eastern	8%	0%	11%	20%	10%	52%	69%	52%	99%
Greater Accra	5%	1%	7%	11%	8%	17%	60%	3%	87%
Northern	5%	4%	6%	12%	7%	16%	55%	53%	61%
Upper East	3%	2%	4%	14%	9%	22%	63%	31%	79%
Upper West	5%	1%	8%	9%	4%	13%	45%	36%	60%
Volta	10%	9%	11%	9%	6%	19%	82%	67%	100%
Western	4%	0%	5%	14%	8%	19%	69%	44%	96%
National	5%	0%	7%	11%	8%	14%	59%	25%	82%

Table 4: Summary of National and Regional Annual average percentage of TB care cascade report showing percentage diagnosed and initiated on treatment (2017-2021)

	Percentage Diagnosed out of Total tested for TB			Percentage Initiated on Treatment out of Total Diagnosed		
Region	Mean	Minimum	Maximum	Mean	Minimum	Maximum
Ashanti	80%	12%	15%	81%	74%	86%
Bono	61%	6%	12%	76%	59%	98%
Central	52%	5%	18%	84%	62%	100%
Eastern	69%	7%	9%	75%	40%	91%
Greater Accra	60%	7%	60%	80%	18%	98%
Northern	55%	7%	10%	99%	92%	108%

Upper East	63%	5%	13%	93%	80%	98%
Upper West	45%	9%	31%	92%	87%	97%
Volta	82%	5%	10%	98%	94%	100%
Western	69%	7%	22%	98%	94%	106%
National	10%	8%	16%	88%	53%	97%

A summary of TB screening conducted for the period of implementation of ICF (2016-2021) showed that on average 5% of OPD attendants were screened for TB symptoms nationally with highest ODP attendants screened (7%) and lowest OPD attendants screened (0%). Regional level TB screening showed the Central region recorded the highest average number of OPD attendants screened (13%) compared to national followed by the Volta region (10%) and Eastern (8%) regions. The Ashanti region recorded the least average number of OPD attendants screened (1%) followed by the Upper East (3%) and the Bono, Greater Accra, Northern and Upper West regions like national (5%). Again, the Central region recorded the highest number of OPD attendants screened (20%) for the period followed by the Bono, Eastern, Volta and Western regions (11%) and the Upper West region (8%) whiles the Central, Eastern and Western regions also recorded the lowest number screened like national (0%) followed by Ashanti, Bono and Greater Accra (1%) and Upper East region (2%) (see Table 3).

Of the total screened for TB nationally, 11% were presumed TB averagely per year with the highest percentage presumed (14%) and lowest percentage presumed (8%). At the regional level, the Eastern region recorded the highest average percentage presumed TB (20%) with a highest percentage presumed (52%) and lowest percentage presumed (10%) followed by the Ashanti region with average percentage presumed TB (15%), highest percentage presumed (18%) and lowest percentage presumed (13%), the Upper East region with average presumed TB (14%), highest presumed (22%) and lowest presumed (9%) and the Western region with average percentage presumed (14%), highest percentage presumed (19%) and lowest percentage presumed (8%). Nationally on average annually 59% of presumed cases were tested for TB with highest percentage tested (82%) and lowest percentage tested (25%) whiles regionally the Volta region had the highest average percentage tested (82%) out of the total presumed, with highest percentage tested (100%) and lowest percentage tested (67%) followed by the Ashanti region with an average percentage tested (80%), highest percentage tested (88%) and lowest percentage tested (75%) and the Western region with average percentage tested (69%), highest percentage tested (96%) and lowest percentage tested (44%)(see Table 3).

At national, an average of 10% was diagnosed TB out of the total tested with the highest percentage diagnosed (16%) and lowest percentage diagnosed (8%) and the Volta region recorded the highest regional average percentage diagnosed (82%), with highest percentage diagnosed (15%) and lowest percentage diagnosed (12%) followed by the Ashanti region with average percentage diagnosed (80%), highest percentage diagnosed (15%) and lowest percentage diagnosed (12%) followed by the Eastern and Western regions with average percentage diagnosed (69%) and highest percentage diagnosed (9% and 22% respectively) and lowest percentage diagnosed (7%). Nationally on average annually, of the total diagnosed TB, 88% were initiated on TB treatment with highest percentage initiated on treatment (97%) and lowest percentage initiated on treatment (53%) whiles the Northern region showed the highest regional percentage average initiated on treatment (99%), highest percentage diagnosed initiated on treatment (108%) which shows an overreporting and lowest percentage initiated on treatment (92%). This was followed by the Western and Volta regions with an average percentage initiated on treatment (98%) and highest percentage initiated on treatment (106% and 100% respectively) with an overreporting by the Western region and then the Upper West region with average percentage initiated on treatment (93%), highest percentage initiated on treatment (97%) and lowest percentage initiated on treatment (87%) (see Table 4).

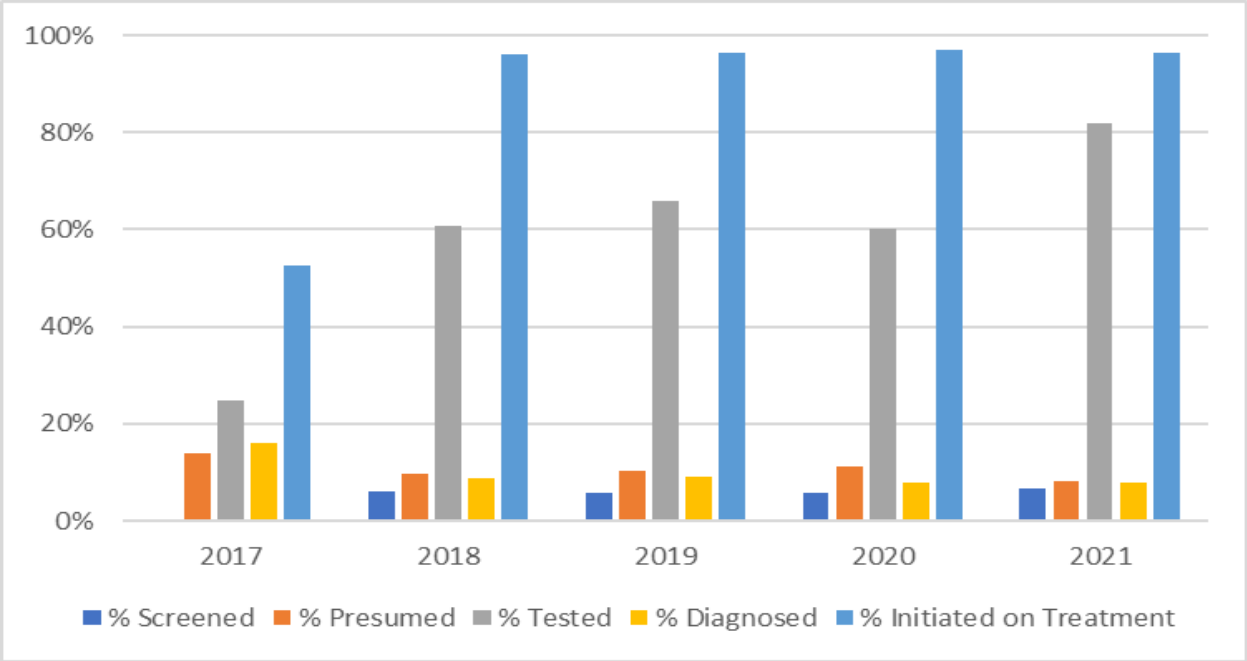

Figure 15: National Trend of TB Screening report (2017-2021)

