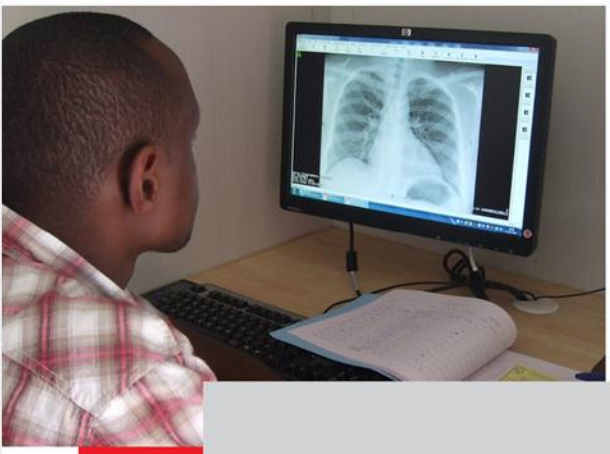



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Rwanda 21-25 July 2014

Epidemiological review and impact analysis of tuberculosis in Rwanda

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Abbreviations

ART	Anti-Retroviral Therapy
BMI	Body Mass Index
CD	Case Detection
CDR	Crude Death Rate
CDT	TB Centre for Diagnosis and Treatment
CHW	Community Health Worker
CHUK	(*Centre Hospitalier Universitaire de Kigali*) Kigali teaching hospital
CHUB	*(Centre Hospitalier Universitaire de Butare)* Butare teaching hospital
CNR	Case Notification Rate
CT	TB Centre for Treatment
D&ND	Daily and non-daily (smokers)
DOT	Direct Observed Treatment
DST	Drug Sensitivity testing
EICV	(Enquête Intégrale sur les Conditions de Vie des ménages) Integrated Household Living Conditions Surveys
EPTB	Extra Pulmonary Tuberculosis
GFATM	the Global Fund for Tuberculosis HIV-AIDS and Malaria
GNI	Gross National Income
GDP	Gross Domestic Product
HIV	Human Immunodeficiency Virus
HMIS	Health Management Information System
IC	Infection Control
IMCI	Integrated Management of Childhood Illnesses
IPT	Isoniazid Preventive Treatment
JANS	Joint Assessment of the National Strategic Plan
LNR	(*Laboratoire National de Reference*) National reference lab
M&E	Monitoring & Evaluation
MDG	Millennium Development Goal
MDR-TB	Multi-Drug Resistant TB
NFM	New Funding Model (of The Global Fund)
NNS	number needed to screen
NSP	National Strategic Plan
NSA	National Strategic Application
NSS+	New sputum smear positive
NTP	National TB Program
ORD	Other Respiratory Diseases
OPD	Out Patient Department
PBF	Performance based financing
SMS	Short Messaging Services
TB	Tuberculosis
TB & ORD	TB and other respiratory communicable diseases
ToR	Terms of Reference
TRP	Technical Review Panel (of The Global Fund)
TSR	treatment success rate
USG	United States Government
USD	United States Dollar

Executive summary

Following a key recommendation from the Joint Assessment of the National TB Strategic Plan (JANS) conducted in June 2014 Rwanda conducted a full "Epidemiological review and impact assessment" following the standardized terms of reference developed by the World Health Organization jointly with key technical agencies. KNCV epidemiologist Eveline Klinkenberg who was involved in the assessment of the TB surveillance system in October 2013 which is part of the assessment was hired to assist the program in conducting the review from 21-25 July 2014 before submission of the joint TB-HIV Concept note to the Global Fund on August 15th 2014.

The main objectives of the assessment were to: 1) Describe and assess the current national TB surveillance and vital registration systems, with particular attention to their capacity to measure the level of and trends in TB disease burden (incidence and mortality), This was already completed in October 2013; 2) Assess the level of, and trends in, TB disease burden (incidence, prevalence, mortality) using available surveillance, survey, programmatic and other data; 3) Assess whether recent trends in TB disease burden indicators are plausibly related to changes in TB-specific interventions taking into account external factors including economic or demographic trends; 4) Define the investments needed to directly measure trends in TB disease burden in future.

Rwanda's history is marked by the 1994 genocide which led to the deaths of 1 million people, and the displacement of millions more. Injury and trauma were followed by the effects of a devastated health system and economy. In the years that followed, a new course set by a new government set into motion equity-oriented national policies focusing on social cohesion and people-centred development (Binagwaho et al., 2014). Central to this vision was health equity. Rwanda put in place a decentralized health system with community-based health insurance and performance-based financing systems as key components.

The assessment concluded that Rwanda has a well-functioning TB surveillance system with accurate, complete, internally and externally consistent data that provide a good overview of the situation in the country. Data are well kept facilitating analyses. Quality and coverage of the vital registration system is low and the country would benefit from a well-developed system to better monitor causes of death. The TB surveillance system in Rwanda accurately captures the efforts of TB control in the country. Trends in the TB epidemic can be well explained by roll out of TB programmatic activities in combination with the HIV response and development of the health system hand in hand with rapid economic development. Access to health care is in general good with broad coverage of the community health insurance and a good coverage of diagnosis and treatment centres offering integrated TB & HIV services. Health care at the grass root level via community health care workers plays a pivotal role. The assessment confirmed that the TB epidemic is declining and prevalence dropped below 100 per 100,000 population, as a result of good program design and implementation of all key recommended TB activities with high performance levels and synergistic efforts in HIV control. Catalysed by the development of the general health sector in conjunction with rapid economic development. The TB epidemic is becoming more concentrated which supports the expanding focus on risk groups (men, prisoners, PLHIV, TB contacts, elderly) under the new developed national strategy (2013-2018). Besides targeting of risk groups the anticipated increase in sensitivity of diagnostic tools to capture cases currently missed through roll out of new diagnostics and wider access to chest X-ray ensuring tailored strategies for each risk group. It is important to keep monitoring the yield of these activities as well as the relative contribution of each group to the overall case load to ensure effective TB control. The lower TB burden makes it more challenging and less cost effective to detect and treat the remaining cases. The program should maintain the current effort, but at the same time develop new strategies requiring more budget. A concerted effort is needed to move towards TB elimination in the decades to come. Rwanda is poised to move in line with the new post 2015 Global TB strategy, to reach less than 10 tuberculosis cases per 100 000 population by 2035 to pave the way for elimination by 2050 (Lönnroth et al., 2010).

1 Introduction

An excellent understanding of the level of, and trends in, disease burden and how these have been (and can be) influenced by the implementation of prevention and treatment interventions is of considerable importance to national health programmes, as well as international donor agencies. It can help to ensure the appropriate allocation of funding and ultimately help to save more lives in the future. Epidemiological and impact analysis should be included systematically as part of National Health Sector Reviews and disease-specific programme reviews. Such analyses are also now required as part of the development of "concept notes" that provide the basis for funding applications to the Global Fund in the new funding model introduced in 2013.

The Rwanda National TB program has developed its new strategic plan for 2013-2018 and is currently developing together with the HIV program the submission of the joined concept note for the new funding model (NFM) of the Global Fund (GFATM). One of the comments raised by the Technical Review Panel (TRP) in May 2014 on the initial version of the NSP and that should be looked at deeply is whether country surveillance data are of enough quality and reliable to guide programming. In October 2013, a first step has been taken to try to evaluate that, using the "WHO Standard and benchmark checklist" to characterize the current surveillance system. One of the key recommendations from the Joint Assessment of the National Strategic Plan (JANS) conducted in June 2014 was to conduct a full "Epidemiological review and impact assessment" following the standardized ToR as developed by WHO jointly with key technical agencies.

Acting on this recommendation the Rwanda TB & ORD division requested the services of KNCV epidemiologist Eveline Klinkenberg who was involved in the assessment of the TB surveillance system in October 2013 to assist the program in conducting the assessment before submission to the Global Fund on August 15th.

1.1 Objectives of the TB Epidemiological review and impact assessment

The main objectives of the TB Epidemiological review and impact assessment were to:

1. Describe and assess current national TB surveillance and vital registration systems, with particular attention to their capacity to measure the level of and trends in TB disease burden (incidence and mortality).
2. Assess the level of and trends in, TB disease burden (incidence, prevalence, mortality) using available surveillance, survey, programmatic and other data.
3. Assess whether recent trends in TB disease burden indicators are plausibly related to changes in TB-specific interventions taking into account external factors including economic or demographic trends.
4. Define the investments needed to directly measure trends in TB disease burden in future.

The detailed terms of reference (ToR) outlining the different analyses to be done for each of the objectives is provided in annex 5.1.

1.2 The implementation process

The 1st objective was evaluated in October 2013, using the WHO Checklist for standards and benchmarks for tuberculosis surveillance and vital registration systems. A full report of that assessment is available and in this report we are providing a summary of the key findings. The current review evaluated objectives 2, 3 and 4. The consultant worked with the full week closely together with Mr Evariste Gasana and Dr Claude Bernard Uwizeye and where needed other member of the NTP M&E team or other NTP staff were asked for input. Before the mission the Rwanda NTP M&E team had prepared the data requested by the consultant well in advance. The first day an inventory of the available data was made to assess which data were still needed. Also on the first day a discussion was held with the Rwanda NTP team (Dr Michel Gasana and Dr Martine Toussaint) to develop a timeline of key events in TB control or the wider health system anticipated to have impacted the TB epidemiology in the country. Thereafter, following the different objectives of the Terms of Reference (ToR) the work was divided in three key parts (objective 2c, objective 3a and 3b) and the three members of the core team first worked to prepare the data in the required format to easily conduct the analysis. Table 1 outlines key indicators, sources of info and analysis done. Subsequently following the outlined ToR systematically for all sub-objectives the outlined patterns were investigated and graphs made to discuss trends. Additional graphs overlaying different in indicators were made to investigate the observed patterns. In the middle of the week a discussion was held to present the initial findings and interpret trends and specifically unexpected observations. This was done collaboratively with key staff members who have been working in the division for many years and have in-depth knowledge of the history of TB control in Rwanda including key developments such as the change in programmatic efforts and implementation of new guidelines. On the last day a debrief was held at the division highlighting key findings outlining the timeline to complete the report and discussing additional data needs.

Table 1 Outline of key indicators, data sourced and analysis done under the different objectives as per term of reference

objective	part	key indicators	data source	analysis
1		*Completed October 2013*		
2	a. Analysis of the level of, and trends in, TB mortality	TB mortality HIV negative individuals	WHO modelled data Global TB report	evaluate pattern
		contributory causes of AIDS deaths	UNAIDS modelled data	evaluate pattern
	b. Analysis of the level of, and trends in, TB prevalence	TB prevalence	national TB prevalence survey data; WHO modelled data Global TB report	evaluate pattern
	c. Analysis and interpretation of the level of, and trends in, TB case notifications	notified cases (rate & absolute number) by	routine TB surveillance data	trend analysis & comparison over time and geographically
		administrative level (national, province, district)	routine TB surveillance data	trend analysis & comparison over time and geographically
		type of TB	routine TB surveillance data	trend analysis & comparison over time and geographically
		age group & gender	routine TB surveillance data	trend analysis & comparison over time and geographically
		category	routine TB surveillance data	trend analysis & comparison over time and geographically
		high risk groups	routine TB surveillance data; national TB prevalence survey data	trend analysis & comparison over time and geographically
		administrative level (national, province, district)	routine TB surveillance data	trend analysis & comparison over time and geographically
3	a) Define and compile data that are relevant to assessment of the extent to which changes in TB disease burden in recent years (e.g. for the last 5–10 years) can be explained by TB-specific interventions/programmatic efforts	*Funding for TB and health care*	World Bank indicators, WHO global TB report	national trend over time, descriptive
		health facility coverage fro TB services	routine TB surveillance data	trend analysis & comparison over time and geographically
		presumptive TB cases over time and by administrative level	routine TB surveillance data	trend analysis & comparison over time and geographically
		active case finding (PLHIV, prisons, community)	routine TB surveillance data, data on PLHIV from HIV program	trend analysis & comparison over time and geographically
		public-private mix activities	routine TB surveillance data	descriptive
		diagnostic delay	research project	descriptive
		treatment succes (overall and PLHIV, smear negative, community TB care)	routine TB surveillance data	national trend over time, descriptive
		MDR-TB control (coverage high risk group testing, treatment outcome)	routine TB surveillance data	national trend over time, descriptive
		TB-HIV activities (testing, ART, CPT, IPT)	routine TB surveillance data	
	b) Define and compile data that are relevant to assessment of the extent to which changes in TB disease burden in recent years can be explained by factors that are not specifically related to TB-specific funding and associated interventions.	*HIV prevalence & ART coverage*	HIV program annual report, UNAIDS modelled data, DHS survey data	trend analysis & comparison over time and geographically
		prevalence of diabetes, tabacco use and under nutrition	World Bank indicators, WHO Global Health observatory	national trend over time, descriptive
		GNI & GDP per capita; % population under poverty line	World Bank indicators, national census data	national trend over time, descriptive
		financial protection (health insurance)	MOH report on health insurance	national trend over time, descriptive
		demographic changes	National census reports	national trend over time, descriptive
		under 5 mortality and other health care performance indicators	DHS survey data	national trend over time, descriptive

2 Description of key findings

2.1 Setting

2.1.1 Overall organization of the health system in Rwanda

Rwanda's history is marked by the 1994 genocide which led to the deaths of 1 million people, and the displacement of millions more. Injury and trauma were followed by the effects of a devastated health system and economy. In the years that followed, a new course set by a new government set into motion equity-oriented national policies focusing on social cohesion and people-centred development. In 1998, the new government launched a consultative process to create a national development plan, which led to a document called Vision 2020.12 The idea was to move from the disaster of the mid-1990s towards becoming a middle-income country by 2020, following the principles of inclusive, people-centred development and social cohesion. Central to this vision was health equity. Prosperity would not be possible without substantial investments in public health and health-care delivery. The Rwandan Constitution of 2003 formalised the inalienable right to health. Rwanda put in place a decentralized health system with community-based health insurance and performance-based financing systems as key components (Binagwaho et al., 2014). In each Rwandan village (Umudugudu), three community health workers are elected by village members, then trained and equipped by the Ministry of Health to deliver key preventive, diagnostic, and therapeutic interventions to link patients to the formal health-care system. There is a CHW for on average every 234 inhabitants. Health Centers operate at the Sector level. Their role is to provide initial care and treatment to patients and to provide preventive care to the community. Their staff members are, in general, secondary and university college level nurses. District hospitals cover the area of a District level. Their role is to provide treatment to patients referred by Health Centers and to provide oversight of Health Centers within their catchment area. Their staff is mainly composed of medical doctors, who have completed seven years of university education in medicine, and nurses who have completed three years of nursing at the university college level. At the national level, the country has four referral hospitals whose role is to provide specialized care to patients referred by District Hospitals. Their staff is composed of specialist medical doctors and high-level nurses.

2.1.2 History of TB control activities in Rwanda

In 1954, a Sanatorium was opened at Gishali in Rwamagana District in the Eastern Province. This inaugurated TB control activities in Rwanda. Until 1989, all TB patients were being managed in this Sanatorium. In 1990 the "Programme National de Lutte contre la Tuberculose" or the "Rwanda National TB Control Program (NTP)" was created by the Ministry of Health. With this, TB control activities were decentralized to the health facility level (all public and faith-based), using the WHO DOTs strategy. The Gishali Sanatorium became a referral center for complicated TB cases until 1994. In February 2005, TB/HIV integrated activities started and in 2006 Cotrimoxazole prophylaxis (CPT) and antiretroviral therapy (ART) were initiated for HIV positive TB patients under the 'one stop service' model (Pevzner, Vandebriel, Lowrance, Gasana, & Finlay, 2011). HIV testing was systematically offered to all TB patients from 2005 onwards. Since 2009 all those with presumptive TB are routinely offered HIV counseling and testing. In 2005, in order to bring TB services close to the community, the community DOT strategy was launched to increase the role of CHWs identification and management of TB patients. Nationwide

coverage for community TB care was achieved in 2010. In 1992-1993, the 1st TB drugs resistance evaluation was conducted indicating a prevalence of MDR-TB in 1.3% and 6.5% of new and previously treated TB patients respectively (Carpels, Fissette, Limbana, & Portaels, 1995). At the end of 1993 the first cohort of MDR-TB patients (20 patients) was initiated on 2nd line treatment. In 1995, when the Rwanda NTP restarted its activities, after the 1994 Genocide against Tutsi, TB treatment was only provided for drugs sensitive patients (new & retreatment regimens). This continued until 2005 when the MDR-TB program was re-launched after the results of a 2nd DR TB survey conducted in 2004-2005. This survey reported a MDR-TB prevalence of 3.9% among new cases and 9.4% among retreatment cases (Umubyeyi et al., 2007). Since then all MDR-TB patients are managed within 3 MDR-TB Specialized Units, before being discharged and being managed within their community, after sputum culture conversion. Since 2010, following the achieved successes in combating MDR-TB, Rwanda is hosting the Programmatic Management of Drug Resistant TB Center of Excellence (PMDT-CoE), serving to share lessons learnt among African countries. The 3rd DRS survey is ongoing and expected to be concluded in 2014.