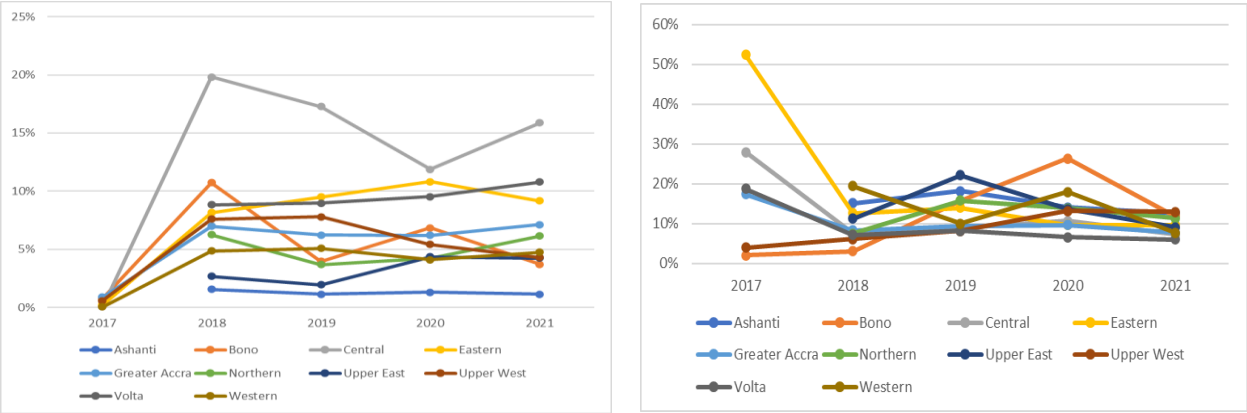

Figure 16:Percentage screened (left) and presumed (right) for TB per Region (2010-2021)

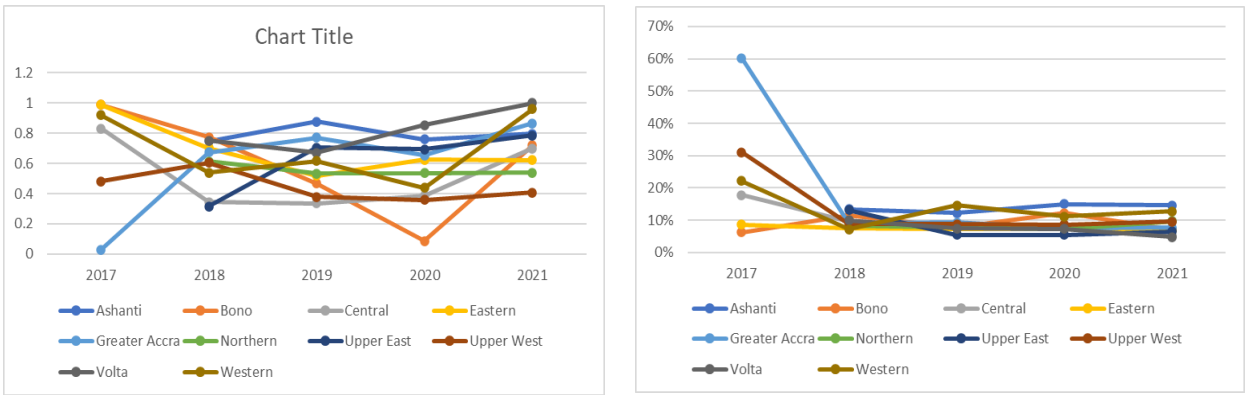

Figure 17: Percentage tested (left) and diagnosed (right) for TB per Region (2010-2021)

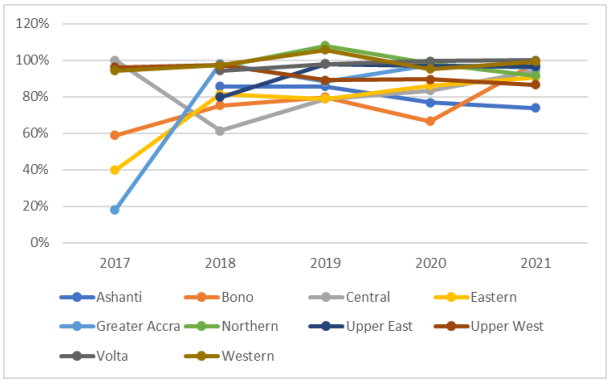

Figure 18: Percentage initiated on TB treatment per region (2010-2021)

The trend of national TB care cascade for the period of the implementation of ICF showed no data for the year 2016 with an increasing trend but low percentage of OPD attendants screened across the years compared to a decreasing percentage presumed, an increasing percentage tested, a decreasing percentage diagnosed, and an increasing high percentage initiated on TB treatment after 2017. Whilst a larger percentage of OPD attendants were presumed (14%) compared to the percentage screened (0%), there was much lower percentage tested (25%), highest diagnosed (16%) and lowest initiated on treatment (53%) in 2017. However, in 2018, 2019 and 2020 the same percentage of attendants were screened (6%) with similar percentage tested (61%, 66% and 60% respectively), diagnosed (9% and 8% respectively), and initiated on treatment (96% and 97% respectively). Contrary to the lowest percentage of attendants screened compared to the highest percentage presumed, the lowest percentage tested, highest percentage diagnosed, and lowest percentage initiated on treatment in 2017, the highest percentage screened (7%) compared to the lowest presumed (8%), highest percentage tested (82%), lowest diagnosed (8%) and highest initiated on treatment was in 2021 (Figure 17).

Regional trend of TB care cascade after the implementation of ICF shows no data for the Ashanti, Northern, Upper East and Volta regions. There was a general low amount of screening conducted by all regions in 2017 as identified in the national trend with the lowest OPD attendants screened by the Central, Eastern and Western regions (0%). Subsequently, the percentage of OPD attendants screened showed a decreasing trend after 2017 with the highest percentage screened (20%) by the Central region in 2018 and across all the years even though it showed an increase again in 2021 (16%). Next is the Bono region which showed an increase in 2018 (11%) but saw a decline in 2019 (4%) increased again in 2020 (7%) and declined again in 2021 (4%). The Volta region on the other hand saw an increasing trend in the percentage of OPD attendants screened (9% in 2018) to (11% in 2021) whiles the percentage of OPD attendants screened stagnated for the Ashanti region after 2018 (2% to 1%). Of the percentage presumed TB out of the total

screened there was a decreasing trend from 2017 with the highest presumed recorded by the Eastern region (52%) while the least was by the Central (28%) and Volta regions (19%). The Bono (2% to 26%) and Upper West (4% to 13%) regions on the other hand showed an increasing trend in percentage presumed TB across the years from 2017 to 2020 but saw a sharp decline (12%) in 2021 for the Bono region whiles the Upper West region stagnated. (See Figure 16).

However, there was a general increasing trend (3% to 100%) in the percentage tested out of those presumed TB compared to the percentage screened and presumed with the highest percentage tested by the Volta region in 2021 (100%) followed by the Bono region (99%) in 2017 and the Western region (96%) in 2021 whiles the lowest percentage of presumed tested was by the Greater Accra region in 2017 (3%). The Greater Accra however recorded the highest increase (3% to 67%) from 2017 to 2018 with a continuous increase in percentage tested except for 2020 (67%) whiles the Bono region recorded the steepest decline (47% to 9%) from 2019 to 2020 and increased again (9% to 72%) from 2020 to 2021. There was a declining trend (60% to 5%) in the percentage diagnosed from 2017 to 2021 as with the percentage presumed with the highest decline by the Greater Accra region (60% to 8%) even though it recorded the highest percentage diagnosed in 2017 (60%) whiles the lowest percentage diagnosed was by the Central and Volta regions in 2021 (5%). The Bono region on the other hand showed an increase in percentage diagnosed from 2017 to 2018 (6% to 11%) and 2019 to 2020 (8% to 12%) and the Western region showed an increase in percentage diagnosed from 2018 to 2019 (7% to 15%) whiles all other regions stagnated in percentage diagnosed from 2018 to 2021 (see Figure 17)

Of those diagnosed TB, there was a general higher percentage initiated on treatment compared to the percentage diagnosed with an increasing trend for all regions from 2017 to 2018 except for the Central region which showed a decline (100% to 62%). There was a decline in trend of percentage initiated on treatment for all regions from 2019 to 2021 except for the Bono region which showed an increasing trend from 2017 to 2021 (59% to 98%) with some decline in 2020 from 2019 (80% to 67%) and an increase again in 2021 from 2020 whiles the Volta region showed an increase from 2018 to 2021 (94% to 100%). The highest percentage initiated on treatment was by the Northern (108%) and Western (106%) even though it shows an over reporting whiles the lowest percentage diagnosed was by the Greater Accra in 2017 (18%) (see Figure 18)

4.4 Results of KIIs

Thematic analysis of information obtained from KIIs using the topic guide showed the following results.

1. **Intensity of ICF and who is being targeted**

Most of the participants interviewed mentioned that ICF implementation is ongoing in all hospitals, health centers and CHPS compounds even though one participant mentioned that is been implemented in mainly hospitals and now extending to all health centers. Other participants also added that ICF is now a national policy and an integral part of the health system. All participants mentioned that ICF is targeted at all entry points of the health facilities as part of triaging including OPD including consulting rooms for patients who may not responds at the triage desk, ART, ANC, Wards, Diabetic, Hypertensive clinics, and child welfare clinics (CWC) using a symptom-based screening tool (see Annex 2) and staff are trained on the use of the screening to investigate symptoms among attendants at the various entry points.

2. **Change of Intervention over time**

One participant mentioned that some facilities go beyond their facilities to do community screening especially in communities where most of the cases diagnosed at the health facilities are identified. Other participants also talked about training and reorientation of staff to bridge knowledge gap on the use of the screening tool and when there are any changes since the screening tool has evolved over time. All participants mentioned the use of Task Shifting Officers (TSO) in some facilities especially the hospitals

who support with screening to make it more effective which has been seen to improve performance in case detection in these facilities compared to facilities with TSOs. A participant said

"Oh yes. Because formally, we realized there was some kind of knowledge gap when you come to the screening but later what we did was to support the district teams to train the staff, especially the OPD and other entry points and we also have some facilities or districts having task shifting officers. Their work purposely is to be at the OPD and be screening so as they are also there, they move around all the units the male ward female ward if the nurses are having any challenge, they support them. And all the nurses that work at the OPD too we train all of them almost all" (RTBC 3).

All participants also mentioned the Sputum Sample Transport system (SSTS) as the new intervention which compliments the ICF as a way of improving diagnostic gap with the implementation of ICF. The SST implemented at the last quarter of 2019 involves linking facilities without diagnostic capacity called spokes to those facilities which have GeneXpert services termed hub. The spokes are linked to the hubs for transportation of sputum samples for TB diagnosis. One participant added that a lot of interventions are being implemented now, for the ICF, the screening the process is still the same, but works hand in hand with other interventions such as the sample transport system and said:

"So at first, we had facilities screening clients that comes through the entry points and when they are presumed they were shepherded or asked to go to the labs for the sample to be taken but now we are having sample transport system where we have marked our GeneXpert sites so this time, instead of asking the patients to go or the clients to go, you rather take the sample at the entry point or the lab at the health facility. The lab at the health facilities is at our beck and call so whenever we screen and suspect they pick the sample package it then we transport the sample instead of asking the patient to go. And so, before they were being asked to go to the nearest GeneXpert site for the sample to be taken, but now their samples are taken, and it is rather sent by the health workers" (RTBC 1).

Another participant mentioned modifications to the screening tool making it simpler and added:

"The intervention hasn't changed much, but it bothers more on the tools. For instance, the screening tool initially was quite long and big. And you know, staff who are applying the tools are the same staff who are also working nurses, midwives and all those things so it was like the data and information we were picking from them was just too much. So, it was abridged" (RTBC 4)

3. Available services

Two participants mentioned that ICF afforded the opportunity to do HIV testing and initiate TB Preventive Therapy (TPT) and added that TPT is given to PHLIVs who test negative for TB and children under-five who test negative for HIV and are contacts of TB patients. Other participants spoke about bidirectional testing which involves two picking samples to test for both COVID and TB at the same since they both have similar signs and symptoms which was first piloted in the Greater Accra region in 2020 as part of mitigating challenges with COVID and found to improve TB diagnosis and now a national policy. Another participant also mentioned screening, testing, treatment, and contact tracing as the available services.

4. Use of Protocols and Algorithms

All participants mentioned that algorithms are being followed and it has been distributed and visibly pasted in all facilities and another participant added that they are more general now with the same algorithm for all the units because it used to be more specific for specific units of the health facility. A participant however mentioned that there were few deviations on how to conduct screening identified

during monitoring visits due to the frequent change of staff at the entry points and there are also presumed registers and lab request forms (TB05/06) which staff needs to be oriented on its use and said:

"Yes, so I will say they are being followed but from our rounds because of the frequent change of staff at the entry points when you go on monitoring you realize at some points in some facilities there might be some changes or deviations, so you try to bring them back to track" (RTBC 1).

5. Duration for ICF implementation

Regarding how long the intervention has been implemented, participants gave varying views. One participant mentioned four years ago and there is a monthly reporting tool in the DHIMS for ICF, another mentioned 2015 and another participant mentioned that the implementation was ongoing over five years. Others mentioned from about five years and from about 2015.

6. Challenges with the Implementation of ICF

Most participants mentioned lack of systematic screening, lack of staff and limited OPD nurses. A participants added that staff see screening as an additional task and there is high staff attrition which contributes to low screening and another participant also mentioned interruptions in screening by the COVID-19 pandemic and said:

"So, with the advent of COVID most of our health workers you know were not armed on how to prevent the COVID so most of the screening at the health facilities stopped. We couldn't do our outreach screening activities too and attendants at the ODP actually also went down. So were not actually having access to most of our client's screen. So that actually accounted for the downward trend from 2019 to 2020. But with 2021 I think COVID was managed well, and the health workers actually came to understand the preventive measures of COVID. Initially, most of them were just screening the COVID alone without the TB so we realize it and we actually implemented this system of whenever you pick a COVID sample, you also have to pick another sample equally for TB" (RTBC 1).