2.1.3 Current organization of TB control activities in Rwanda

At the community level, CHWs are primarily responsible for identification of presumptive TB cases and case holding. They identify from their villages (called umudugudu) both actively and passively people with symptoms of TB disease and refer them to the nearest health center. This can either be a Center for TB diagnosis and Treatment (CDT) or a Center for TB Treatment (CT). In addition they administer TB drugs to diagnosed TB patients as part of the community DOTS strategy, and increase awareness of the community by conducting community sensitizations on TB symptoms and management(TRAC Plus, 2009). Most of TB diagnosis activities are conducted within CDTs, which are either Hospitals or Health Centers (TRAC Plus, 2009). There are currently (by July 2014) 200 CDTs, including 46 hospitals CDTs (districts and referral hospitals), 143 health centers CDTs, 8 prisons CDTs and 3 private clinics CDTs. This makes an average of 1 CDT per 55,000 inhabitants. Unlike CDTs, CTs are Health Centers with no laboratory facilities for TB. Currently there are 307 CTs. Each CT is under the catchment area of a specific CDT. The CTs collect sputum from presumptive TB cases and prepares slides which are then sent to CDT laboratory for staining and microscopy examination. The CTs also provide treatment to Tb patients based on laboratory results received from CDT. At the District level, District Hospitals provide operational support to Health Centers (whether CDT or CT) through coordination of activities (TRAC Plus, 2009). They provide supervision, mentorship and quality control of all TB technical work done at health centers. This includes quality control for laboratory related activities at CDT/CT and quality of TB case management as well as quality of surveillance data. At the national level, the Tuberculosis and Other Respiratory Communicable Diseases Division (TB & ORD Division, formerly called the TB Unit and internationally known as the Rwanda NTP) determines the strategic orientation of the country's TB control activities. It supervises and coordinates all TB related interventions and advocates for resource mobilization. The overall goal of the national TB program is to mitigate morbidity and mortality, reduce transmission of tuberculosis, and prevent the occurrence of drug resistance tuberculosis strains (TRAC Plus, 2009). TB laboratory related activities and policies are coordinated by the mycobacteriology section of the National Referral Laboratory (NRL) (TRAC Plus, 2009). TB control activities are organized in a multi-year strategic plan subdivided into several detailed plans, i.e. operational annual plan,

monitoring and evaluation plan and other specific plans as required. Rwanda's TB control strategy is based on WHO's Stop TB strategy.

2.2 Objective 1: Assessment of current national TB surveillance and vital registration systems with particular attention to their capacity to measure the level of and trends in TB disease burden

In October 2013 two consultants from KNCV Tuberculosis Foundation provided assistance to Rwanda under the USAID funded TB CARE I initiative to conduct an evaluation of the national TB surveillance system using the Standard and Benchmark Checklist (WHO, Version 2.4.1. October 2013). Below the key findings of that mission are outlined below. Full details can be found in the mission report of October 2013[1].

a) Provide a written description and explanation of the main features of the current national TB surveillance and vital registration systems.

i. TB surveillance system

Since January 2013, TB data are being recorded using an internet based health management information system (HMIS) by each Centre for Treatment of Tuberculosis (CT) and Centre of diagnosis and treatment (CDT). There are a total of 543 centres of which 199 are CDTs. All CTs and CDTs report their data using a standard set of indicators using standardized tools and forms. Case notification data are recorded and reported by the CDTs who hold the TB case registers; these are the centres that diagnose and initiate TB treatment. The CTs follow up patients after treatment initiation and identify people with presumptive TB, they only report on the latter using the HMIS system.

At present, aggregated data are being reported from CDT/CT level upwards. There is a breakdown of where cases originate from including whether a community health worker (CHW) or traditional healer referred them. Rwanda has developed an electronic patient's based system (TB Individual Records management System) which has been piloted in the first half of 2014 and will be rolled out in the second half of 2014. This will provide real time patient level data that will allow multiple episodes of TB in the same person to be identified and at the same time allow for patient management. For example, an SMS system will be inbuilt whereby patients that do not report for their appointment will automatically be reminded.

At CDT level data are verified by the M&E officer and the director in charge before the report is signed off and transferred to central level. Each quarter, TB Evaluation meetings are held at district hospital (DH) level, during which the last quarter's TB data are reviewed and cross-checked with the data from the register and agreed upon in case of discrepancies. Once updated, the CDT/CT data managers upload their facility data into the HMIS system. Only the CT/CDT data manager can make changes to the data file for his/her facility. If the central level finds an anomaly during review they discuss with the CT/CDT data manager who will then query and correct. The DH staff supervises the C(D)Ts in its catchment area and should visit them on monthly basis. During this visit similar to the quarterly review, all data are verified. In addition, quarterly, data verification visits are conducted by RBC/HMIS wherein TB is also included. During these visits data from the TB register, CDT report, DH report and central level report are verified and matched. In the new HMIS system for each report it is indicated whether it was submitted in time and there are inbuilt data quality check to verify reported numbers.

1 Klinkenberg, E and Ochola, R. 2013. Rwanda - Evaluation of TB surveillance system using Standard and Benchmark Checklist. Mission report USAID/TB CARE I, KNCV Tuberculosis Foundation, The Hague, the Netherlands.

ii. Vital registration system

Although there is a national system of registration of births and deaths in the country, causes of death are not documented. Causes of death are being registered at the hospitals where death certificates are given. The government is currently exploring ways to link the two systems and the legal framework is currently being developed for that.

b) Assess the current capacity of national TB notification and vital registration systems to provide a direct measure of TB disease burden using the WHO TB surveillance checklist

Rwanda's TB surveillance system was found to be well-functioning. Rwanda has a system that is designed to capture a minimum set of variables and all periodic data submission are received and processed at national level. The surveillance data provide a good overview of the situation in the country and are externally consistent. Of the 13 standards on the checklist, Rwanda met 6, while 4 were partially met, 2 were not met and 1 was not applicable as the country does not currently have an electronic patient-based reporting system. Overall the data were accurate, complete and internally consistent although when carrying out a detailed verification of the 2012 Annual TB dataset it was observed that for 4/34 districts (11%) the total of sub-aggregated data did not fully match the total numbers reported. However differences were small, a discrepancy of 9/3571 = 0.25% cases. Since 2013, the Rwanda programme reports aggregated electronic TB data via the HMIS system. As a next step it is shifting to electronic surveillance at the patient level and has developed an electronic TB register (ETR) which will be rolled out in the second half of 2014. Quality and coverage of a vital registration system is low as although Rwanda has a national system of registering births and deaths, this coverage is not complete and the system does not document causes of death which are registered at the hospitals.

Using the alternative standard of the checklist it was concluded the benchmark on internal consistency of the surveillance data over time was only partially met as the annual change in TB case notification was not consistent over time during the last 5 years. Although not all standards were fully met, there are no indications that there is severe underreporting of TB cases. Out of pocket health expenditure stands at 21%, below the 25% cut off value. Access to health care is high in Rwanda with 83% having access to care within 2hrs of their home and health insurance is wide spread with 91% of the population being covered (Ministry of Health Government of Rwanda, 2012). The standards related to surveillance of drug resistant TB and TB-HIV were both met. The standard on surveillance of childhood TB was not met as the ratio of age groups 0-4 to 5-14 years was below 1 indicating that especially in children below 5 years TB is underdiagnosed. Child health is an important spear point of Rwanda's health minister. In the new national TB strategic plan of Rwanda (2013-2018), childhood TB was identified as weakness and activities to enhance diagnostic capacity are outlined to increased diagnosis of children with TB. The programme should continue to monitor and try to re-evaluate the quality of diagnostic practices with regards to childhood TB in an attempt to address under-reporting of childhood TB. In addition, enhancement of contact tracing could also contribute to increased detection of childhood TB cases. Two standards could not be met because no inventory study has been done. When looking at the need to conduct an inventory study as outlined in the WHO guide[2], Rwanda would not undertake one as surveillance coverage is good and there is no indication of severe underreporting and no prominent private sector. Therefore these standards could be considered met.

2 Assessing tuberculosis under-reporting through inventory studies, WHO, February 2013, ISBN: 978 92 4 1504942, WHO reference number: WHO/HTM/TB/2012.12, available via http://www.who.int/tb/publications/inventory_studies/en/index.html

c) Summarize the main strengths of the current surveillance system and the weaknesses/gaps that need to be addressed, based on the findings from a) and b).

Based on the strengths and weaknesses outlined above it can be concluded that although some minor inconsistencies were observed in the data in general the TB surveillance system in Rwanda seems to accurately capture TB cases detected as well as the efforts of TB control in the country. Key recommendations made (in October 2013) for the strategic plan were:

Recommendations (Oct 2013)	Current status (July 2014)
a) Develop a scale-up plan for the electronic patient-based system	Being finalized
b) Update the M&E plan to include task-shifting as a result of shifting to an electronic system	Under development
c) Develop OR plan outlining key research questions to be answered (initial analysis using patient based data, prospective studies to be integrated etc.)	Included in the NSP
d) Consider developing a scoring system for supportive supervision to better quantify results	Being tested
e) Conduct in-depth analysis of the surveillance data over the last 5-10 years	conducted, this report
f) Every 5 years, evaluate the surveillance system and the data it generated linked to the external TB Programme Review	Planned in the new NSP

M&E = Monitoring and Evaluation; OR = Operational Research; NSP=National Strategic Plan

2.3 Objective 2: Assessment of the level of, and trends in, TB disease burden

a) Analysis of the level of, and trends in, TB mortality.

i. Analysis of trends in TB mortality among HIV-negative individuals.

As there is no well-functioning vital registration system documenting causes of death or survey data indicating trends in TB mortality among HIV-negative individuals, the modelled mortality estimates from the WHO global report were used. The estimates from the 2013 Global report indicated a downward trend (although with wide confidence intervals) since 1994. However, the new profile for the 2014 Global TB report (as realised in draft on 31st July 2014) suggest a very different trend with much narrower confidence bounds (Figure 1). The 2013 one starts around 40/100,000 in 1990 with a level of around 10/100,000 at present, meaning the Millennium Development Goal (MDG) of halving TB mortality is achieved. The new trend as prepared for the 2014 Global TB report suggest much lower levels of TB mortality then previously, with la level around 5/100,000 in 1990, peaking in 2006 at around 8/100,000 population after which a decline to a current level of around **7**/100,000 is observed. This trend would mean the MDG target would not have been achieved but instead an increase in mortality is hypothesized since 1990 levels. Considering the trend in case notification rate (CNR -see Figure 4) and the breakdown of the health system following the 1994 genocide and the collapsed system in the years after, higher TB mortality in the second half of the nineties is expected (Binagwaho et al., 2014). Therefore the difference in estimated mortality between the 2013 and 2014 global TB report could be due to changes in modelling assumptions or methods which are not specified (Binagwaho, Gasana, Nyemazi, Nutt, & Wagner, 2013).

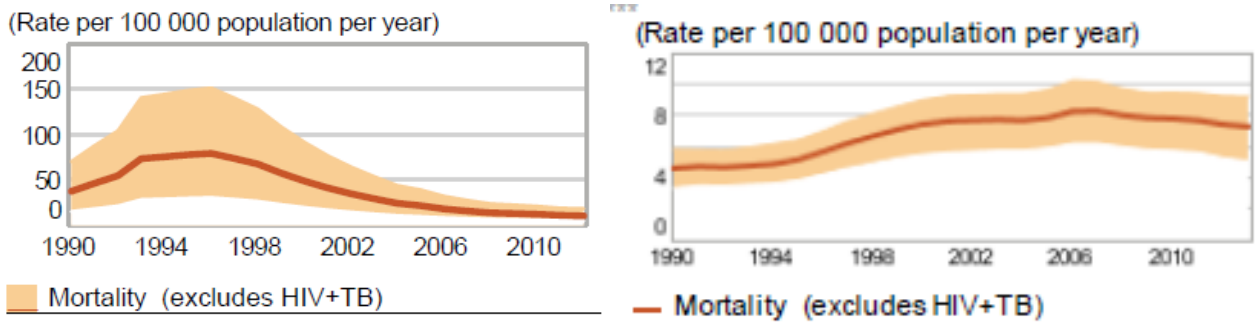


Figure 1 Estimated trend in TB mortality as estimated by WHO in 2013 (left) and 2014 (right) Global TB report.

ii. Analysis of trends in the distribution of contributory causes of AIDS deaths (with particular emphasis on TB)

The hypothesized trend in AIDS deaths from 1990-2013 shows an increase from 1990 onwards reaching maximum levels during 2000-2003 after which the number of deaths rapidly declines (Figure 2) after the introduction and rapid scale up of ART from 2004 onwards (Figure 49). It should be noted that among the AIDS death there will be several TB deaths that are registered as HIV death when applying the ICDX coding (Mudenda et al., 2012). There are no data available on contributory cases of AIDS deaths in the country either from a vital registration system or specific studies. The WHO global report (2013) estimates a TB mortality rate of HIV+ persons of 6.5 per 100,000 population (Table 2).

Table 2 Estimated TB mortality for 2012 as per the 2013 Global TB report

Estimates of TB burden * 2012	Number (thousands)	Rate (per 100 000 population)
Mortality (excludes HIV+TB)	1.2 (0.53–2.1)	10 (4.6–18)
Mortality (HIV+TB only)	0.74 (0.6–0.92)	6.5 (5.2–8)

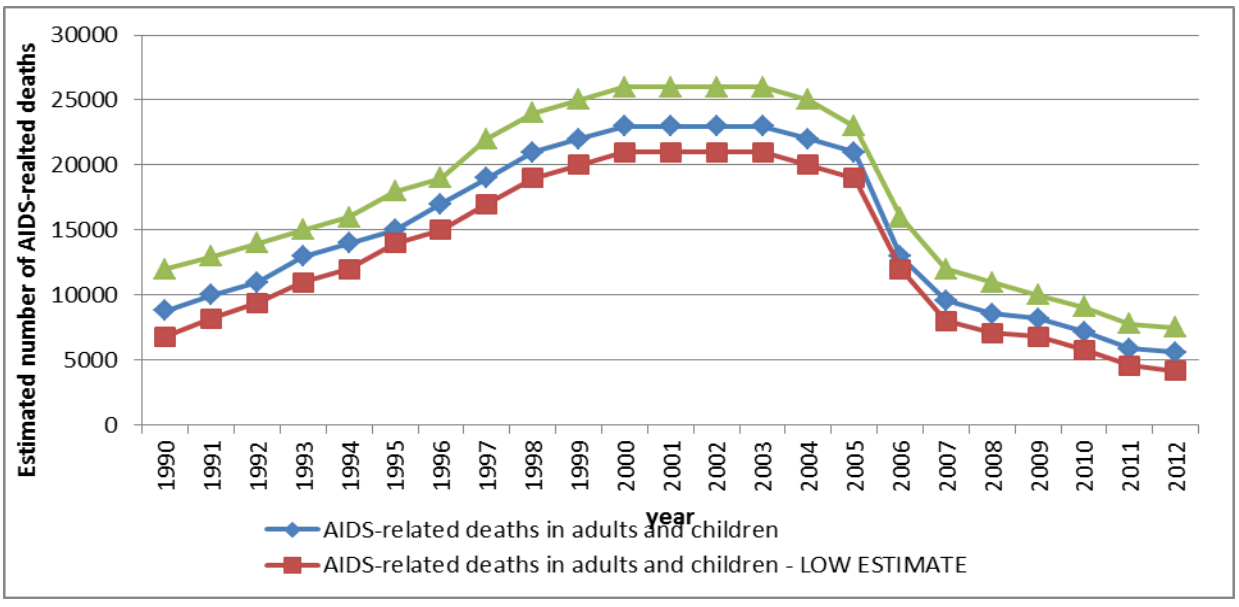


Figure 2 Estimate trend time of AIDS-related deaths in adults 15-49 years with low and high estimate bounds
(Source: UNAIDS Report on the Global AIDS Epidemic – 2013)

iii. Analysis of the level of, and trends in, TB prevalence.