Another participant added there is a gap at every level of the care cascade starting with screening and said:

"So, one is our low level of screening, that's a big gap because that is the starting point of the care cascade, so if your starting point is not solid, then you're expecting that it will keep decreasing as you go down the line" (RTBC 5)

Another participant mentioned staff fatigue especially when they are not monitored and lack of documentation of screening by staff especially at the ANC due to the use of huge ANC register and inadequate documentation of screening conducted at other units in various registers and said:

"TB services used to be a service at the DOT center with particular group of people only involved so with the ICF introduction it has to expand to bring all on board. So now OPD nurses are on board. And they are helping a lot in the screening activities but in some facilities, they still see it as an additional role. So sometimes it needs a lot of continuous monitoring to make sure that they are applying the tools I mean in assessing the patient"

All participants mentioned logistic constraint particularly with shortage of GeneXpert cartridges which creates a diagnostic gap whiles others spoke about huge gap between presumed and tested in some facilities due to lack of diagnostic capacity, poor geographical network and porous facility density which makes it difficult to transport sputum samples. Another participant also added gap between presumed and

tested due loss of patient along the cascade and clients unable to produce sputum leading to high dropout rate.

Other challenges mentioned by participants were lack of entry of data in DHIMS even though reports are available, inability to conduct tracing due to lack of funds even though the NTP provides some funds to support the activity, there's delay in release of funds and challenge with transportation of sputum samples due to delay in the release of funds for facilities which transport their own samples because of issues with courier service picking samples and lastly clients who are unable to produce sputum may require X-ray but are unable to pay for the cost. This is what a participant said:

"Financing it is a challenge because even though we get some funds to support the transport to the GeneXpert sites the funds are not enough and they don't come on time, so that place too there is a gap that sometimes not all the samples are transported and some gets discarded and when it gets to the testing sites availability of GeneXpert cartridges this year alone, we've had two shortages and once you get a shortage then the people there taking the sample are not motivated to continue picking samples because they are not getting any results coming.

7. Suggestions to improve implementation of ICF

One participant suggested frequent monitoring by Region and District to facilities to address identified challenges such as unavailability of staff to conduct screening, lack of screening tools, entry of data in DHIMS. The participant said:

"Regions should provide feedback to districts on their performance especially when there is a decline to address any challenge and district should also monitor facilities to ensure screening has been done".

Another participant suggested ownership by hospital management and staff especially Nurse Manager and OPD in-charge and early stakeholder engagement at the start of the intervention and said:

"The OPD nurse or the matron of the hospital should own it and assign roles so that OPD nurses and triage nurses will be appraised as part of their activity, they will be appraised on screening activities, but if it looks like it is the TB program that has brought the work to the nurses, sometimes we have instances where even the OPD nurse managers are themselves are sabotaging the whole thing because they think is an additional role that is given to me"

One participant suggested training to solve issue of high staff attrition and as well as provision of funds for patients who require X-ray and added:

"We have a high staff attrition. So, you train somebody the person is doing the screening and the person moves another person comes, doesn't really understand what is going on and so doesn't take up nicely. And so there's a gap so more staff trained would help with the screening and with clients unable to produce sputum I belief for such clients, if there was, if you ask them to go and do an X-ray, a lot of people will tell you they don't have money to pay because it's not covered by health insurance, so some form of financing for chest X-ray for TB clients would also help"(RTBC 5).

Another also mentioned making the screening tool simpler especially for ANC clinic to improve documentation and said:

"So, if we make the tool simpler, as simple, and as concise as possible. It really makes the work so well, especially at the ANC. The ANC the midwives are doing a lot. They have big ANC register; they have maternal and child health record book they must document then you go and bring another screening tool

that is also long that you must answer to. So, I still think that we if we can simplify the screening tool especially for the Antenatal clinic is going to really improve" (RTBC 4).

All participants suggested constant supply of GeneXpert cartridges and others increasing GeneXpert sites based on geographical location, improving SST by making every screening facility a spoke for easy movement of samples, enough funds for contact tracing and early disbursement of funds especially for contact tracing from regions to districts and for transportation of sputum samples by facilities who are transporting their own samples due to issues with the courier service. This is what a participant said:

"So basically, is not all the situation where the patient themselves didn't want to come, but there are also situations where patient produce sample alright, but we don't have cartridge to conduct the test. And of course, I mean the sputum sample also has a life span. So, by the time that our cartridges will be available then the sputum is spoilt and of course patient once they get to the community, it becomes very difficult to follow them up. So constant supply of diagnostic commodities is also a major factor that can improve what we are doing" (RTBC 4).

Another participant also added:
"And when it comes to the transportation challenges enough funds for the transportation to be done well and then provision of enough cartridges so that we don't get shortages. So, once you get shortages for long periods, then people are demotivated to collect the samples because sometimes even the storage of the samples at the testing sites they will tell you to stop bringing samples because they've piled up a lot over the period and the fridge is full. So, it acts as a demotivation for people to continue picking samples. And any time you stop an intervention, and you are going to restart, it takes time to get everybody on board, so there's always this lack face before everybody comes on board again and that's really affecting our case detection last year too, we had periods of shortages of cartridge and this year is continuing. So, if those things are provided, I believe it would help improve our case detection" (RTBC 5).

CHAPTER 5: DISCUSSION

This study aimed at evaluating the effectiveness of ICF in its performance on TB case detection in Ghana by comparing trends of CNR at the national and regional level from 2010 to 2021 to quantify the change in CNR before (2010-2015) and after (2016-2021). The results of the analysis conducted for the period under study showed a declining trend in the national CNR before and after the implementation of ICF which indicates that the implementation of ICF did not show any significant effect on national CNR. Similarly, regional trend of CNR showed a declining trend before and after the implementation of ICF with regional variations in the performance of CNR. The trend of CNR for the Brong-Ahafo and Upper West regions showed a change after the implementation of ICF compared to before the implementation of ICF with a significant increase in CNR directly at the level of implementation of ICF. Subsequently, the Western region showed a significant decline in CNR at the level of the implementation of ICF compared to the before the implementation of ICF. However, the Greater Accra and Western regions showed some change in the trend of CNR after the implementation of ICF over time with a significant increase in CNR compared to the trend before the implementation of ICF. The Volta region on the other hand showed a significant decline in the trend of CNR after the implementation of ICF over time compared to the period before the implementation of ICF. The Northern region even though was the only region that showed a significant increase in CNR before the implementation of ICF did not record any significant change in CNR after the implementation of ICF.

Nationally, there was no significant association between the implementation of ICF and a change in CNR both at the level of implementation and in trend. The main aim of the intervention is to increase TB case finding through screening among people attending the health facility irrespective of their reason for the visit. However, TB care cascade report shows only 5% of OPD attendants were screened on average annually, ranging from 0% in 2017 to 7% in 2021. The low level of screening could explain the lack of results on a national level. The key informants provide some insight into why screening could be low such as lack of systematic screening due to lack of staff, high staff attrition, staff fatigue and lack of and inadequate documentation of screening activities, lack of diagnostic capacity among others gathered from key informants. Other literature also mentioned staff attrition as a barrier to the implementation of interventions aimed at ICF or ACF activities. One study into barriers to TB case finding by Ereso et al 2020 provides such evidence(74).