Rwanda conducted its first national TB prevalence survey in 2012, surveying 43,128 participants in 73 randomly selected clusters all over the country and detected 40 cases of M.TB and 16 MOTT cases. Adjusting for design and non-participation the obtained TB prevalence among adults was 74.1 (95% CI 48.3–99.3) per 100,000 population for smear positive TB and 119 (95% CI 78.8-159.9) for bacteriological confirmed MTB in Rwanda (Table 3). This estimate is considered to be robust because the participation rate was high at 95.7%, with 99.8% of participants conducting both symptoms and X-ray screening procedures, and 99.0% of those eligible submitting at least one sputum sample. Males were 4-5 times more likely to have TB than females and people in the oldest age group of 55 years and above were 3 times more likely to have TB compared to those 15-34 years old (Table 3). Using the estimates for the adult population obtained from the first national TB prevalence survey, WHO extrapolated to the total population for all forms of TB at 91 (95% CI 66-120) (Draft profile Rwanda Global TB report 2014), which is lower than the previous WHO point estimate (2012) of 114, but within the 95% confidence interval of 61–183. Using this new TB prevalence figure, the trend in TB prevalence was re-estimated for the 2014 Global TB report. The new trend shows a smoother curve at much lower levels than the earlier trend which followed more the pattern of the case notification with an increase from the early 1990s, peaking around 1996 after which a steady decline is hypothesized till the current level of below 100 per 100,000 population. Similar to the above outlined figures for TB mortality (see 2.2.a) above), it can be expected that after the 1994 genocide TB prevalence was highest therefore the assumption on which the draft 2014 figures are based need to be explained further.

Table 3 Summary of Pulmonary TB Prevalence Estimates in the adult population in Rwanda

	Prevalence of smear positive TB per 100,000 adult population	Prevalence of bacteriologically confirmed MTB per 100,000 adult population	Patient Diagnostic rate For smear positive TB in the adult population
	Estimate (95% CI)	**Estimate (95%CI)**	**Estimate (95%CI)**
Overall	74.1 (48.3 – 99.3)	119.3 (78.8 – 159.9)	0.77 (0.57-1.18)
By sex			
Male	141.9 (87.5 – 196.2)	208.2 (138.7 – 277.8)	0.56 (0.41-0.91)
Female	23.7 (4.7 – 42.6)	53.0 (19.9 – 86.1)	1.51 (0.84-7.60)
By age group			
15-34 yrs	56.8 (27.4 – 86.2)	85.5 (46.1 – 124.9)	0.86 (0.56-1.78)
35-54 yrs	65.6 (21.1 – 110.2)	113.8 (35.0 – 192.6)	1.12 (0.66-3.47)
54+ yrs	158.8 (54.1 – 263.0)	262.4 (104.4 – 420.5)	0.39 (0.23-1.13)

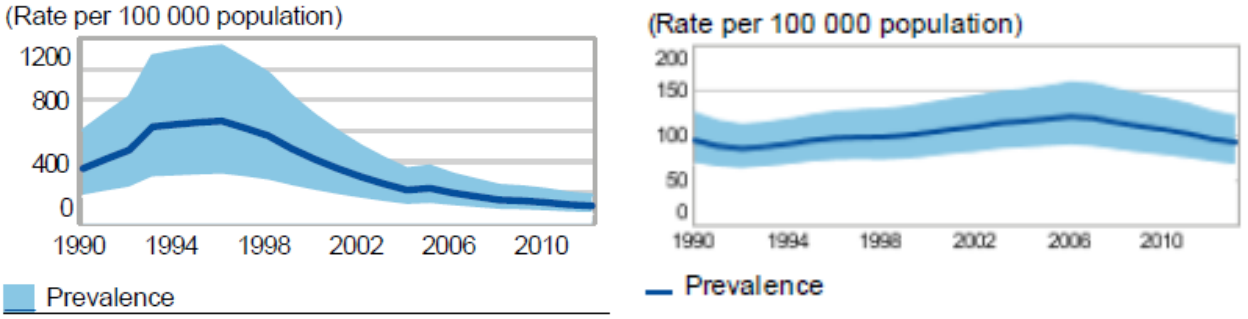


Figure 3 Estimated trend in TB prevalence by WHO from the 2013 (left) and 2014 (right) Global TB report.

b) Analysis and interpretation of the level of, and trends in, TB case notifications

i. Plot time series of case notifications and analyse results,

The trend in case notification rate(CNR) for new cases of TB showed a general increase over the last two decades between 1995 and 2006 with clear peaks in 1998-1999, a smaller peak in 2002 reaching a maximum of 92.0 per 100,000 population in 2006 (Figure 4). Since then, CNR has been declining annually at a rate of 5-10% (Figure 5). The peak in 1998-1999 is likely the results of two key developments. The 1994-genocide resulted in a breakdown of the health system (Binagwaho et al., 2014) resulting in a back log of TB cases to be diagnosed and put on treatment. At the same time after the genocide there was a large prison population mounting to nearly 130,000 people. Over the period 1996-1998 a screening program was introduced in the prisons to control TB with the aim to conduct active and passive case detection and put detected cases on directly observed treatment. Eight diagnostic and treatment centres were set up in prisons while at the same time the district hospitals provided the necessary support. In the 8 prisons with a population of 57, 961 prisoners, 1949 cases were detected indicating a prevalence of 3.8% (Karibushi & Kabanda, 2000)(see annex 5.5). Treatment success rate in the first cohort was 86%.

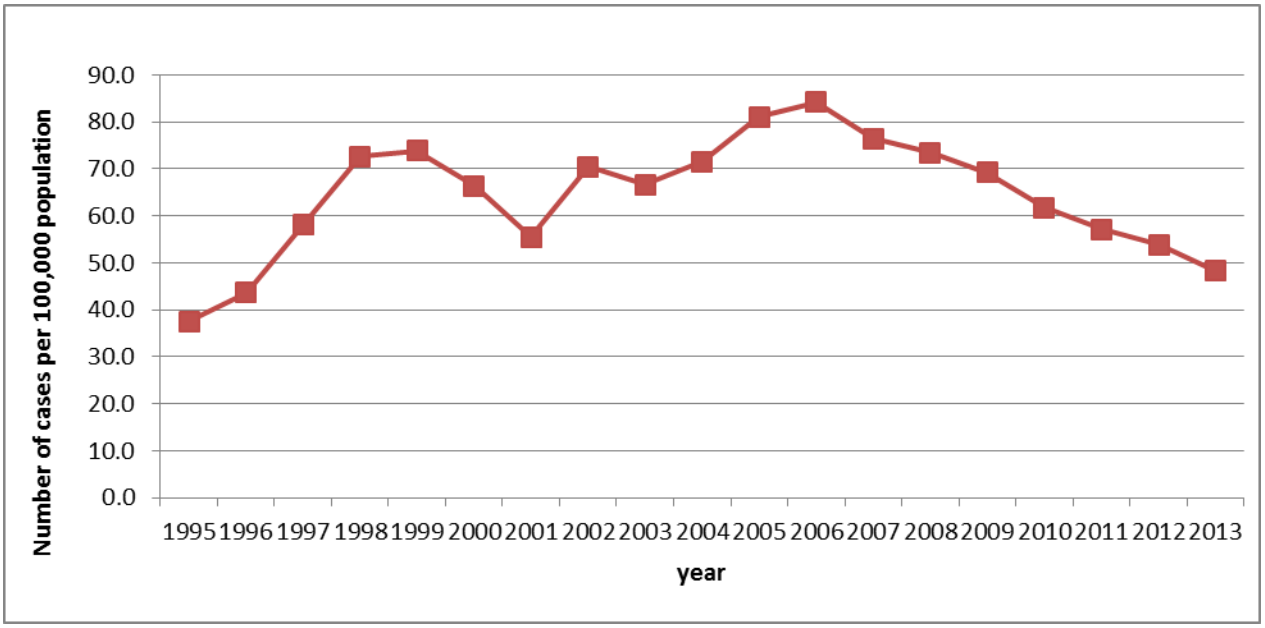


Figure 4 Trend in Case Notification Rate (CNR) of new cases of TB between 1995 and 2013
(source: National Surveillance data Rwanda NTP)

After 1999 TB CNR started falling probably as a result of the backlog of cases that had been cleared. From 2001 the TB CNR has been increasing again likely a result of the increasing TB programmatic activities following the built up of the health system. Activities received a further boost in 2003 with the start-up of TB-HIV activities, the conduct of the first TB specific training for doctors since 1995 and laboratory training. The lower number of notified cases around 2001 could maybe also be partly attributed to issues with recording and reporting as a quote from the 2003 TB annual report illustrates (Box 1 – in French). In 2004-2005 more and more TB activities were rolled out while at the same time there was a rapid expansion of diagnostic and treatment centres (see the list of key events in annex 5.3 and Figure 32 & Figure 34). The first National Strategic Plan published in 2005 focused for TB on:

1. Improving care and treatment of TB cases
2. Improving TB screening & diagnosis specifically for women
3. Improving case finding and management for TB-HIV co-infected patients
4. Improving care and treatment for drug resistant TB cases
5. Health system strengthening for TB control at all levels

In 2006 CNR reached a maximum after which it has been steadily declining despite further enhancement of the TB program in subsequent years with notably in 2010 the start of PBF for TB, reaching of full coverage of community DOT, policy change to offer HIV testing to all presumptive TB cases, in terms of Infection Control (IC) the triage of coughers at OPD & HIV clinics and under the NSA the scale up of community TB control and other health activities while at the same time the change in suspicion criteria for presumptive TB cases from 3 to 2 weeks cough as well as the change in the criteria for defining a positive slide from two out of three to one out of three (see annex 5.3).

In absolute numbers Rwanda currently reports about 5000 new TB cases annually, increasing from 2734 cases in 1995 when the program was revived after the 1994 genocide to a peak of 6232 cases in 1999, decreasing to just close to 5000 (5047) in 2001 and reaching a maximum level of 7589 in 2006 since when it has been declining steadily with a few hundred cases per year to the current level of 5,087 cases (Figure 6).

Box 1 : Weak points in M&E as described in the annual report of the TB program in 2003, p 7-8

Points faibles :

- Dans tous les districts supervisés le registre de cas de tuberculose du district est incomplet.
- Pour la plupart des districts sanitaires il y a encore des erreurs dans l'élaboration des rapports trimestriels sur la tuberculose transmis au PNILT.
- La transmission des rapports trimestriels est irrégulière
- Le DS Muhima et le DS Remera n'ont jamais transmis le rapport trimestriel sur la tuberculose au PNILT alors que la plupart de leurs FOSA élaborent ce rapport.
- Dans la plupart des districts il n'y a pas de supervision des activités de lutte contre la TB dans les FOSA ou des supervisions irréguliers par les superviseurs du district.
- Les DS de Nyagatare et Rwinkwavu ont connu une rupture de stock de médicaments.
- Le DS Remera n'a jamais eu des antituberculeux dans la pharmacie de district ni les produits et matériels de labo.
- Dans les DS Kibilizi et DS Bugesera le médecin chef de district sanitaire ou un superviseur est parti ou a été muté ailleurs

Looking at the trend in case notification by province which is available from 2007 onwards indicated that all provinces show a decreasing trend expect for the Northern province (Figure 7). The Northern Province however has the lowest CNR throughout. Kigali city has the highest CNR throughout (note Kigali used the secondary Y-axis with a different scale!) which is 3-5 times higher than in the other provinces. Also it shows the sharpest decrease in CNR since 2007, falling from 125 to 77 per 100,000 population.

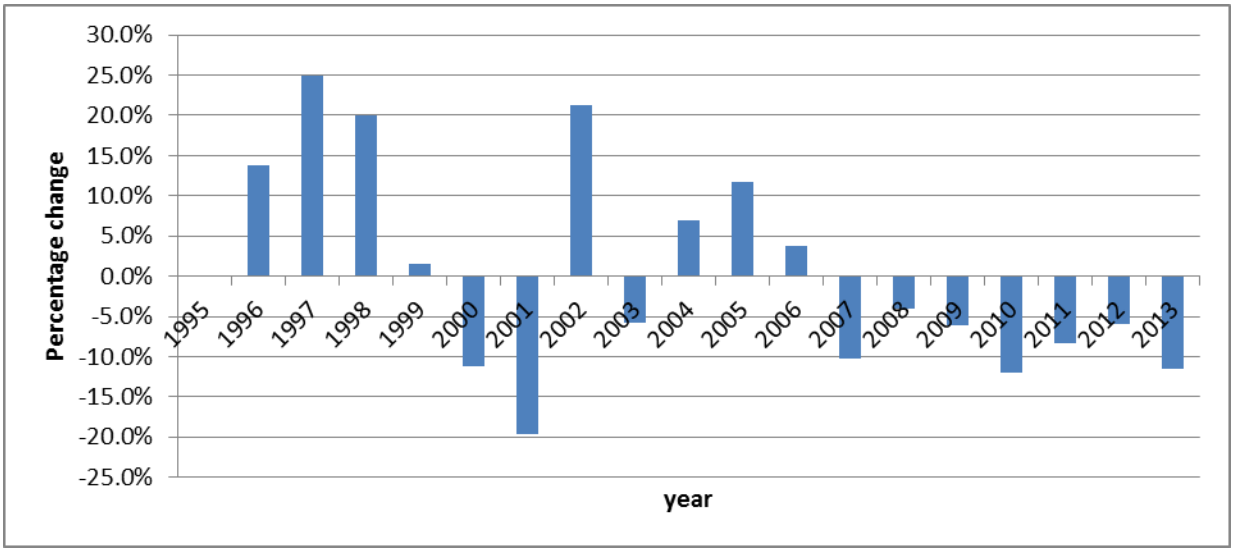


Figure 5 Percentage of annual change in case notification of new cases compared to the previous year for the period 1996-2013

(Source: National Surveillance data Rwanda NTP; percentage change is calculated as year2 -year1 divided by year 2)

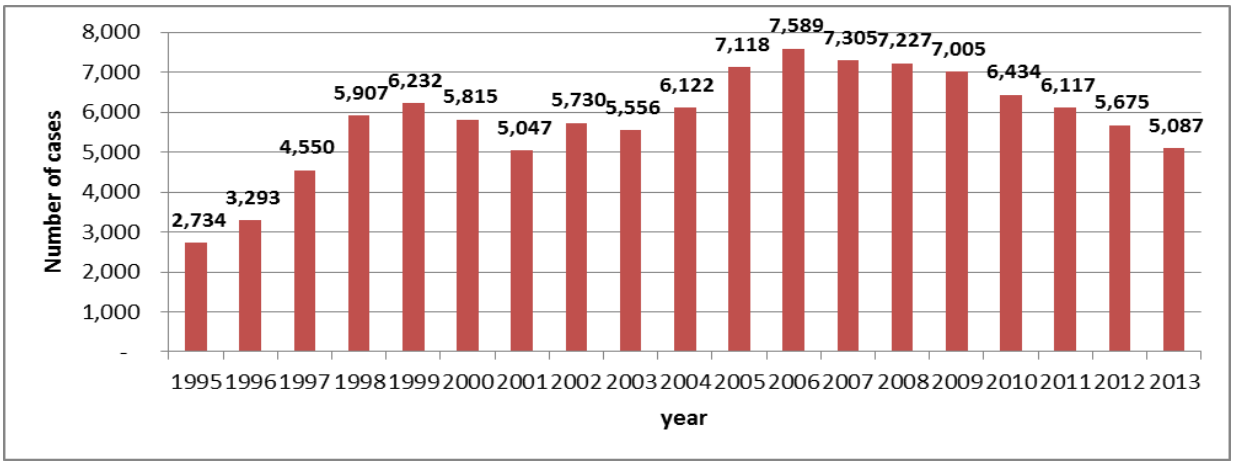


Figure 6 Absolute number of notified new TB cases (all forms) in Rwanda from 1995 to 2013.

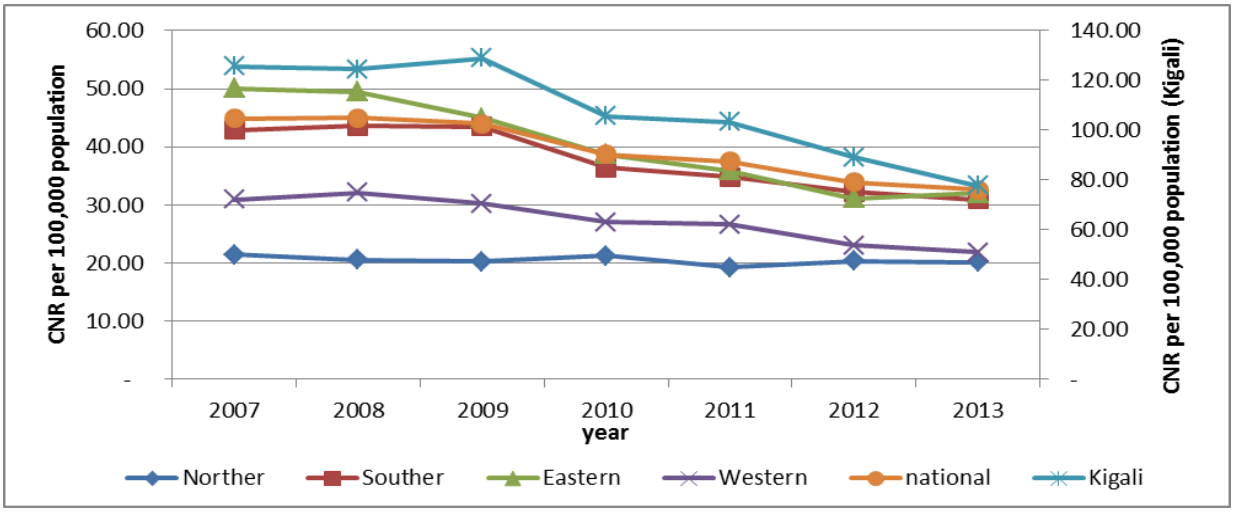


Figure 7 Trend in TB Case notification Rate (CNR) per 100,000 population by province and at national level between 2007 and 2013.

[Note Kigali used the secondary Y-axis!]

ii. Analysis of the geographic distribution of case notification rates among subnational areas and how this has changed over time, and exploration of reasons for observed trends and geographical heterogeneity.

Case notification rate varies substantially over the country (Figure 8), ranging from a CNR of 10.2 in Nyaruguru district in Southern province to 134.2 in Nyarugenge district in Kigali city. There is substantial variation among the districts within the provinces, except for the Eastern Province where CNR is more or less homogeneous. Kigali has by far the highest CNR throughout, but even there, CNR varies with Nyarugenge district having more than double the CNR of Gasabo district. During discussions with the central level team it was indicated that most of the districts with higher CNR are urban/towns. Urban areas in Rwanda are known to have higher HIV prevalence, data from the DHS 2010 indicate that "HIV prevalence is three times as high in urban areas (7.1 percent) as in rural areas (2.3 percent)" (National Institute of Statistics of Rwanda, 2010) but there might be other factors affecting TB in the urban setting like crowding following rural population migration and access to diagnosis. The reason why Eastern Province shows a more homogenous pattern of CNR could be linked to the fact that overall the region is more homogenous; it is a plateau that is more or less rural throughout with no clearly defined urban areas. While the other provinces have more differences in altitude and development.

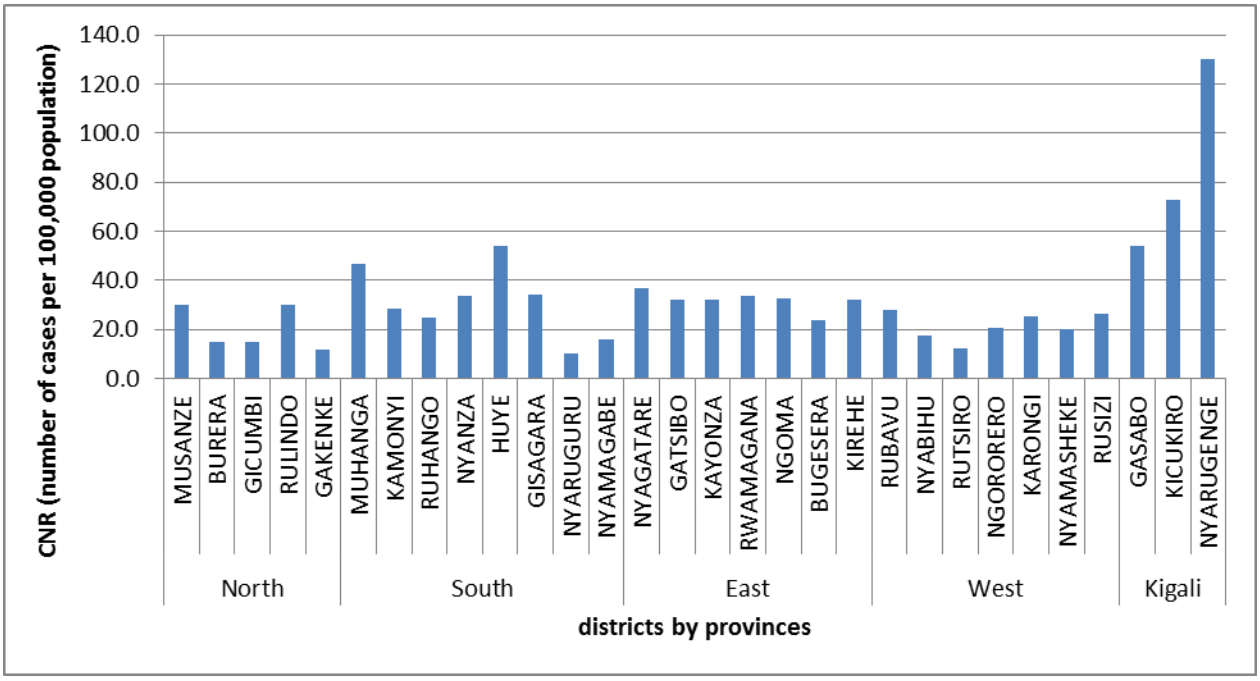


Figure 8 TB case notification rate for new smear positive TB cases by district for the year of 2013

Mapping the CNR by district (Figure 9) for 2013 shows that that most districts have a CNR below 40 per 100,000 population. Five districts have a higher CNR: the 3 districts of Kigali (in central Rwanda and the district of Huye and Muhanga in the Southern Province. The reason for the higher CNR in the three Kigali districts is likely linked to the higher HIV prevalence in Kigali in combination potentially with crowding conditions in the capital city. Comparing the districts in terms of access to and spending on health care and health insurance coverage does not indicate any specific difference for these five districts. Health insurance is generally high with three quarters of districts having a coverage of at least 85%. In terms of coverage of health facilities providing TB services, there are no clear difference observed between districts that could explain the observed differences in

CNR, Gasabo in Kigali has the lowest among the five districts at 1.56 per 100,000 population while Huye and Nyarugenge have a coverage above 3 per 100,000 population (see table in annex 0 and Figure 33 & Figure 34). During the DHS survey data on the number of people per sleeping room are collected which did not show huge variation among districts ranging from 2.3 to 2.6 people per room (National Institute of Statistics of Rwanda, 2010). Childhood mortality and malnutrition as proxies for general health do also not differ in these districts. A difference is observed in smoking behaviour, with both Huye and Muhanga, reporting the highest proportion of women that smoke cigarettes (1.2%). However when look at overall tobacco use, Huye is high at 8.9% although not the highest which is 15.5% in Gisagara district also in Southern province. For men, both any tobacco use and smoking cigarettes is highest in Huye at 31.5 and 21.7% respectively. However men in Muhanga smoke less, at 18.4 for any tobacco Data on alcohol consumption could not be obtained at district level. Although HIV prevalence is higher in urban sites and especially Kigali it is not specifically high in Huye and Muhanga district (see for more details below Figure 10 & Figure 11). After discussion with the teams no specific reasons could be identified for the higher CNR in Huye and Muhanga besides a potential role for smoking, therefore a more in-depth investigation in these districts s for the higher reported CNR would be needed to identify and address the higher CNR in these areas.

The pattern by district over time (see graphs in annex 5.5) shows a quit consistent pattern with most district having a decreasing trend in new smear positive CNR or remaining at the same level. Two districts in the Northern Province (Rulindo and Buhera) show an increasing CNR between 2011 and 2013. The reason for this should be further investigated. Mapping the new smear positive CNR by district between 2007 and 2013 clearly shows the declining trend over the country with most district turning from red and orange to yellow and green except for the five discussed earlier (see maps in annex 5.5).

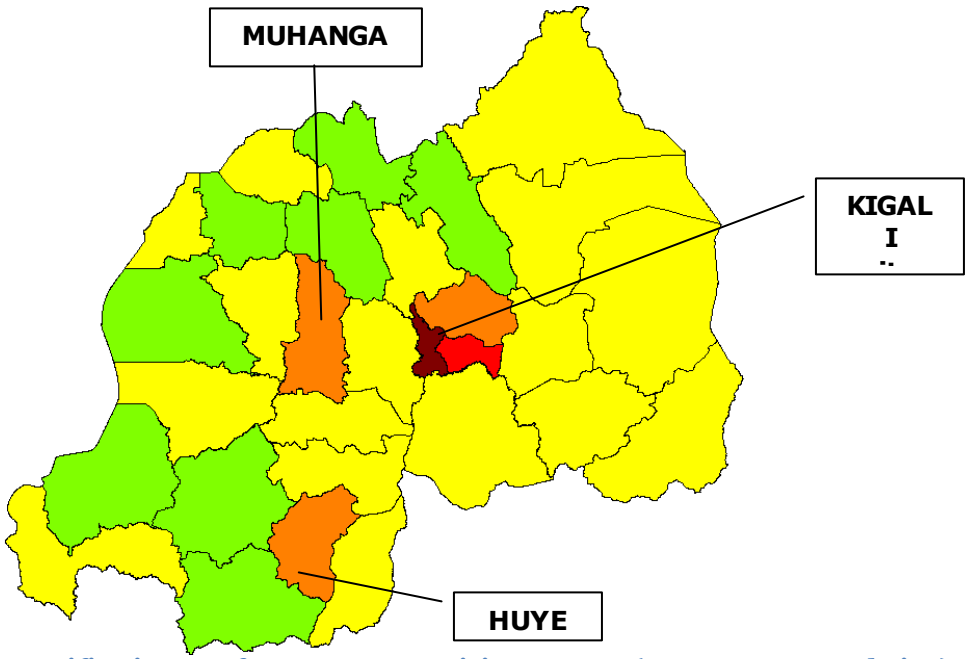


Figure 9 Mapped case notification rate for new smear positive TB cases (per 100,000 population) by district for the year of 2013

The geographical HIV pattern indicates the HIV prevalence is highest in Kigali and lower in the North and South of the country as outlined on a map from 2008 (Figure 10 & Figure 11). There is a central zone with intermediate prevalence that extends along the border with DRC. A comparison of the reported HIV prevalence during the DHS of 2005

and 2010 indicates that the geographical patterns at provincial level remained stable over this period (Table 4). Looking at HIV prevalence at district level (2010 DHS data), overall and for men and women separate shows that overall and for men the HIV epidemic is concentrated in Kigali. For women the highest prevalence is also in Kigali but there are several others districts with a prevalence above and thata more heterogeneous picture (Figure 11), suggesting that in most of the country seropositivity has dropped below 1% apart from few district, notably Kigali.

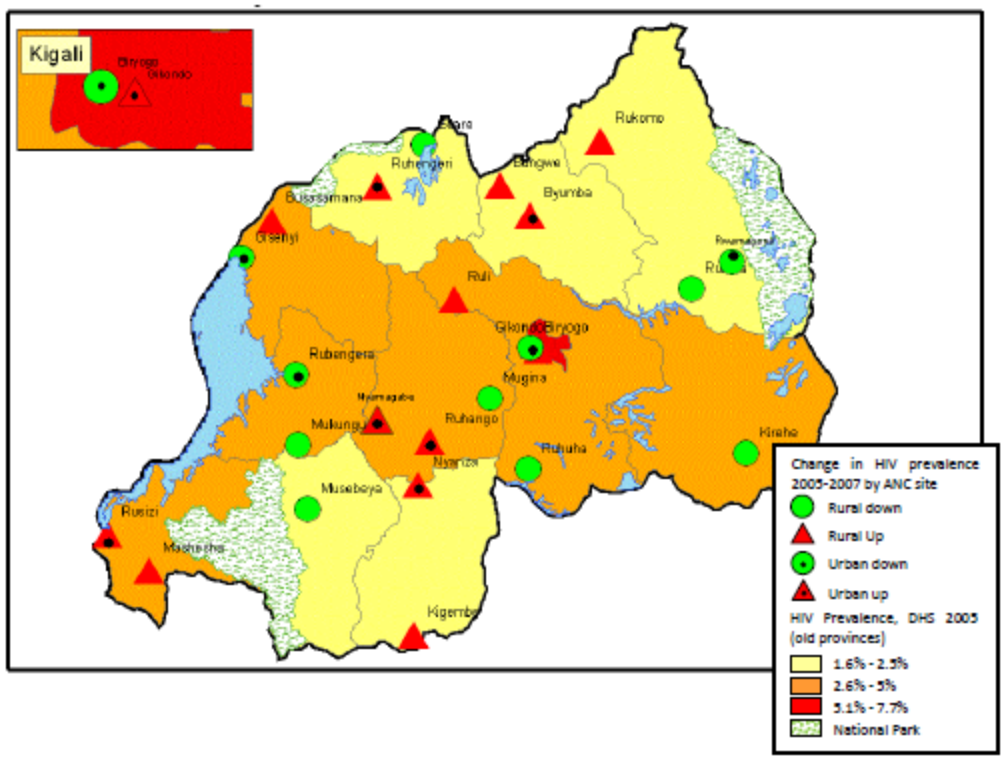


Figure 10 HIV prevalence by province based on DHS and change in ANC sentinel surveillance sites from 2005 to 2007 by urban and rural site (TRACplus, 2008)
(source: figure adapted from Rwanda National Strategic Plan on HIV and AIDS 2009-2012, march 2009)

	DHS 2005			DHS2010		
province	**Women**	**Men**	**Overall**	**Women**	**Men**	**Overall**
City of Kigali	8.0	5.2	6.7	9.4	5.1	7.3
South	3.1	2.0	2.7	3	1.8	2.4
West	3.7	2.4	3.2	3.2	2	2.7
North	2.6	1.1	2.0	3.1	1.8	2.5
East	2.9	2.1	2.5	2.5	1.6	2.1
Type						
Urban	8.6	5.8	7.3	8.7	5.4	7.1
Rural	2.6	1.6	2.2	2.8	1.6	2.3

DHS=Demographic and Health Survey
Table 4 HIV prevalence (%) as reported in the DHS 2005 and 2010 by province and urban rural.

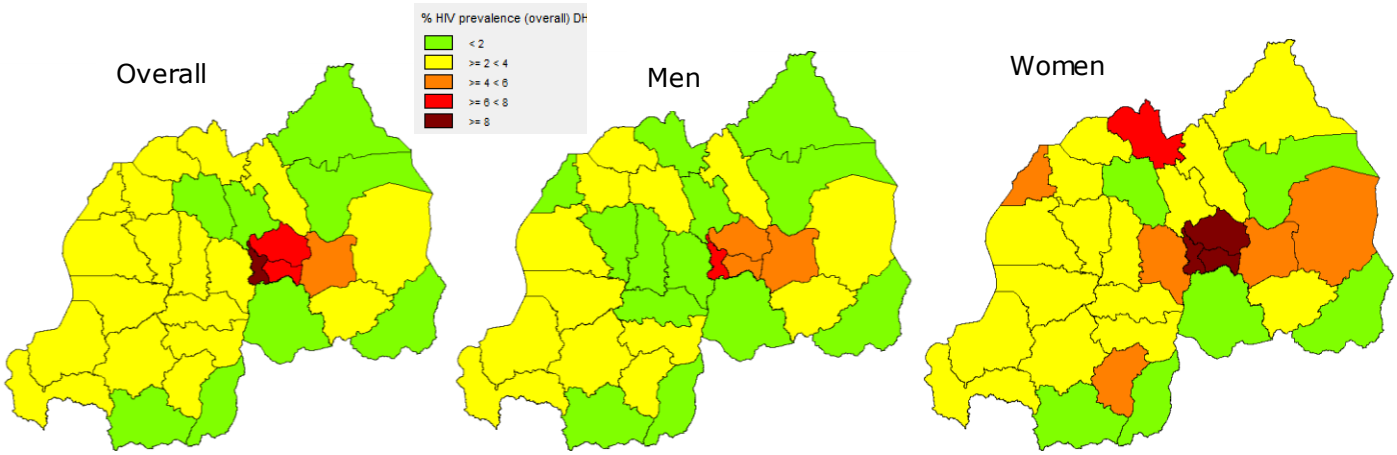


Figure 11 HIV prevalence in Rwanda, overall, for men and for women (DHS 2010 data)

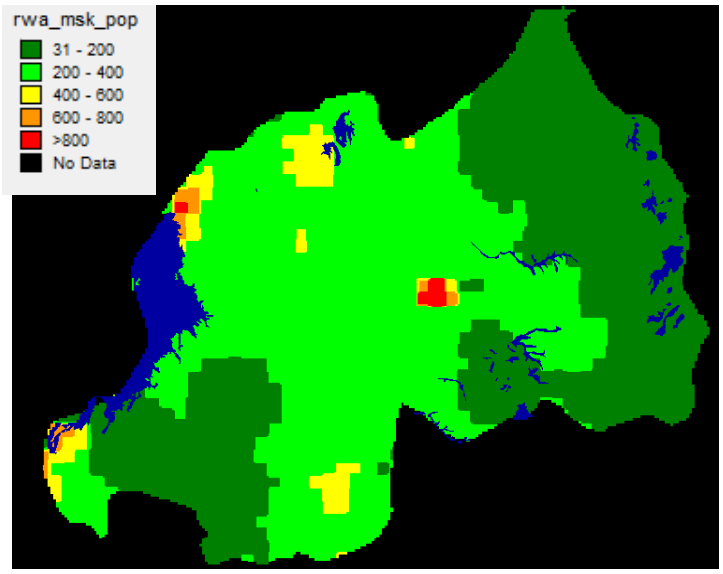


Figure 12 Mapped population density in Rwanda

Investigating the CNR pattern for males and females highlights some interesting differences (Figure 13;Figure 14). Overall the male CNR is much higher, double or more than that in females, except for some districts (circled in red in Figure 13) where the ratio is much lower. The reason for this lower ratio was discussed with the team but no plausible reason could be identified. The lower ratio could be either due to a higher TB burden in women in these areas or underdiagnoses of men in these districts. Plotting the male and female CNR on a map by district indicates that only in Kigali female CNR reached >40 per 100,000 while male CNR is 40-60 per 100,000 population in the eastern province and few other districts. Muhanga and Huye and the 3 districts of Kigali have the highest CNR (over 60 per 100,000 population and two districts even >80 per 100,000 population). For the females the districts of Huye and Muhanga do not have a higher prevalence suggesting it is the men driving the epidemic there.