Despite the lack of results on the national level, there is evidence of slight improvements in the level of CNR associated with ICF in the Brong-Ahafo and Upper West regions. Programmatic data shows that the level of screening was higher in these regions compared to other regions, ranging from 1% in 2017 to 11% in 2018 for the Brong-Ahafo region and 1% in 2017 to 8% in 2019 for the Upper West region. Similarly, the percentage presumed TB for was also higher these regions compared to other regions ranging from 2% in 2017 to 26% in 2020 and 4% in 2017 to 13% in 2021 for the Brong-Ahafo and Upper West regions, respectively. The Brong-Ahafo on the other hand had much higher percentage tested ranging from 9% in 2020 and 99% in 2017 and 36% in 2020 and 60% in 2018 for the Upper West region which indicates these regions showed an increase in the percentage screened, presumed and tested for TB at the start of the intervention but showed a decline later into the intervention and therefore could not show any significant increase in trend of CNR when the intervention was implemented over time with a significant decline for the Brong-Ahafo. This may be associated with challenges with implementation outlined by key informants including staff fatigue due to lack of monitoring, high attrition, poor documentation, lack of ownership of screening intervention and interruptions in screening by the COVID-19 pandemic.

In addition, the Greater Accra and Western regions showed slight improvements in the trend of CNR associated with the implementation of ICF over time. Programmatic data shows that the level of screening in these regions was also higher in these regions compared to other regions ranging from 1% in 2017 to 7% in 2021 for the Greater Accra region and 0% in 2017 to 5% in 2021 for the Western region. Likewise, the

percentage presumed TB for these regions was also higher compared to other regions ranging from 8% in 2021 to 17% in 2017 for the Greater Accra region and 8% in 2021 to 19% in 2018 for the Western region. Percentage tested for TB for these regions ranged from 3% in 2017 to 87% in 2021 and 44% in 2020 to 96% in 2021 for the Greater Accra and Western region respectively. This shows there was an increasing trend in these indicators for these regions after the implementation of ICF over time which may have contributed to their high CNR. This could be due to better access to health care and TB diagnostics in these regions which have been shown to increase TB case notifications, continuous monitoring and on-the -job-coaching, outreach services, in addition, the Greater Accra region is the region where bidirectional testing was first piloted to mitigate challenges of the COVID-19 as mentioned by key informants.

Subsequently, the trend of quarterly CNR also showed the highest CNR after the implementation of ICF was reported by the Western followed by the Brong-Ahafo, Greater Accra, Upper East, and Volta regions with a slight increase in CNR for the Brong-Ahafo and Upper West regions. However, there was a decline in CNR for the Greater Accra, Upper East, Volta, and Western regions after the implementation of ICF which was statistically significant at the level of implementation of ICF for the Western region and in trend after the implementation of ICF over time for the Volta region compared to the period before the implementation of ICF. This may also have consequently led to the decline in the national CNR. Even though the Brong-Ahafo and Upper West regions saw an increase in quarterly CNR directly at the level after the implementation of ICF which was statistically significant, there was a slight but statistically significant decline in trend after the implementation of ICF over time for the Brong-Ahafo region and could not have improved the national CNR.

This study results is contrary to results of a study on a similar intervention implemented by the National TB and Leprosy Programme (NTLP) of Tanzania, a LMIC like Ghana in 53% of regions in the country within a space of eighteen months with majority of the intervention facilities yielding 100% increase in CNR and a 12.4% increase in case notifications for the country with 4000 additional TB cases(75). In comparison to Ghana, implementation of ICF in Tanzania was done only in Q1 of the implementation period with close coaching and supervision unlike Ghana where an all-year-round implementation was done which may have led to implementation fatigue as shown in the results of KIIs and may be a reason for not achieving intended results. Also, implementation of ICF in Tanzania was only in selected regions and health facilities and not across the whole country as in the case of Ghana which have been demonstrated in this study that implementation of ICF did not show significant change in CNR for all regions even though was implemented in almost all health facilities as identified through the KIIs. In addition, CNR have been found to vary across different regions with regards to who is most affected, disease transmission and prevalence in other LMICs like Ghana(29–31,33). Areas with better access to healthcare have also been shown to have high CNR, quality of diagnostic services and the healthcare system's ability of to detect and initiate treatment among some of the challenges identified with ICF implementation in Ghana through the KIIs which contribute to regional variations in CNR(52–56). This may have accounted for the variations in performance of CNR before and after the implementation of ICF with a typical example is the Northern region with lowest CNR due to vast geographical area compared to a porous facility density and poor diagnostic capacity.

Trend of TB care cascade report for national for the period of implementation of ICF showed no data reported for 2016 for all regions and for the Ashanti, Northern, Upper East and Volta regions in 2017 which can be explained by the fact that there were no reporting forms available in the DHIMS2 at the start of the intervention. Consequently, only hard copy reports were available which the study did not have access to. And even after the form has been uploaded in the DHIMS2 staff needed to be trained on the data entry but with continuous monitoring and on-the-job-coaching which may have improved data entry in subsequent years. The lack of data for some regions and very low screening by some regions in 2017 may have contributed to the low national average of attendants screened. Other reasons may be lack of documentation and data entry in the DHIMS which are among the challenges identified with the implementation of ICF at

the health facilities through the KIIs. The national TB care cascade report also shows the same proportions of persons were screened from 2018 to 2020 with a slight increase in 2021. However, the proportion of presumed cases identified was highest in 2017 with the lowest proportion of OPD attendants screened compared to 2021 where the proportion of attendants screened was highest which implies that screening may have been more targeted.

Regional summary of screening conducted shows the Central region reported the highest average and number of OPD attendants screened in 2018 as well as one of the regions with the least attendants screened in 2017 and may have contributed more to the national average but at as same time contributed to the low national average in addition other regions which recorded the lowest proportion of OPD attendants screened in 2017. The trend of regional TB care cascade report for the period of implementation of ICF also shows that even though the Easter, Central, and Western regions recorded the least proportion of attendants screened in 2017, these regions recorded the highest proportion of presumed cases and may have accounted for the 2017 national performance. Similarly, the Ashanti, Upper East regions even though screened the lowest proportion of attendants in 2018, also reported the highest proportion of presumed cases with a similar pattern in 2019 but showed some decline in 2020 and 2021 with the implementation of ICF over time. On the other hand, the Ashanti, Central and Western regions reported the highest proportion of presumed cases tested whiles the Greater Accra, Upper West and Western regions reported the highest cases diagnosed yet the Central, Upper West, and Western regions initiated the highest proportion of diagnosed on treatment and the Greater with the least proportion of cases initiated on treatment in 2017. This shows similar results in subsequent years but with some increases and declines with implementation of ICF over time.

The result of the regional trend of the TB care cascade may be that screening may not have been systematically conducted with the symptom-based screening tool for all attendants or provider-initiated but only limited to persons presenting with respiratory symptoms which may also be that staff still lacked understanding on the use of the screening tool but with continuous monitoring and on-the-job coaching there was improvement in subsequent years. Another reason may be staff fatigue due to the limited number of staff at the health facilities and staff also see screening as an additional role as identified as a challenge with ICF implementation through the KIIs which requires continuous monitoring and supervision to ensure screening is systematically conducted as observed in the case of Tanzania(75). The differences in proportions of tested, diagnosed and initiated on treatment may also be attributed to the differences in access to TB diagnostics and ability to initiate treatment which have been shown earlier to contribute to regional variations in CNR.

This may also have accounted for the high proportion of persons diagnosed in 2017 in the care cascade for national compared to 2021 even though the care cascade report shows increasing proportions of number tested across the years with increasing diagnostic capacity. Subsequently, only a little over half of those diagnosed were initiated on treatment in 2017 compared to majority initiated on treatment in the subsequent years which may also have resulted in the decline in national CNR in 2017 compared to 2016 after the implementation of ICF. However, CNR continued to show a decline which may be due to the several implementational challenges identified through the KIIs such as lack of systematic screening, lack of staff and high attrition, staff see screening as an additional role, lack of documentation of screening activities, low screening, staff fatigue, lack of data entry in the DHIMS2, intermittent shortage of cartridges, inadequate funds and delay in the release of funds to conduct tracing and transportation of sputum samples among others.