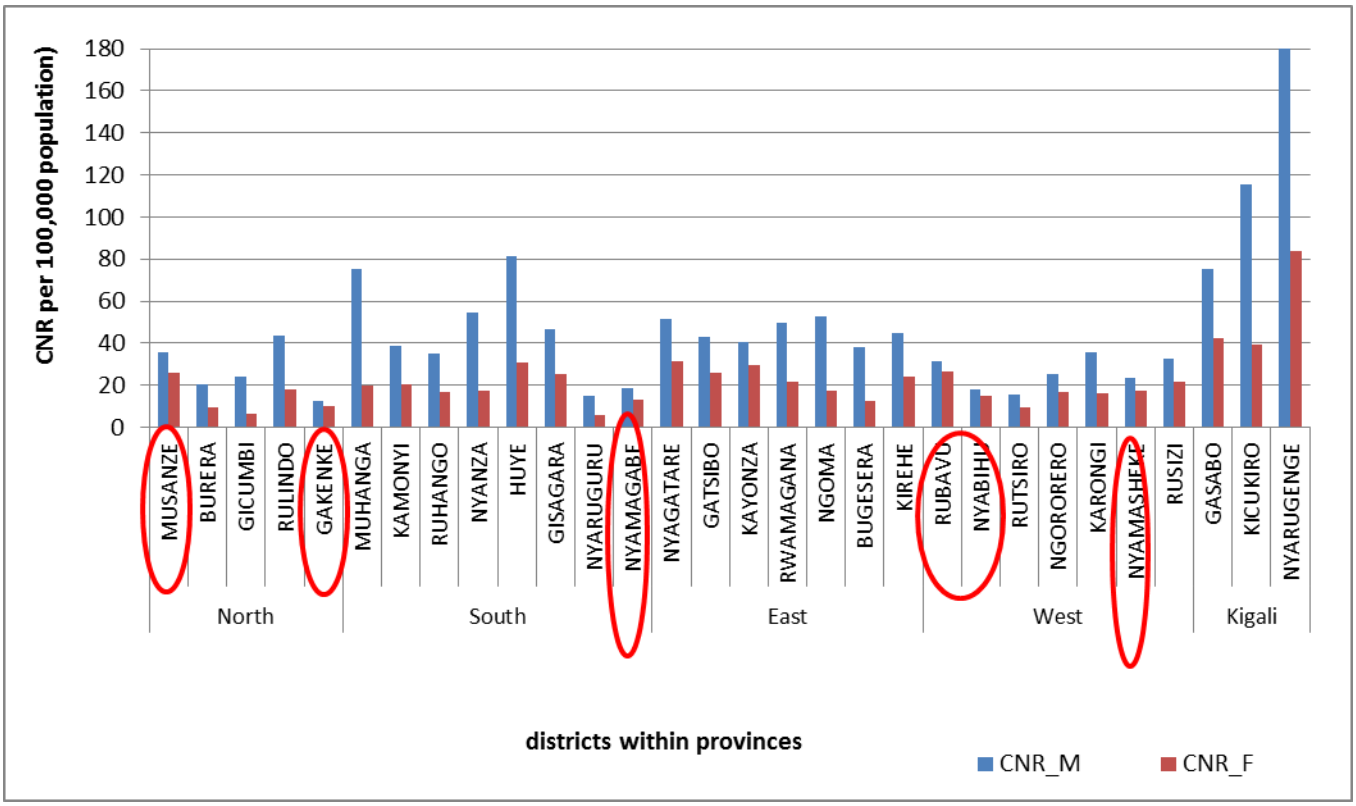


Figure 13 Male and female case notification rate for new smear positive tuberculosis by district for the year 2013.

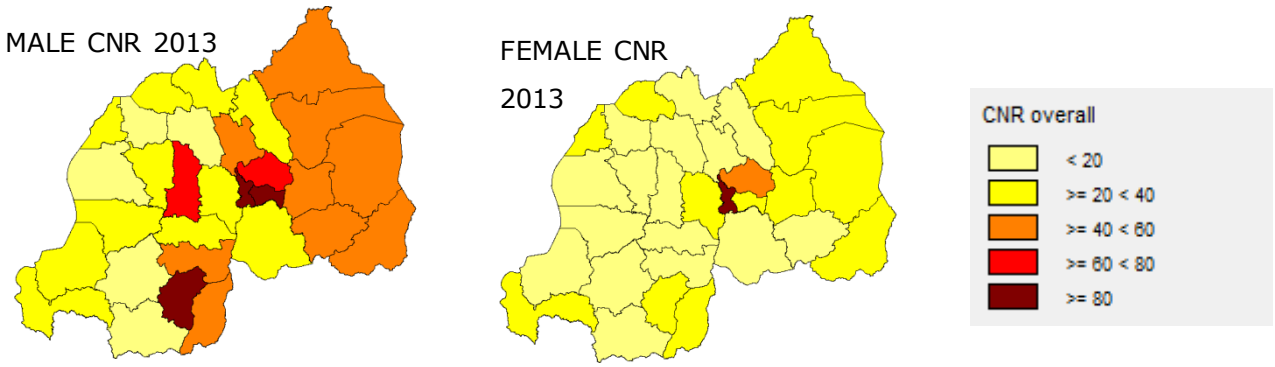


Figure 14 Mapped male and female case notification rate for new smear positive tuberculosis by district for the year 2013.

Looking at case notification by age group and gender (Figure 15) for each of the provinces shows the very high CNR for men from 15-44 years but especially from 25-34 years in Kigali. The difference between male en female seem most profound in Kigali, South and East and less so in the Western and Northern province. For age related patterns see also below and Figure 18.

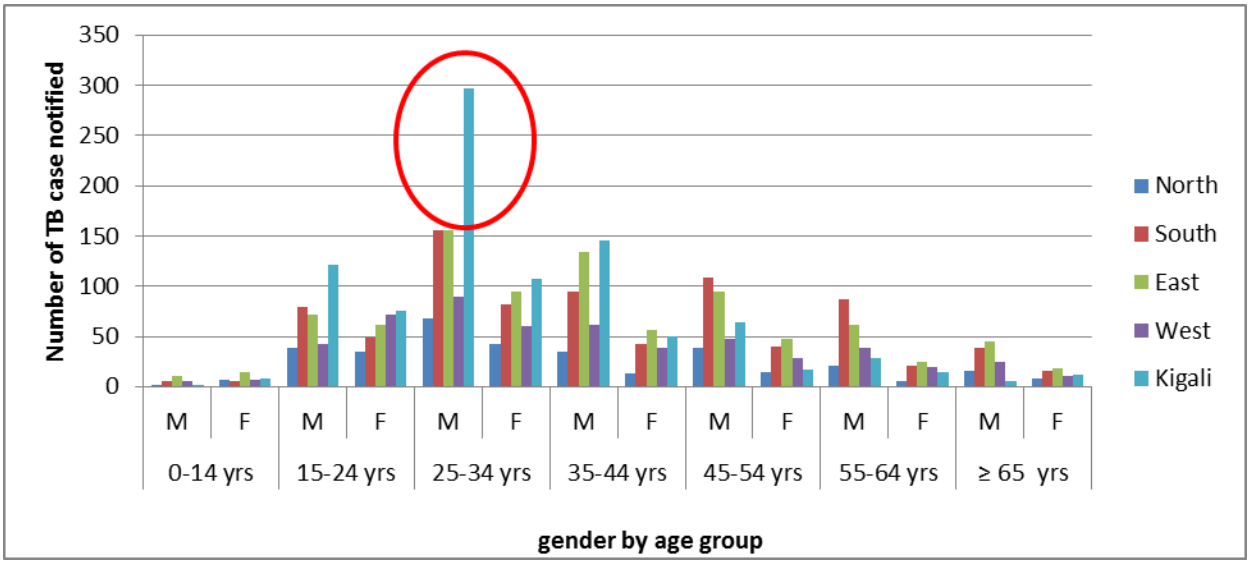


Figure 15 Notified number of male and female new smear positive TB cases by age group and sex for the year 2013

iii. Analysis of trends in the proportions of notified cases: (a) by type of TB disease - bacteriologically confirmed and extra-pulmonary TB;

Looking at the proportion of notified cases by type of TB disease indicates that for smear positive cases there is a slight increasing trend in recent years (Figure 16), although in absolute numbers all type of TB show a downward trend (Figure 17). The relative increase in smear positive cases in recent years could be linked to different policy changes: In January 2008, the Ziehl-Nielsen staining was rolled out nationwide replacing the cold staining method (*2008 NTP Annual Report Section 6.1. page 15*). Then in 2010 a change was made in diagnostic definition whereby a person was considered smear positive already if one of the three slides was positive while before 2 slides needed to be positive. Both changes could have resulted in more smear positive TB cases having been detected and notified. A parallel development was the active case finding by CHW who look predominantly for cough and do not really actively look for cases of EPTB.

Figure 16 Trend in proportion of smear negative, smear positive and extra-pulmonary tuberculosis cases notified between 1995 and 2013

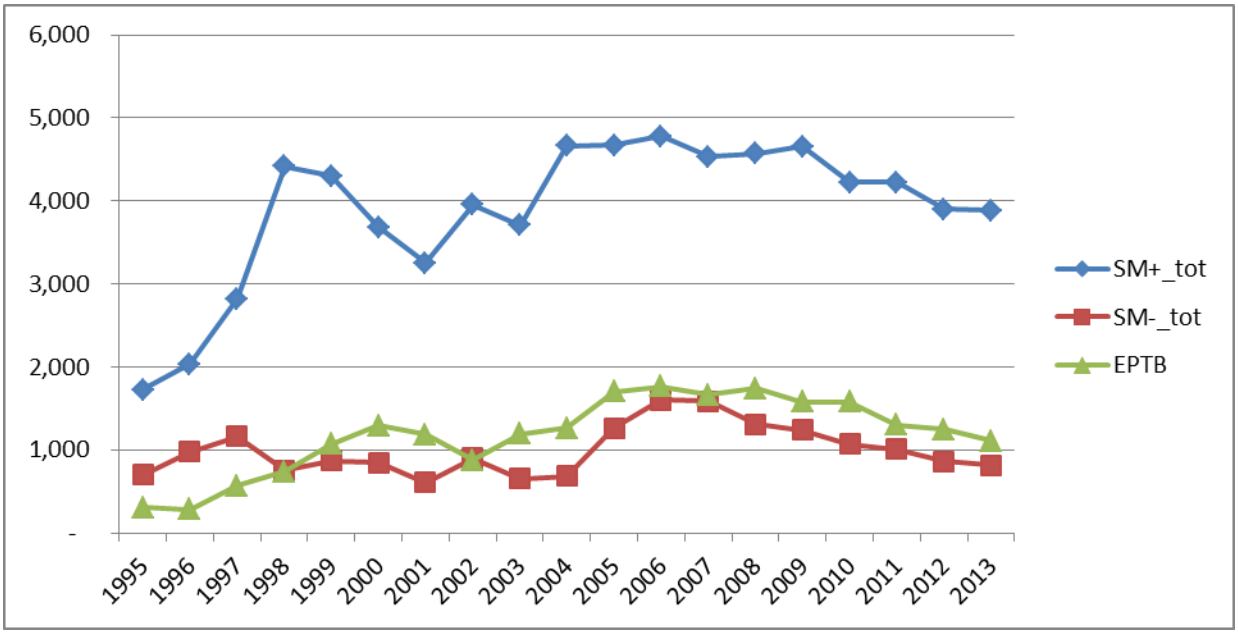


Figure 17 Trend in number of notified smear negative, smear positive and extra-pulmonary tuberculosis cases between 1995 and 2013

(b) by age group, including the proportion of cases among children (0-4, 5-14);

The pattern in case notification by age group and gender shows that for both male and females the highest number of cases is reported in the 25-34 years old age group (Figure 18). At the same time in the young and elderly the difference in reporting level between male and female is less profound. Comparing this pattern in the last decade (2003 to 2012 - Figure 19) indicated this pattern has remained very similar over time. Interestingly case numbers have been decreasing in the 15-24 year age group in both males and females. IN the 25-34 year age group the trend is less clear while cases also seem to be decreasing in the 35-44 year old. However in the elderly, above 55 years notified cases have been steadily increasing. The prevalence survey data indicate a higher burden in the older age group and the calculated patient diagnostic rate suggest a the highest level of underreporting in this age group.

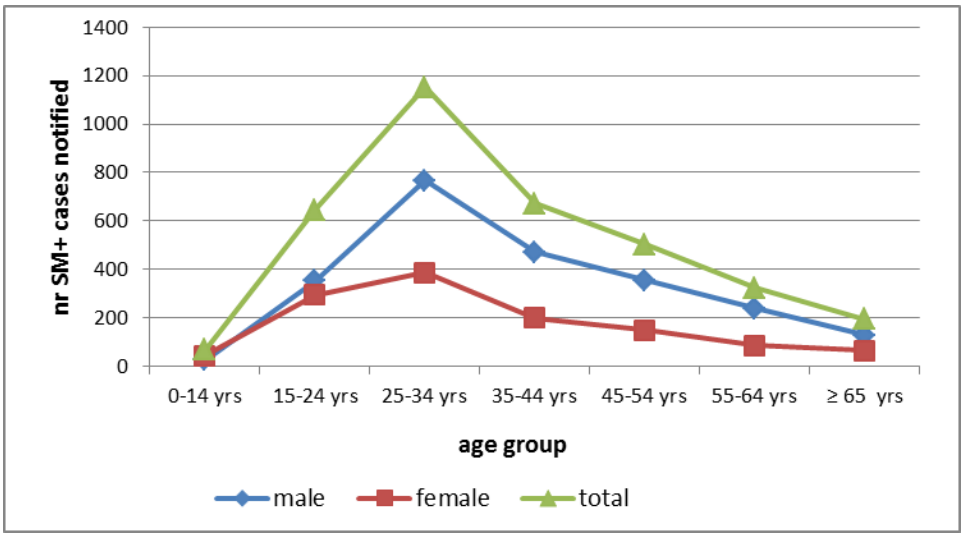


Figure 18 Pattern by age group for male, female and overall for smear positive tuberculosis in 2013.

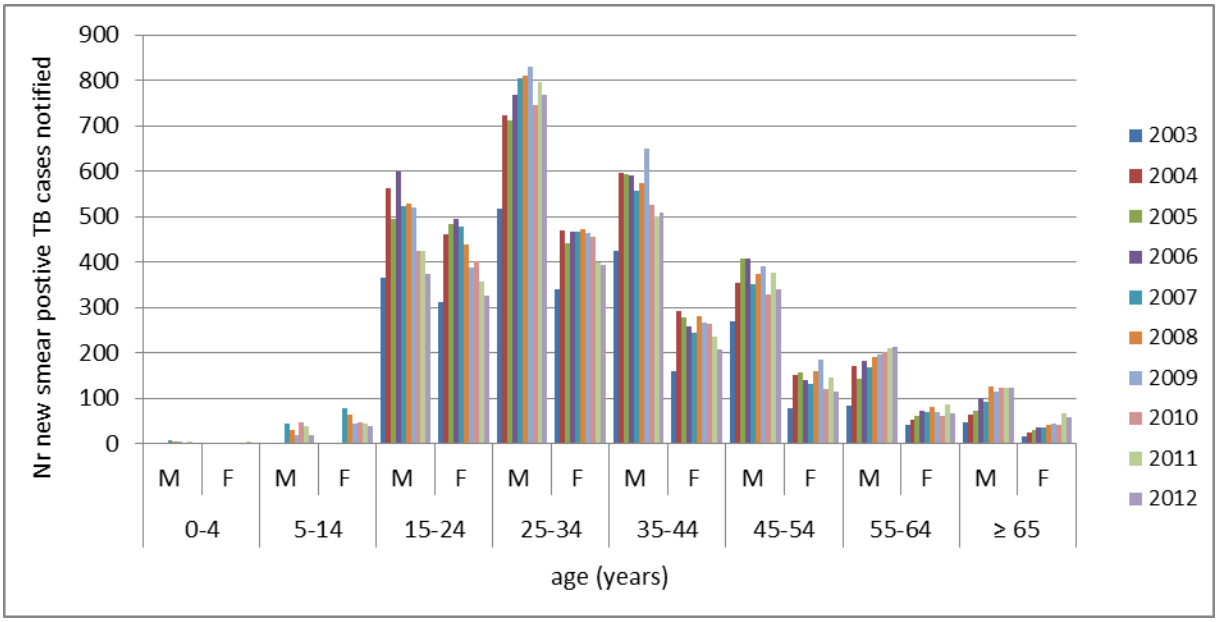


Figure 19 Pattern by age group for male and female smear positive tuberculosis cases between 2003 and 2012

Comparison with surveillance data *(adapted from TB prevalence survey report)*

Comparing the surveillance data with the TB prevalence survey estimates (see Table 3) provides interesting insights. The proportion of cases in the elderly (54 years and above) has gradually increased in the last decade from 7.1% in 2003 to 13.2% in 2012 (Table 5; Figure 20). This suggests elderly are being increasingly detected but there is still under diagnosis of those 55 years and above. Prevalence estimates indicate prevalence to be 2-3 times more in elderly but in routine data this is not observed as the highest case notification rates are observed in the 35-54 years old (Figure 7). Comparing case notification rate (CNR) by age group between 2003 and 2012 shows that CNR rate has remained similar for the 15-34 yrs and 35-54 yrs age group while it has increased by a factor 1.6 for those 55 years and above, from 37.8 to 61.3 per 100,000 population. This confirms elderly are increasingly being detected. This increasing trend supports a shift of the epidemic to the elderly population, a pattern often observed in Asian countries, suggesting the epidemic in Rwanda has matured.

Table 5 Proportion of notified cases by age groups from 2003 to 2012 (surveillance data)

year	15-34 yrs	35-54 yrs	54+ yrs
2003	57.7%	35.2%	7.1%
2004	56.5%	35.5%	8.0%
2005	55.1%	37.1%	7.8%
2006	56.6%	33.9%	9.5%
2007	58.0%	32.7%	9.3%
2008	55.2%	34.0%	10.7%
2009	53.5%	36.2%	10.3%
2010	54.8%	33.6%	11.6%
2011	53.1%	33.8%	13.1%
2012	53.2%	33.6%	13.2%

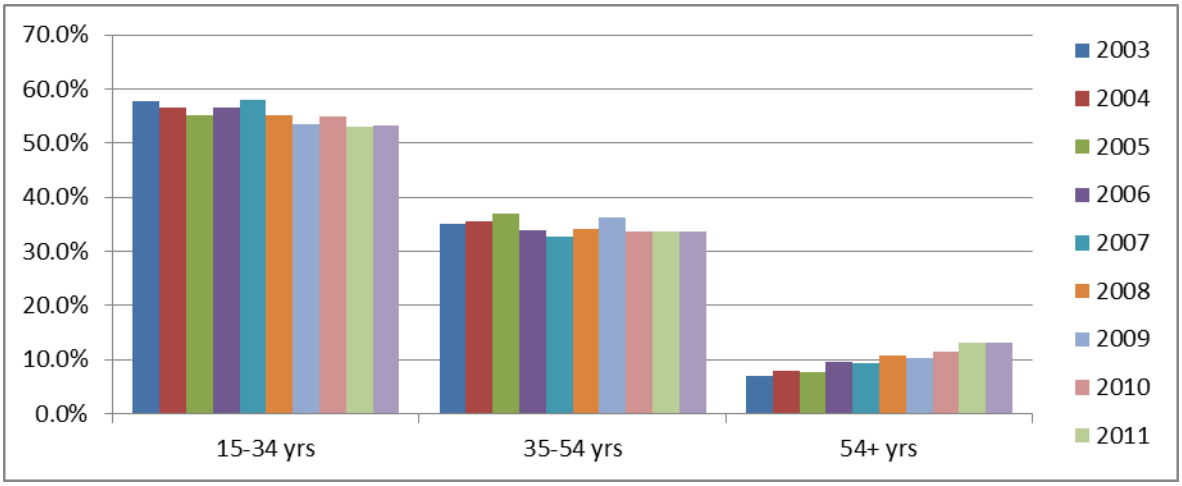


Figure 20 Trend in proportion of cases by age group for the period 2003 to 2012

Table 6 Notification rate by age group for 2003 and 2012 based on the notified cases from routine surveillance

Age group	2003*	2012	TB prevalence estimate
15-34 yrs	51.3	48.6	56.8 (27.4 – 86.2)
35-54 yrs	74.9	73.2	65.6 (21.1 – 110.2)
54+ yrs	37.8	61.3	158.8 (54.1 – 263.0)

**Census data from 2002 with linear interpolated population growth between the 2002 and 2012 census were used as denominator*

The Male:Female (F/M) ratio is 1.95 in the 2012 surveillance data (Figure 21), the M/F ratio shows some variation over the last 10 years and suggests a slight upwards trend, meaning less females are being notified relatively. This could either mean more men are being detected or the TB burden in women is falling, possibly as a result of the decreasing HIV epidemic which is more profound among women. The estimated TB prevalence figures suggest the rate in males is up to five times that in females (Table 3) which is not seen observed in routine surveillance. Despite the wide confidence intervals around the estimated TB prevalence the patient diagnostic rate suggest men are under diagnosed.

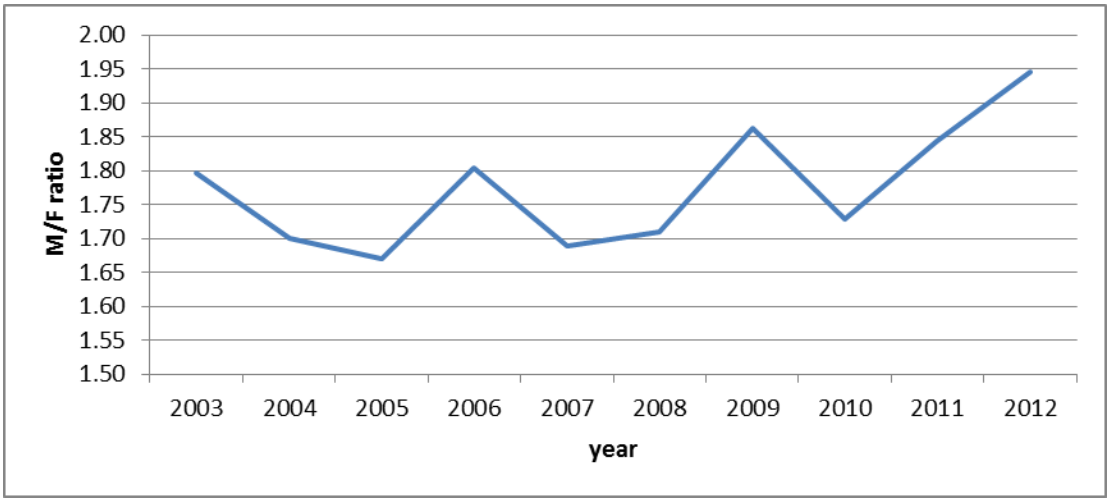


Figure 21 Male –Female ratio as observed in the surveillance from 2003 to 2012.

The proportion of cases among children below 15 years has seen a downward trend, decreasing from 10.8% to 6.9% over the period 2007 to 2013 (Figure 22). The decrease instead of an expected increased with more attention for childhood TB could be linked to the fact that since 2008 integrated management of childhood illnesses (IMCI) started for pneumonia in the community. Possibly some of these earlier cases were treated as TB but where in fact not TB. Also although there is a TB paediatric algorithm, nurses are often reluctant to diagnose children locally and instead will refer them to higher level. The relative increase in recent years (2010-2012) seems more due to an increase among 5-14 year olds. The proportion of children of 5-14 years detected is consistently higher than the proportion among the 0-4 year olds. The ratio of age groups 0-4 to 5-14 years should be in the range of 1.5-3.0 ((WHO, 2013)). Plotting this rate in Rwanda indicates it has been below 1 since 2007 and is even decreasing. The above suggests children and especially those below 5 years of age are underdiagnosed and as planned under the new strategic plan more attention should be given to finding children with TB by improving diagnostic procedures for this group. The implementation of IPT linked to contact tracing has seen in increased effort since 2006 with a specific boost in 2011 (Figure 24). For the three years there are data available IPT completion rates have been >90%.

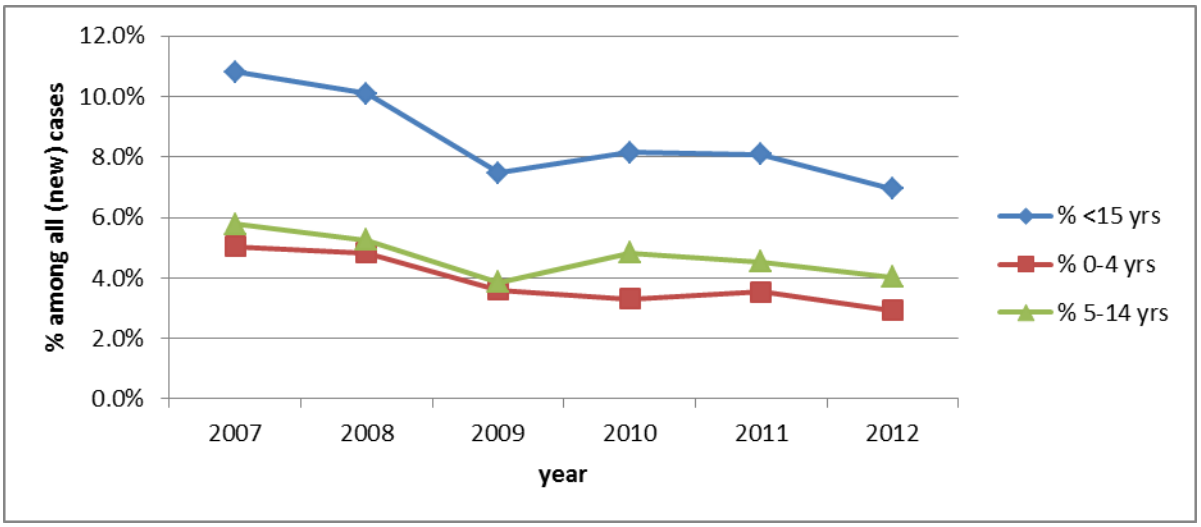


Figure 22 Proportion of tuberculosis cases among children (for three age groups) among all new notified tuberculosis cases

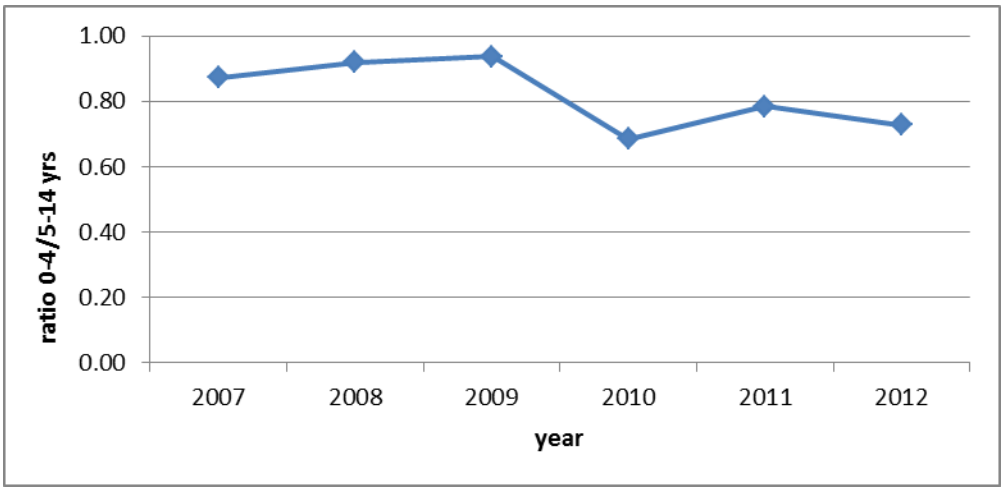


Figure 23 Ratio of TB in 0-4 over 5-14 year old children notified in Rwanda 2007-2012

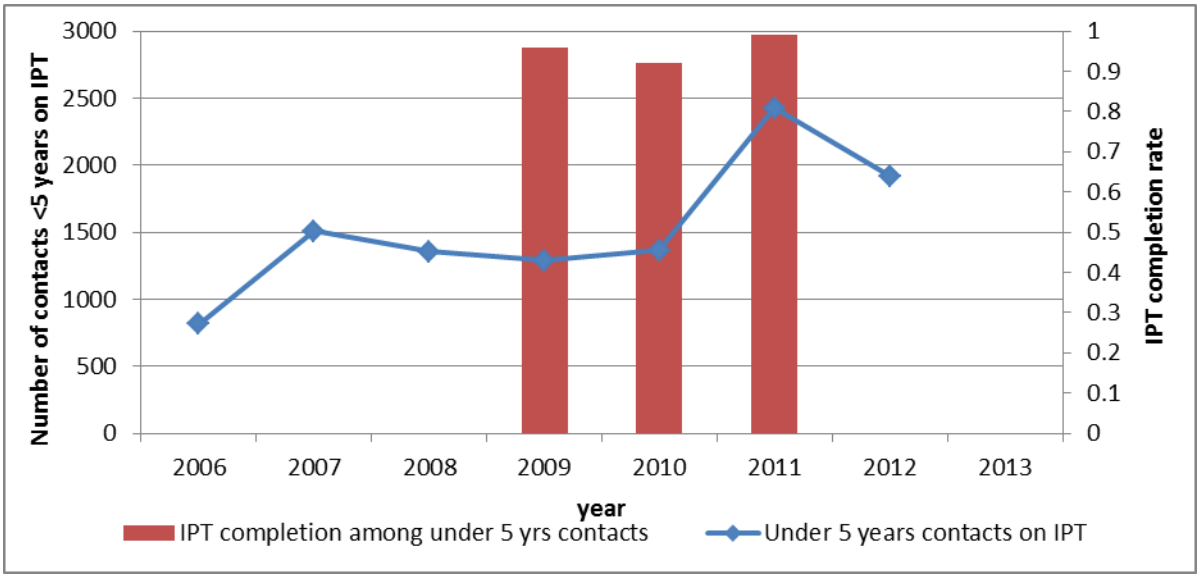


Figure 24 Trend in number of contacts <5 years on IPT between 2006 and 2013 and IPT completion rate for 2009-2011.

(c) by category (retreatment out of the sum of new and retreatment cases).

The proportion of retreatment cases out of all cases show a decreasing trend since 2004 but a small increase again from 2008 to 2009.This increase is likely due to changes in case definition. From the training material available it was concluded that in 2002 the definition of retreatment was based on a positive sputum result at the end of month 5 (M5). In the 2005 manual this was changed to end of month 4 (M4). The earlier decision on whether a person is retreatment could have resulted in more retreatment cases if there are several cases turning negative between month 4 and 5. Also, in 2008 Performance based financing (PBF) was introduced countrywide for all health facilities and district hospitals and included some laboratory indicators. Under the PBF system, patient files were more consistently checked for correctness of treatment regimen and it was checked whether patients are treated according to guidelines. This could have raised awareness for staff on correct procedures leading to more retreatment cases being reported. The countrywide introduction of ZN staining in 2007 could also have led to more retreatment cases being notified as the more sensitive method could have detected more patients still being smear positive at M4/5 and thus being classified as retreatment. There are no reasons to believe the higher retreatment rate is due to an actual change in the burden but is more an artefact of changes in definition and diagnostic techniques. The trend of proportion of retreatment cases by province shows considerable variation among provinces (Figure 26) although the general trend between 2008 and 2013 is downwards after an increase in 2009-2010. Kigali and Southern province have the highest proportion of retreatment cases although in 2013 the proportion in all provinces has come to around 6% except for Western province where it seems much lower in the last 3 years, around 3.5%. The reason for this could not be identified.