5.1 Limitations

Several factors as identified by the TB care cascade for which cases are missed (Gap 1) due to regional variations could be attributed to the change in trend of TB notifications overtime but not limited to the

implementation of the ICF intervention and could serve as confounders. This will require further studies by collecting and analyzing data on these factors to determine their effect on TB case detection in various settings. There was no pre-treatment data on the care cascade, no counterfactual population and the linear model may not necessarily be the best model for the type of data. Post-intervention trend of CNR can be influenced by the COVID-19 pandemic. Change in TB diagnostics from microscopy as first line before the implementation of ICF to GeneXpert with the implementation of ICF could results in change in TB case detection over time as also indicated by the TB care cascade (Gap 2) and for that matter the study focuses on case notification for all forms of TB diagnosed irrespective of the diagnostic procedure. The One KII could not be conducted because contact person could not be reached. Difficulty in obtaining programmatic data from the NTP for the period before of ICF implementation since data for that period was underreported or not captured in the DHIMS2 and data quality of the TB care cascade with missing data for 2016 and for some regions in 2017 in the DHIMS2.

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

This study sought to determine the effectiveness of the ICF intervention on TB detection in Ghana, to identify challenges with the implementation of ICF and proffer recommendations to improve implementation and for future interventions. The results shows that national CNR did not show any significant change after the implementation of ICF but a slight and significant decline in CNR before the implementation of ICF with some regional variations in the performance of CNR. Challenges identified with the implementation of ICF include the lack of systematic screening, lack of staff and limited OPD nurses, high staff attrition, staff see screening as an additional task, lack of ownership of intervention by facility management, lack of and inadequate documentation of screening activities, lack of data entry in the DHIM, logistic constraint particularly shortage of GeneXpert cartridges, geographical location of GeneXpert machines and lack of and inadequate funds and late release of funds by national and region to facilities to conduct sputum transportation and contact tracing.

6.2 Recommendations

The following are the recommendations proposed based on the results of the study to improve implementation of ICF in Ghana to achieve its intended purpose and for the implementation of future interventions:

- The NTP Ghana should adopt the quarterly implementation of ICF rather than an all-year-round implementation to make efficient use of the available resources in the phase of limited resources with close monitoring and supervision to prevent implementation fatigue as shown in the case of Tanzania
- The NTP Ghana should consider implementation of other case finding interventions in different regions based on the results of the study that have demonstrated that implementation of ICF did not show significant change in CNR for all regions in addition to the various factors identified by this study to contribute to regional variations in CNR
- The NTP should collaborate with Regional Directors of Health Services (RDHS) to strengthen the capacity of lower levels of the healthcare system to conduct monitoring and supervision especially from district to facilities to ensure that ICF implementation is as expected to yield the necessary results and address issues of staff attrition, low screening, documentation, and data entry in the DHIMS
- The NTP should also work with the RDHS to strengthen community outreach services by health facilities which have been shown to improve TB case detection through follow-ups of patients who miss treatment and sensitization of community leaders and members on the signs and symptoms of TB to increase access to healthcare as in the case of Tanzania and outlined in activities been implemented by facilities as part of ICF identified through the KIIs
- The NTP should consider the incorporation of the symptom-based screening tool into existing registers to improve documentation especially at the ANC since staff see it at as additional role documenting it in addition to other registers to improve documentation of screening activities
- The NTP should work with the RDHS to undertake sensitization meetings with health facility management to take ownership of the intervention to ensure staff are supervised to systematically implement ICF in their various facilities and not see as an additional task
- The NTP should work with RDHS to conduct quarterly reviews and stakeholder engagement to provide feedback on performance of ICF intervention from region to national, region to district and district to facilities
- The NTP should consider geographical allocation of resources especially GeneXpert machines to improve the diagnostic capacity of hard-to-reach areas and improve TB case detection in these areas

- The NTP should develop a long-term plan to address issues with intermittent shortage of laboratory diagnostics particularly GeneXpert cartridges which interrupts with implementation and as acts a demotivator for staff implementing ICF because their effort is not rewarded with no results for screening conducted and sputum samples taken leading to more staff fatigue
- The NTP should ensure prompt allocation of funds to regions and from regions to health facilities for transportation of sputum samples to improve access to diagnostics and for contact tracing to improve case detection through the identification of contacts of index TB cases who are presumed cases

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ANNEX

Annex 1: Topic Guide for Key Informant Interview

Identification Code…… Date: ……

Topic: Evaluation Facility-based Intensified Tuberculosis (TB) Case Finding Intervention in Ghana

My name is Mercy Adobea Baah, a student with the KIT Royal Tropical Institute conducting a study to evaluate the implementation of Facility-based Intensified Tuberculosis (TB) Case Finding (ICF) intervention in Ghana as part of my thesis for an award of a Master's in Public Health.

Purpose of the Study

The purpose of the study is to assess the effectiveness of the ICF intervention in Ghana, identify challenges with implementation, and proffer recommendations to address the challenges to improve implementation. The study will look at a six-year implementation of the ICF intervention from 2015 to 2021 compared to the period before ICF from 2010 to 2014.

Demographic Information:

1.	Professional Background	
2.	Level	National …….
		Region …….
		District ……

Questions

1. Can you tell me about the implementation of ICF since you assumed your position with regards to the intensity of activities at the National/Region/District/Facility level?
    - Who is being reached with the ICF intervention and are these the same as the intended target?
    - Has the intervention changed over time?
    - Are protocols/algorithms being followed? If not, why not?
    - What are the available services?
2. How long has ICF been implemented at the National/Region/District/Facility level?
3. What are the challenges with the implementation of ICF at the National/Region/District level?
4. What are your suggestions for the improvement of ICF implementation?

Annex 1.2: Informed Consent Form

Informed consent for Key Informants

Hello, My name is Mercy Adobea Baah, I am a Master of Public Health student at the KIT Royal Tropical Institute and staff with the National TB Control Programme (NTP). I would like to assess the effectiveness of Facility-based Intensified Tuberculosis (TB) Case Finding (ICF) intervention on TB case detection in Ghana. To ensure the effectiveness of ICF implementation on TB case detection, it is important to identify and address changes with implementation to improve implementation and increase TB case detection. I hope that this information will help to improve the implementation of ICF in Ghana.

Procedures including confidentiality.

If you agree we would like to interview you about the implementation of ICF, how ICF has contributed to TB case detection in your region, best practices, and challenges with the implementation of ICF in your region; what you think could be improved or changed.

The interview will take place in a private space where nobody can hear us and last about an hour.

With your permission, I will tape-record the answers you give to make sure that we do not forget or change what you are saying. Everything that will be said, written down will be kept confidential. Your name will not be recorded or written down. Notes will be kept in a locked place. Only the investigator will have access to the notes.

In publications, the findings will be attributed to the implementation of ICF intervention in general and by region and not to you in particular so that nobody can recognize the setting. The tape recording will be destroyed 6 months after finishing the study.

Risk, discomforts, and right to withdraw

You are free to refuse to answer any question for any reason. Refusing to take part or withdraw during the interview will not in any way affect your reputation or the performance review by your employer.

Benefits

This study will not help you directly but the results will help to improve ICF implementation to increase TB case detection and reduce the TB disease burden in Ghana.

Sharing the results

After the study is completed findings will be shared with stakeholders through scientific publications and with the National TB Control Programme. In addition, the results will be available in written form through the institution. A copy of the report will be shared with you as well.

Consent and contact

Do you have any questions that you would like to ask?

Are there any things you would like me to explain again or say more about?

Do you agree to participate in the interview?

DECLARATION: TO BE SIGNED BY THE RESPONDENT

Agreement respondent

The purpose of the interview was explained to me and I agree that …….. (Name of person) is interviewed.

_____

Signed Date

WITNESS SIGNATURE

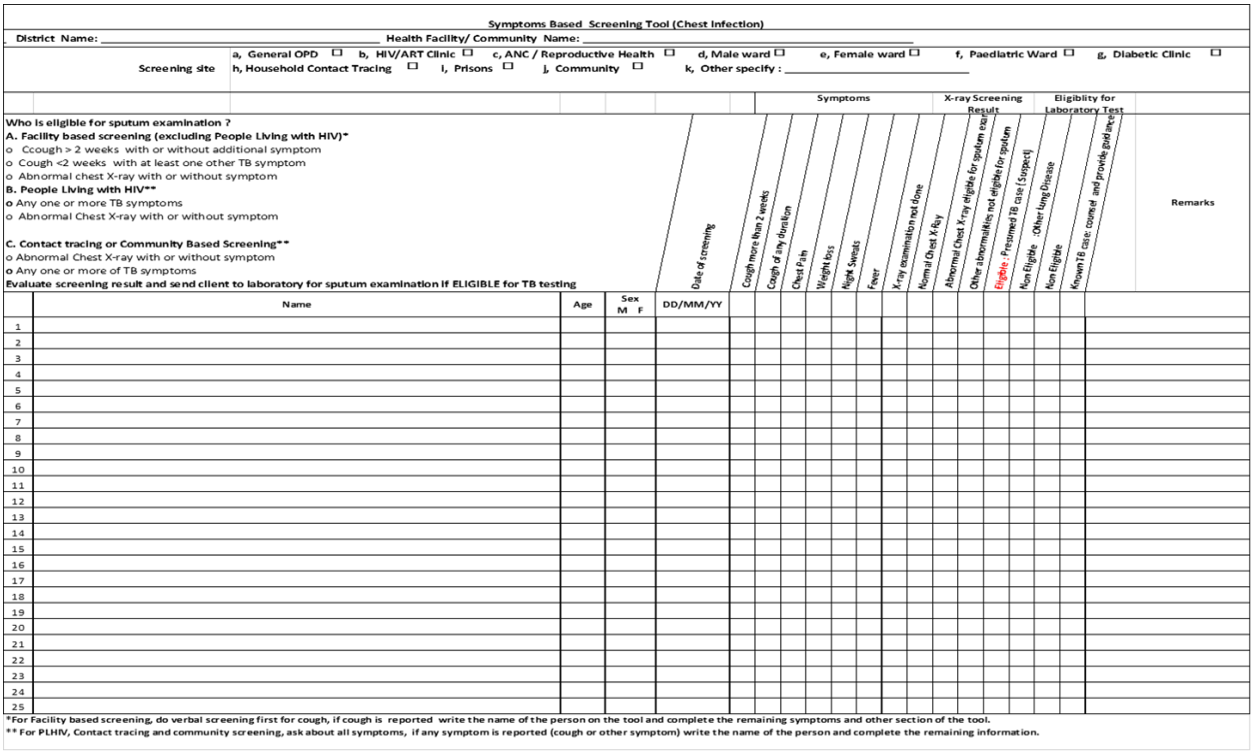
_____

Signed Date

If you have any questions or want to file a complaint about the research you may contact:

Contact information organization	Contact for Ethics Committee

Annex 2: Screening tool and Algorithms



Symptoms Based Screening Tool (Chest Infection)

District Name: _____ Health Facility/ Community Name: _____

Screening site: a, General OPD ☐ b, HIV/ART Clinic ☐ c, ANC / Reproductive Health ☐ d, Male ward ☐ e, Female ward ☐ f, Paediatric Ward ☐ g, Diabetic Clinic ☐ h, Household Contact Tracing ☐ i, Prisons ☐ j, Community ☐ k, Other specify : _____

Who is eligible for sputum examination ?
A. Facility based screening (excluding People Living with HIV)*
o Ccough > 2 weeks with or without additional symptom
o Cough <2 weeks with at least one other TB symptom
o Abnormal chest X-ray with or without symptom
B. People Living with HIV**
o Any one or more TB symptoms
o Abnormal Chest X-ray with or without symptom

C. Contact tracing or Community Based Screening**
o Abnormal Chest X-ray with or without symptom
o Any one or more of TB symptoms
Evaluate screening result and send client to laboratory for sputum examination if ELIGIBLE for TB testing