The pattern for 2011-2013 by district also shows considerable variation but no distinct pattern (Figure 27). Although in many districts the proportion seems to have increased over the last three year (like for example Kirehe and Musanze), this is not the case for all districts as in Ruhango and Nyamagabe district the proportion of retreatment cases shows a downward trend. While it other like Nyaruguru the proportion goes up and down.

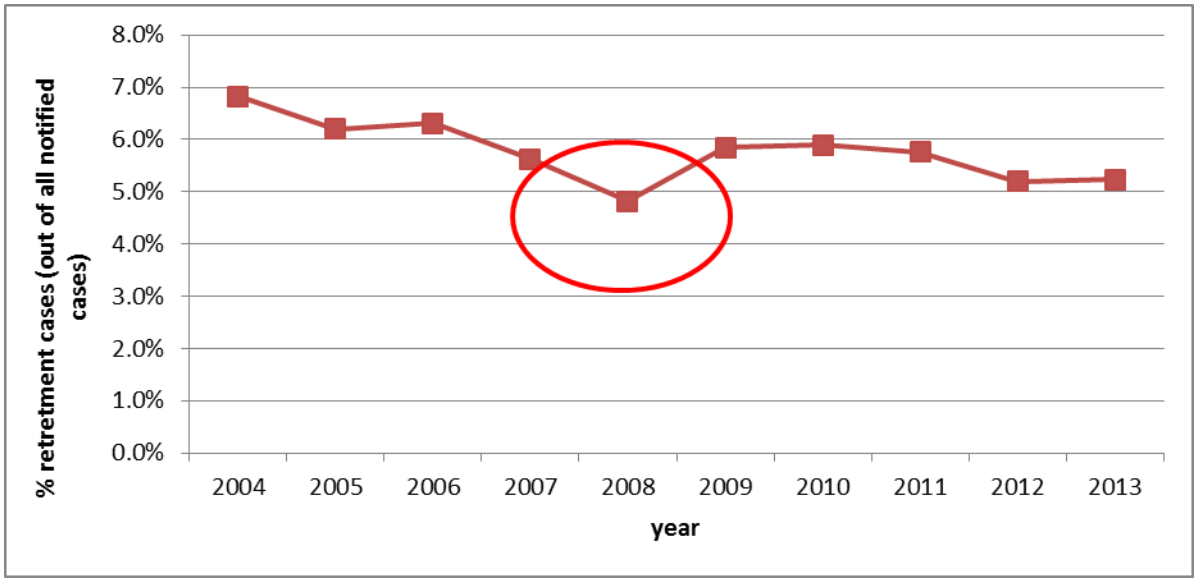


Figure 25 Proportion of retreatment cases out of all notified cases between 2004 and 2013.

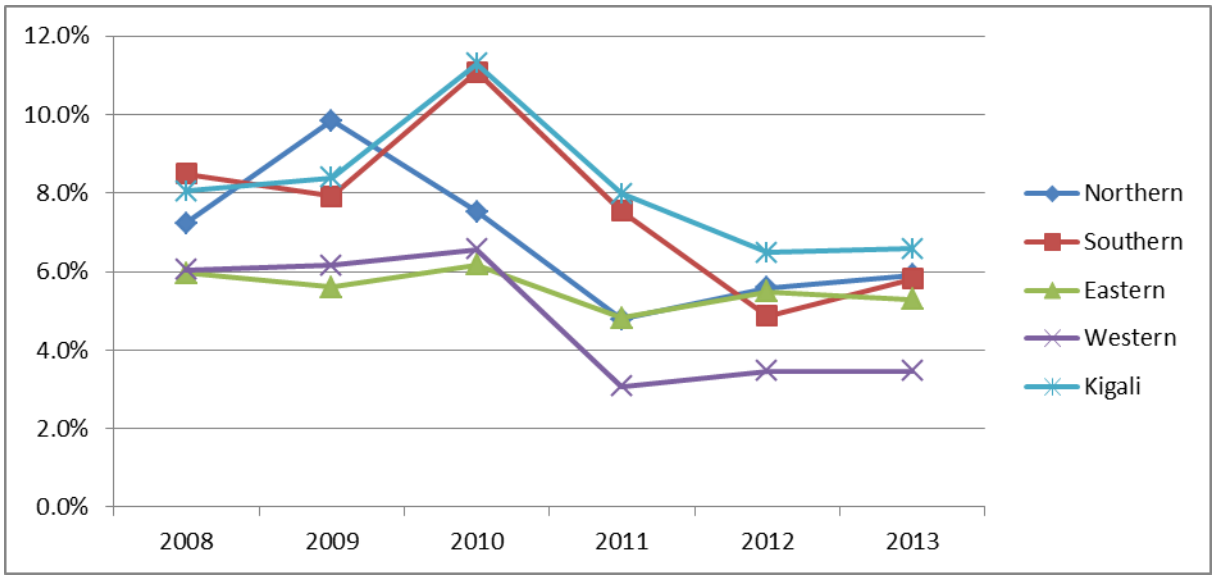


Figure 26 Proportion of retreatment cases out of all notified cases between 2008 and 2013 by province.

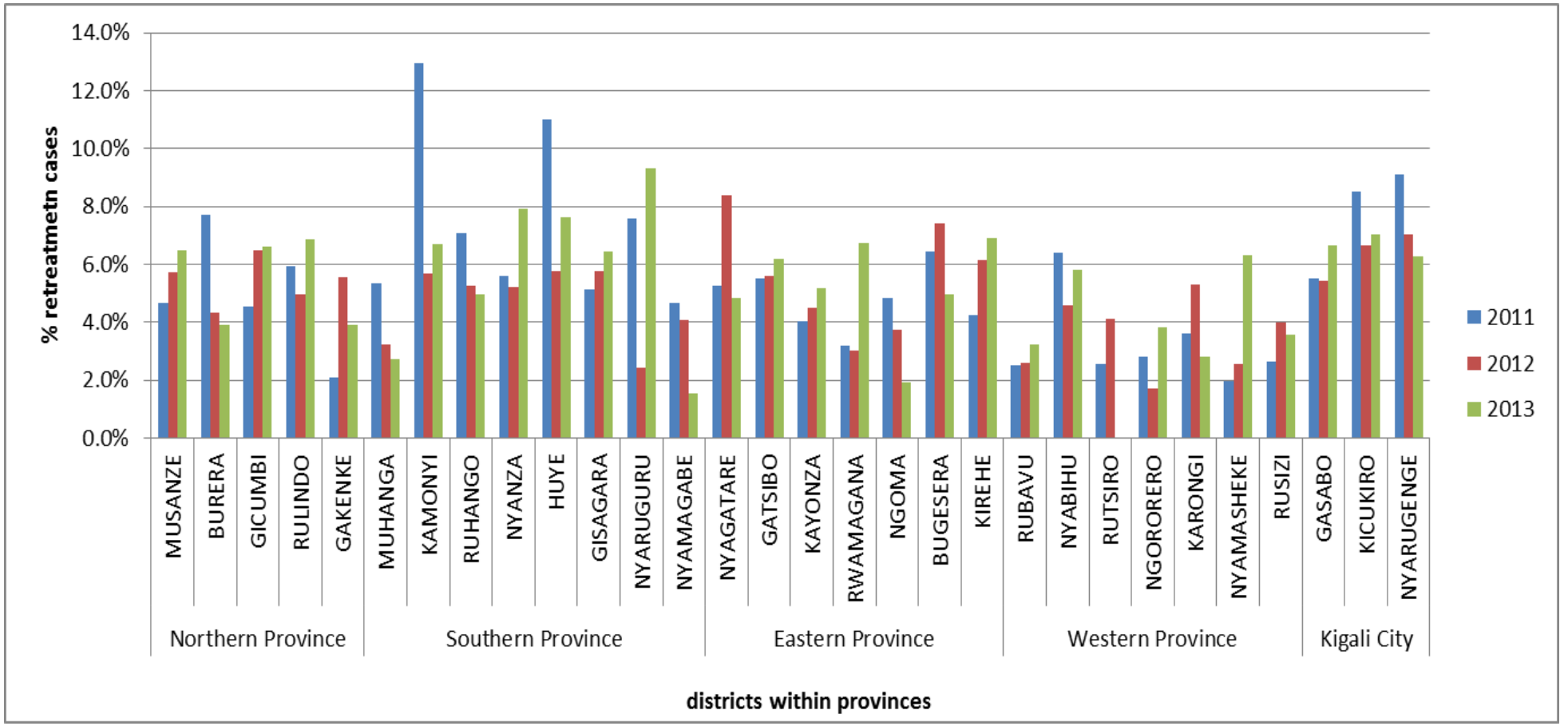


Figure 27 Proportion of retreatment cases (out of all cases) by districts within provinces for 2011, 2012 and 2013.

i. Trends in age- and sex-specific case notification rates, the average age of newly notified cases, and the extent to which these can be explained by demographic or other factors.

Except for the youngest age groups (0-14 and 15-24 years) males have much higher CNR than females about 3-4 times. In the prevalence survey the ratio between male and female prevalence was 4 in all age groups (although with large confidence intervals), suggesting young men are being underdiagnosed at least to some extent. In the younger age groups the CNR is very similar between male-female cases. The underlying reasons could be linked to the age people start working and differences in exposure. Men often have more frequent movement and men also more often use alcohol and tobacco (see page 57). A study conducted on 2006 surveillance data suggested that women might be underdiagnosed (Uwizeye, De Serres, Gilca, Schwartzman, & Gasana, 2011) the prevalence survey data in combination with the surveillance data suggest men are underdiagnosed. The more severity of disease in women as reported in the study by Uwizeye et al. should be further investigated to understand the reasons behind this.

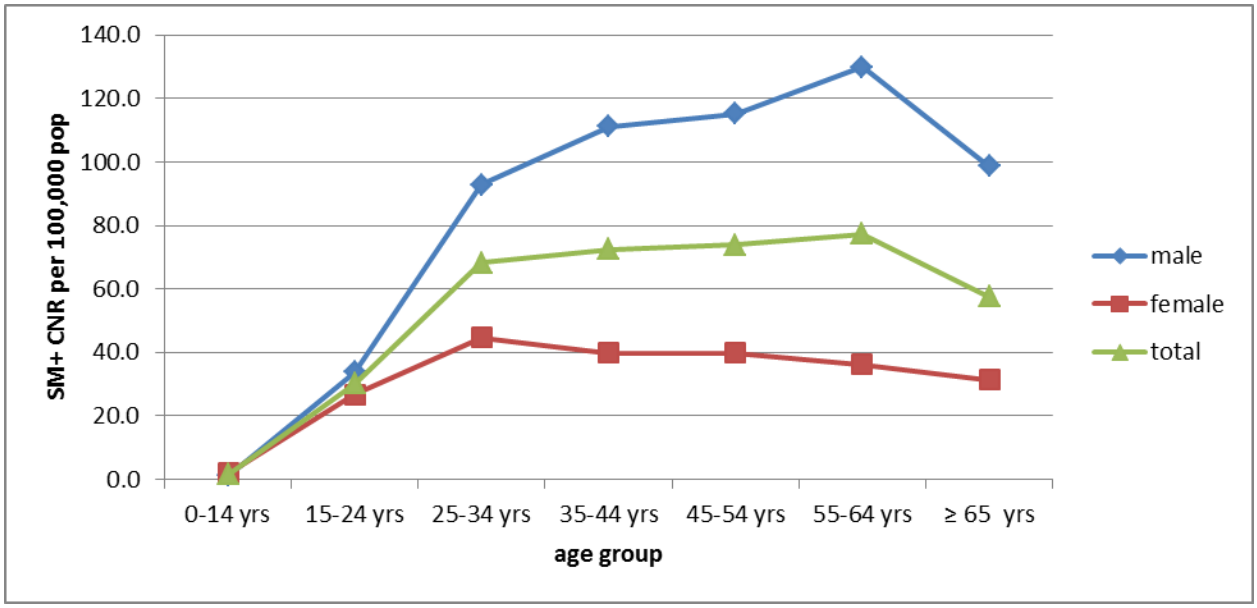


Figure 28 Case notification rate by gender and overall for different age groups for new smear psotivie TB in 2013.

ii. Analysis of the level of (and ideally trends in) under-reporting from national inventory studies if these are available before the assessment.

Not available – no inventory study has been conducted to discern rates of under-reporting, but there is no reason to believe there is severe underreporting as there are few private (for profit) facilities. The results of the surveillance checklist concluded that that there is limited added value or potential to conduct an inventory study in Rwanda at this time (Klinkenberg & Ochola, 2013).

iii. Any data available on TB in high risk groups such as people living with HIV, the elderly, people with diabetes, people with compromised immune systems, prisoners, miners, etc.; numbers, denominators; and if available proportions and trends.

TB among PLHIV

Rwanda's HIV/AIDs program has data available on the screening for TB among PLHIV since 2006. The data collection is done using pre and ART registers and could not done in all ART sites had serious data recording issues in some sites. The screening coverage is gradually increasing while the proportion of PLHIV with a positive screen decreases as is expected during role out. The % TB among all PLHIV screened for TB which is likely linked to the decreasing HIV epidemic.

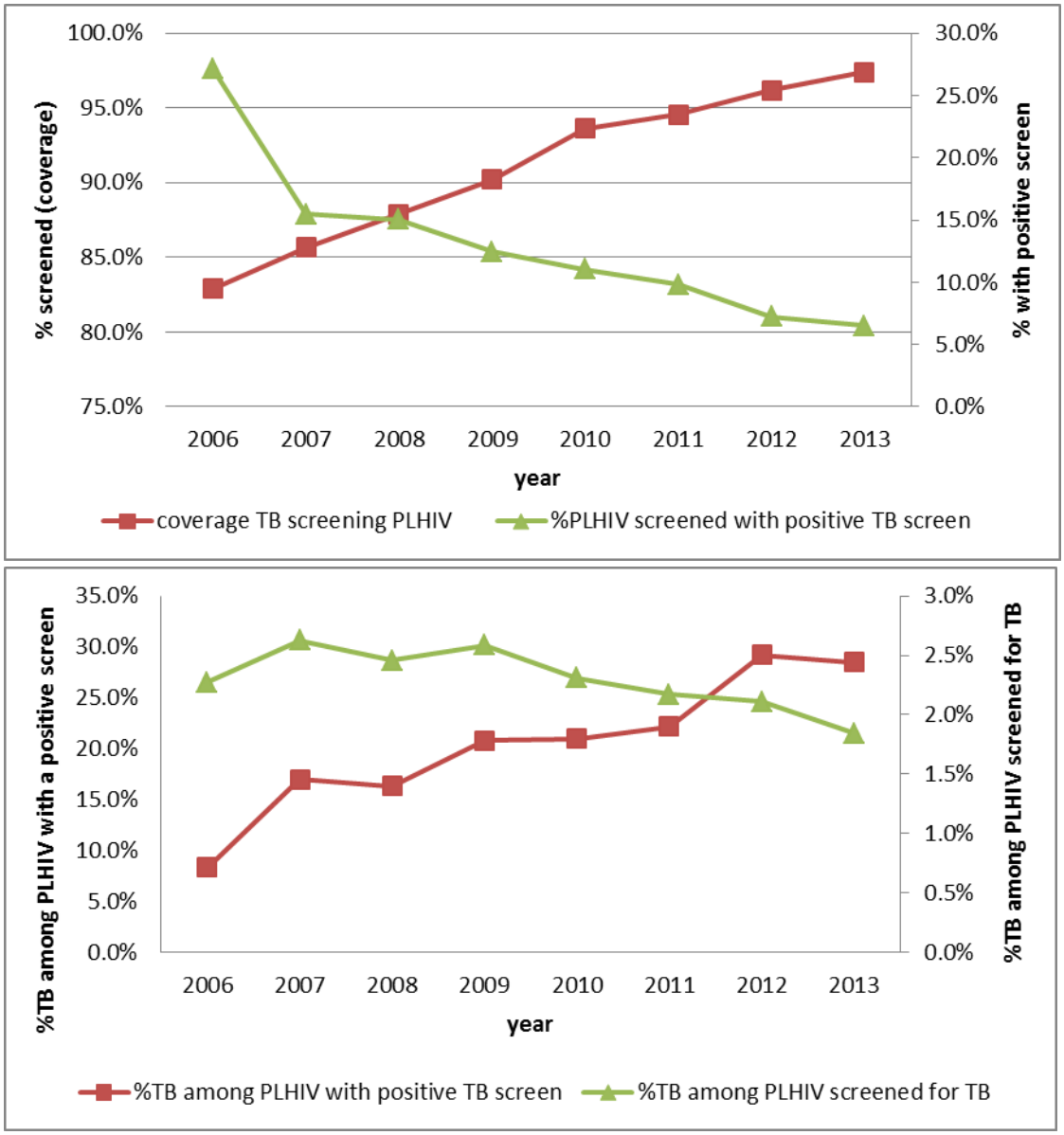


Figure 29 TB screening effort among people living with HIV (PLHIV),coverage of screening and proportion screened positive (top) ad TB prevalence among PLHIV screened and those with a positivescreen (bottom)

Prisons

Rwanda routinely reports cases detected in prisons using active and passive case detection (Figure 30). Case notification rate is high in the prisons, around 300 per 100,000 population, 6 times that in the general population. However, in actual case numbers the prisons in 2012 contributed 106/3571 = 3.0% of smear positive cases and 175/6207= 2.8% of all cases. Since 2009, there is routine entry screening using symptoms in all prisons. In 2013 a project was started to expand active case finding in prisons and using the mobile chest X-ray trucks from the TB prevalence survey. Thus, all prisoners will be actively screened. Those with an abnormal CXR (whether or not they have symptoms) will be asked to provide two sputum samples. To date 4/14 prisons have been completed but these are some of the largest prisons. The result for the first 4 prison indicate that among the 21,516 (98.8% of 21,773 prisoners expected) a total of 2797 (13%) had an abnormal CXR and where asked to submit sputum for microscopy and GenXpert. Among these a total of 149 TB cases were detected, a crude prevalence of 689 per 100,000 population. This is double the CNR detected during routine (entry) screening. Among the 149, there were 40 smear positive and 146 GenXpert positive cases of which 7 where RIF resistant. Of the 149 detected cases, 83(56%) did not report any cough suggesting that symptom screening alone may have a limited impact on TB control in prisons.