	Name	Age	Sex M F	DD/MM/YY	Symptoms: Cough more than 2 weeks	Cough of any duration	Chest Pain	Weight loss	Night Sweats	Fever	X-ray examination not done	X-ray Screening Result: Normal Chest X-Ray	Abnormal Chest X-ray eligible for sputum exa	Other abnormalities not eligible for sputum	Eligible : Presumed TB case (Suspect)	Non Eligible : Other Lung Disease	Eligibility for Laboratory Test: Non Eligible	Known TB case: counsel and provide guid ance	Remarks
1																			
2																			
3																			
4																			
5																			
6																			
7																			
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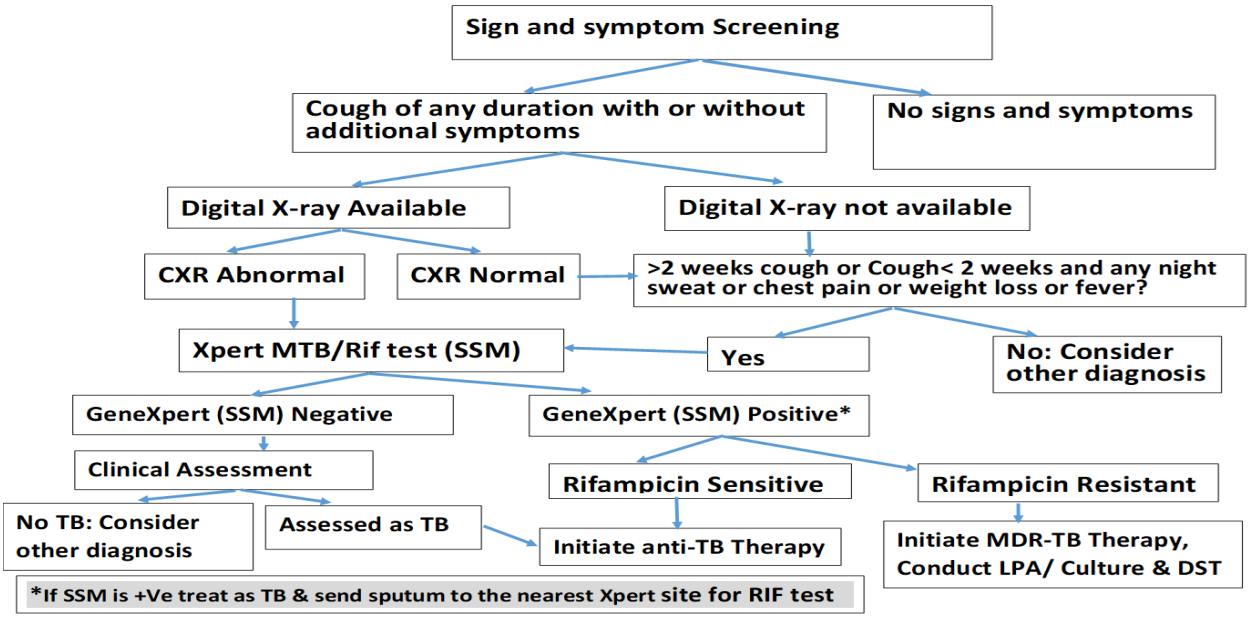
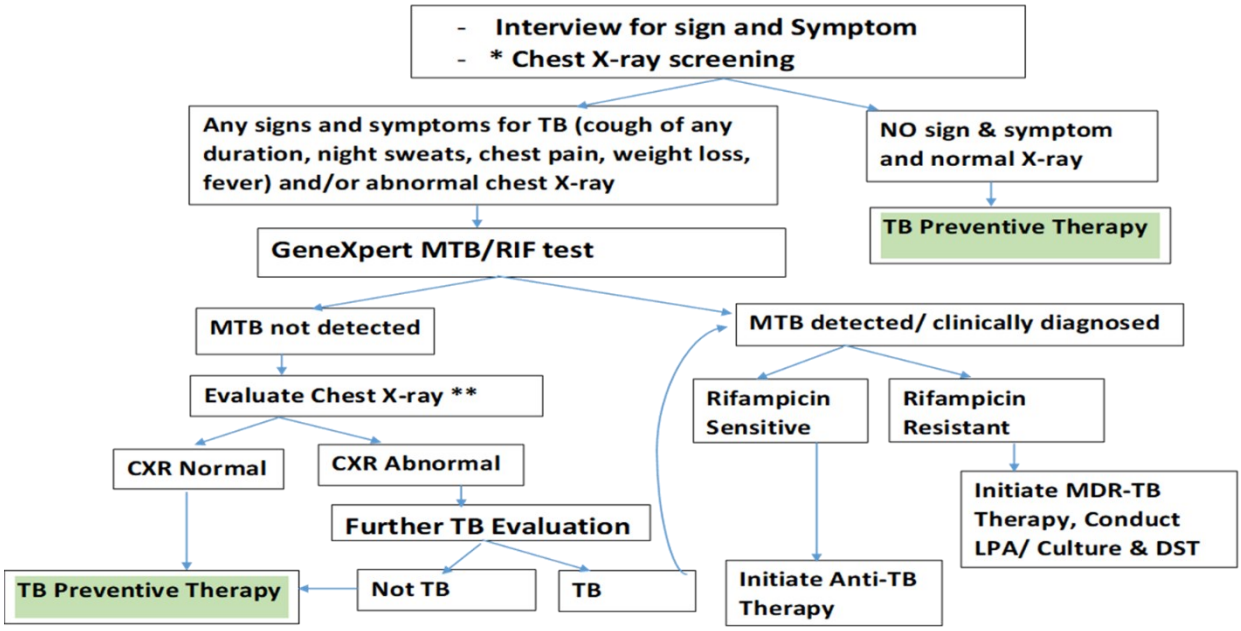
*For Facility based screening, do verbal screening first for cough, if cough is reported write the name of the person on the tool and complete the remaining symptoms and other section of the tool.
** For PLHIV, Contact tracing and community screening, ask about all symptoms, if any symptom is reported (cough or other symptom) write the name of the person and complete the remaining information.

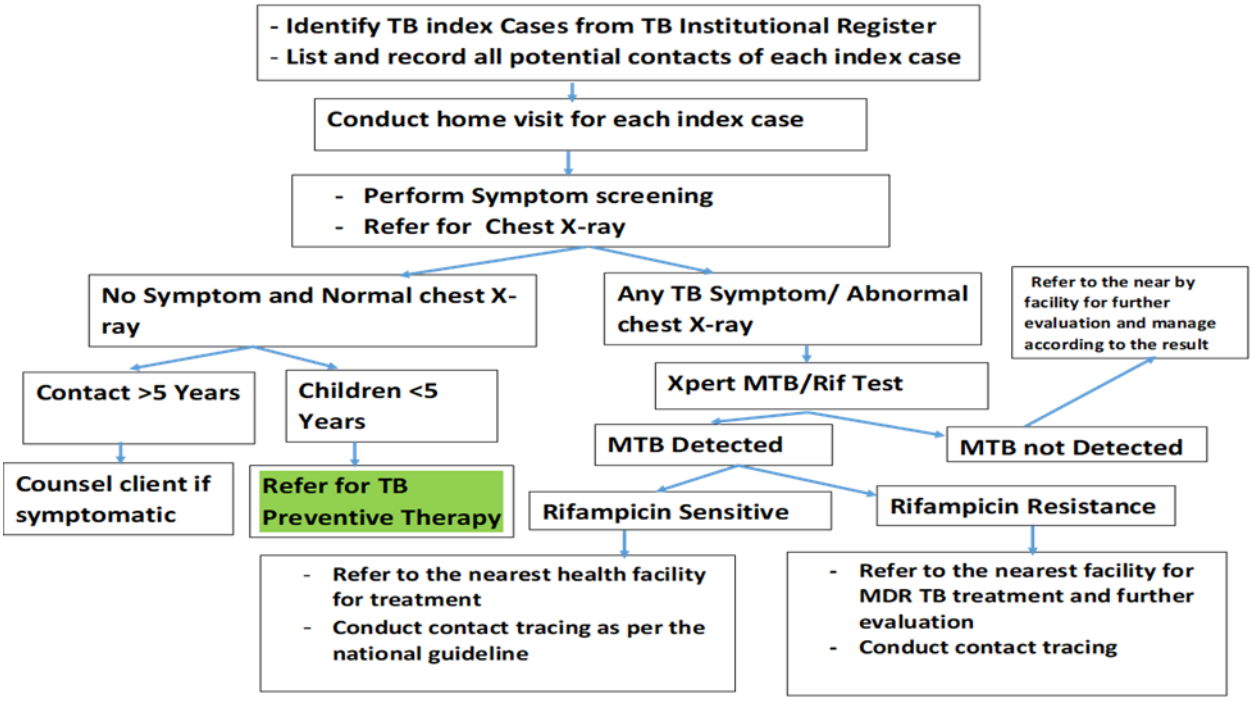
Algorithm for Screening and Diagnosis of TB for Facility Based Case Finding

*Note that ART clinics and Contact tracing have own algorithms



Algorithm for Screening and Diagnosis of TB in PLHIV




- Identify TB index Cases from TB Institutional Register
- List and record all potential contacts of each index case
Conduct home visit for each index case
- Perform Symptom screening
- Refer for Chest X-ray
No Symptom and Normal chest X-ray
Any TB Symptom/ Abnormal chest X-ray
Refer to the near by facility for further evaluation and manage according to the result
Contact >5 Years
Children <5 Years
Xpert MTB/Rif Test
Counsel client if symptomatic
Refer for TB Preventive Therapy
MTB Detected
MTB not Detected
Rifampicin Sensitive
Rifampicin Resistance
- Refer to the nearest health facility for treatment
- Conduct contact tracing as per the national guideline
- Refer to the nearest facility for MDR TB treatment and further evaluation
- Conduct contact tracing