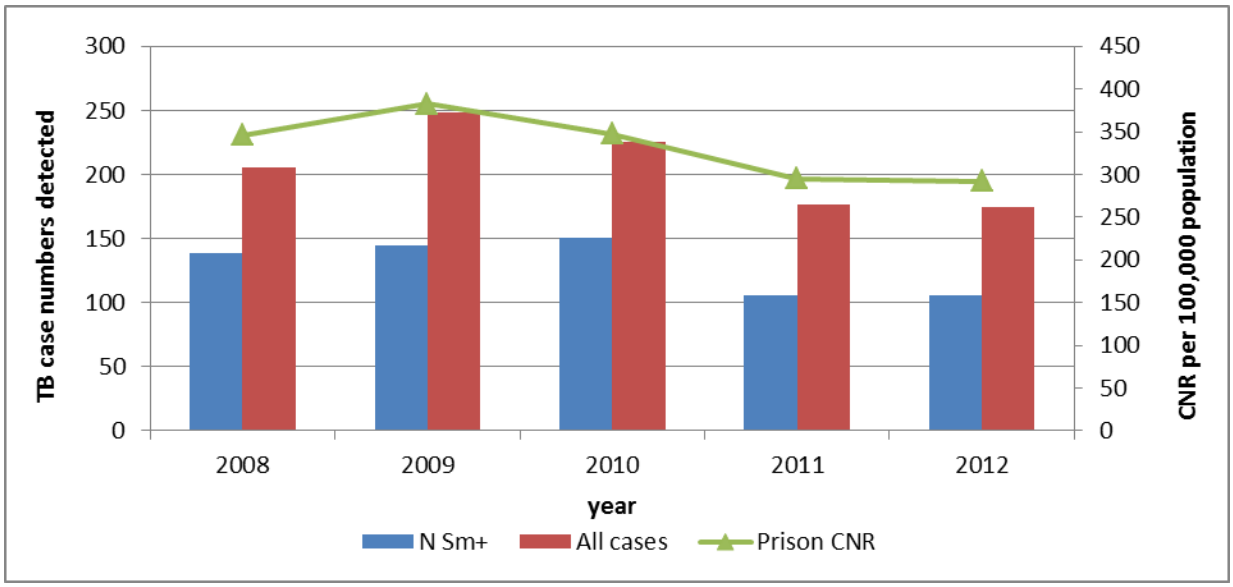


Figure 30 Notified number of cases (new smear positive and all forms) as well as case notification rate in prisons between 2008 and 2012 as reported from routine surveillance (active and passive case finding).

Another high risk group being targeted are TB contacts. CNR among contacts is higher than in the prison at 729 per 100,000 population which was more than 3 times higher in 2009 at 2359 per 100,000 population. Over time, with an increased effort, the number of cases detected increased slightly but the CNR dropped sharply. There is a need to look into the contacts of TB patients in more detail: who are the contacts that turn out to be TB cases? can they be characterized and better targeted to maximize the CT investigation efforts? With the new electronic patient based system, it will be easier to implement a study looking more in-depth into the contacts. In terms of number, there were 193/6207 cases found via CT suggesting a yield of 3.1%

In the new NSP an overview table was made to compare the risk of different subgroups with the general population using the routine surveillance data. Beside the relative risk of TB in particular key populations, the magnitude of the groups will be an important criterion for prioritization of strategies and investments going forward.

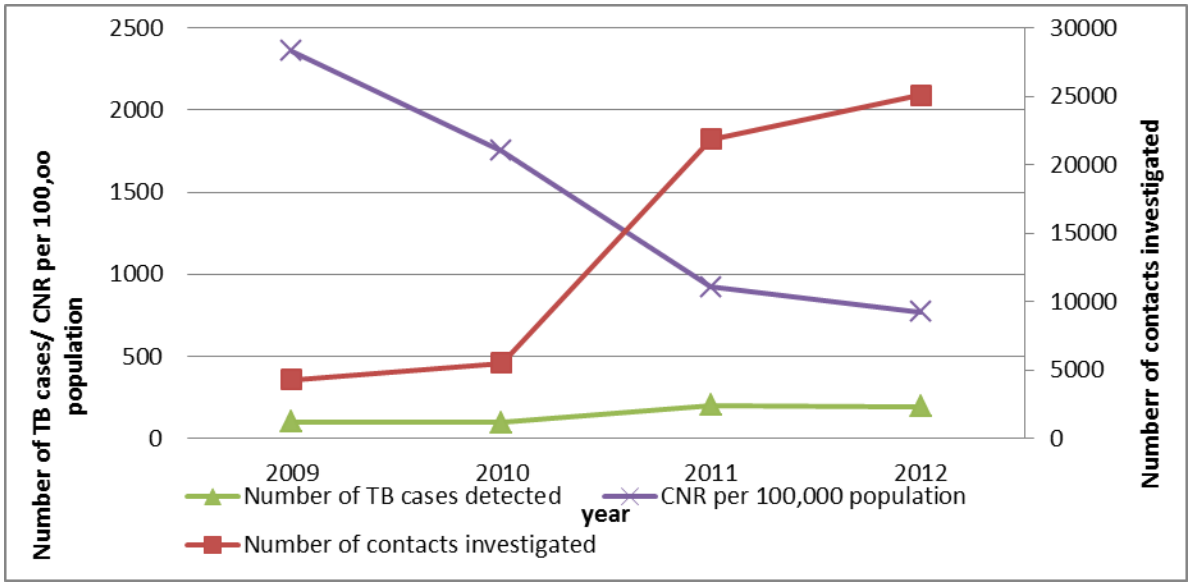


Figure 31 Contact tracing effort between 2009 and 2012 as illustrated by the number of contacts investigated, number of TB cases detected among them both absolute as well as per 100,000 population.

Table 7 TB risk among some key affected populations compared to general population, 2012, Rwanda

Group	Population in 2012	#TB cases in 2012	TB CNR	Risk compared to general population*	Number needed to find 1 TB case¶
General Population	10,515,973	All TB 6091	58	1	1,726
	10,515,973	SS+ 3811	36		2,759
PLWH newly diagnosed	13,369	314	2,349	44	43
All PLWH	104,496	1,018	974	18	103
TB household contacts	21,858	202	924	17	108
PLWH enrolled > 6months	91,127	704	773	15	129
Prisoners	60,000	All TB 177	295	6	339
	60,000	SS+ 106	177	5	566
High TB prevalence districts (Kigali City)	1,132,686	All TB 1,850	163	3.1	612
		SS+ 1,009	89	2.7	1,123
Prisoners upon entry	16,001	6	37	0.7	2,667
Children 0-14	4,311,549	394	9	0.2	10,943
People > 55 years	757,150	SS+ 462	61	1.8	1,639
Diabetics, health workers, refugees, in-patients, malnourished children	NA	NA	NA	NA	NA

* Ratio of TB notification rate in each risk group over the TB notification rate in general population; ¶: Number TB cases over Population

(Source Rwanda National Strategic Plan 2013-2018)

iv. Other miscellaneous analyses that may be relevant in specific settings (to be determined by the epidemiologist(s) undertaking the assessment).

Rwanda has a performance based financing (PBF) mechanism operational in the health care system (Basinga et al., 2011; Ireland, Paul, & Dujardin, 2011; Meessen, Soucat, & Sekabaraga, 2011). This was rolled out from 2008 in the general health care system and from 2010 onwards specific TB indicators were put in place measuring clinical as well as community TB indicators. PBF TB indicators are evaluated at both level- DH and HC level. For the HCs and the private clinics evaluation the hospitals mandate a team with the TB focal point among it, to evaluate all the HCs within the hospital catchment area. The DHs and RHs have been evaluated quarterly by central level PBF team. Over the three year (2010-2013) that the program has been running the monitoring data show that for most indicators targets and performance increased between 2010 and 2013 (Table 8). However there are few where more attention is needed like registration of culture results for both regular TB and MDR-TB patients contact investigations childhood TB and transfer out

cases (see yellow and orange highlighted indicators in Table 8). The conclusion from the latest annual PBF report (year 3) indicated that: *"The Global Fund indicator number 13 i.e. "the number and percentage of health facilities that received PBF for reaching the targets for at least 50% of their indicators" shows the overall performance on TB indicators. The performance on this indicator in the last quarter of the third year of the project was 98,2% of the target. "* (Ministry of Health Government of Rwanda, 2013).

Table 8 Overview of achievements of targets set for TB indicators in the performance based financing system in Rwanda in year 1 (2010-2011) and year 3 (2012-2013)

	July 2010 -June 2011			July 2012-June 2013		
Indicator	**Target**	**Result**	**Achieved**	**Target**	**Result**	**Achieved**
All CDT including DH have quality control for microscopy (EQA) during the evaluated quarter and no major error	776	643	**83%**	792	735	**93%**
DH have collected smears from all CDT of their area during the evaluated quarter, results are available and the copies were sent to NRL with all discordant smears.	160	126	**79%**	152	158	**104%**
All TB patients registered for retreatment during the evaluated quarter had a culture at start of treatment and the result is indicated in the TB register and on patient card	651	273	**42%**	676	338	**50%**
All new SS+ registered during the evaluated quarter had a sputum smear control at Month 2 and 4 (if applicable); sputum was sent to NRL for any positive control.	4428	3517	**79%**	4260	3202	**75%**
SS+ patients are cured (new SS+ and retreatments registered during the evaluated quarter of the previous year).	3494	4170	**119%**	4272	4181	**98%**
MDR-TB patients on ambulatory treatment had culture(s) for control during the evaluated quarter according to the norms and the results are reported on the patient card.	966	377	**39%**	1192	421	**35%**
TB suspects examined during the evaluated quarter have available microscopy results within 48 hours at CDT and 72 hours at CT.	88051	118884	**135%**	144184	148168	**103%**
TB suspects whose HIV status is unknown were tested for HIV ; the date and results are available in the lab register (CDT) or in the suspects' register (CT)	79251	109070	**138%**	104960	160195	**153%**
All TB-HIV+ patients registered during the evaluated quarter receive cotrimoxazole	2270	2359	**104%**	2992	2020	**68%**
All TBHIV+ patients receive ART if eligible (<500 CD4) (patients registered during the evaluated quarter of the previous year)	1644	1825	**111%**	1732	1692	**98%**
Contact examination was done and reported on the treatment card for all SS+ patients (new, retreatements, MDR-TB) registered during the evaluated quarter and under-5 contacts receive INH if eligible	10480	13423	**128%**	26796	18873	**70%**

Number of under-5 contacts who competed INH preventive treatment (contacts enrolled for INH during the evaluated quarter of the previous year)	1286	1331	**103%**	2668	2158	**81%**
Number of children < 15 years registered for TB treatment during the evaluated quarter	700	554	**79%**	676	436	**64%**
CHW administering DOT were supervised monthly during the evaluated quarter.	5880	6207	**106%**	7056	15829	**224%**
TB patients who were transfered during the evaluated quarter continue their treatment at the CDT where they were transferred.	2100	454	**22%**	1824	825	**45%**
Treatment outcomes are available for all TB patients who were transferred (patients registered during the evaluated quarter of the previous year)	1911	761	**40%**	2140	1053	**49%**
TB drugs were available without interruption for all TB patients on treatment during the evaluated quarter and a reserve stock of drugs is available at the day of evaluation	776	719	**93%**	776	777	**100%**
CDT apply the minimum package of TB infection control measures established by NTP	77	81	**105%**	144	753	**523%**
CDT submit their quarterly reports on time; reports are complete and correct.	776	734	**95%**	776	786	**101%**
CT submit their quarterly reports on time; reports are complete and correct.	884	1023	**116%**	748	1189	**159%**
Last CT quarterly report is analysed: table identifying weakness and solutions, detection graph updated and displayed	884	879	**99%**	740	987	**133%**
Last CDT quarterly report is analysed: table identifying weakness and solutions, detection graph updated and displayed	604	521	**86%**	596	558	**94%**
Last DH quarterly report is analysedanalyzed: table identifying weakness and solutions for the district and per HC, detection graph updated and displayed	160	151	**94%**	160	163	**102%**
Health centers (CDT and CT) are supervised monthly by DH	4500	354	**8%**	3700	3884	**105%**
TB program tools are available in all health facilities (CDT & CT)	415	469	**113%**	416	1996	**480%**
IEC sessions are planned and executed according to the targets (per	68724	19977	**29%**	83756	106092	**127%**
PRISON: All new prisoners are screened for TB upon entry	20000	10252	**51%**	19000	15155	**80%**
PRISON: Culture is done for all SS+ detected in prison (new and retreatment's)	175	127	**73%**	192	97	**51%**

Source Annual reports PBD program year 1-3

2.4 Objective 3: Are recent trends in TB disease burden plausibly related to changes in TB-specific interventions accounting for other external factors?

Funding for and implementation of high-quality TB-specific interventions should result in detection of people with TB and curative treatment; in turn, this should have a direct impact on TB mortality (cutting case fatality rates compared with no treatment or substandard treatment). Shortening the duration of disease through detection and treatment of cases will also reduce the prevalence of TB disease, and therefore, transmission. There will be an impact on TB incidence if transmission can be reduced sufficiently and/or if preventive treatment of people with latent TB infection is effectively implemented on a large scale. At the same time, a range of factors besides TB-specific interventions influence levels of TB disease burden, by affecting population susceptibility to both TB infection and the risk of developing TB disease once infected. These include overall levels of wealth and the distribution of wealth (measured e.g. as GNI per capita, the proportion of people living in poverty), the overall coverage and quality of health services and the prevalence of HIV and other risk factors for TB. Having considered trends in disease burden in Objective 2, it is important to assess whether these trends can partly be related to changes in TB-specific interventions (and associated funding).

a) Define and compile data that are relevant to assessment of the extent to which changes in TB disease burden in recent years (e.g. for the last 5–10 years) can be explained by TB-specific interventions/programmatic efforts. This should include, at a minimum:

i. Government and international donor funding for TB care and control;

Funding for TB control has increased substantially from close to 1 million in 2002/2003 to over 15 million in 2012/2013 (Table 9). Although in absolute numbers the government contribution doubled in this period the proportion paid by government reduced from 40% in 2002/2003 to just 5% in 2012/2013. However, this represents only the amount allocated to the NTP central level, and doesn't include budget allocated by the Government to TB control at peripheral and community levels. Although there are several key partners the majority of the funding for TB control in Rwanda has come from the Global Fund in the last 4 years.

Table 9 Overview of funding from government for key budget items (drugs, salaries and other) and complementary finding from partners between 2002 and 2013 in USD

	In US $	2002/3	2003/4	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10	2010/11	2011/12	2012/13
Government budget to NTP	Drugs	129 921	125 827	182 837	194 507	99 153	110 701	99 153	100 000	100 000	100 000	100 000
	Salaries	187 879	199 872	212 630	226 202	240 640	256 000	272 000	288 000	304 000	320 000	336 000
	Others	71 979	76 573	81 461	86 660	92 192	188 530	200 000	220 000	242 000	266 200	292 820
		389 779	402272	476928	507369	431985	555231	571153	608 000	646000	686200	728 820
	Sub total	40% tot	37% tot	19% tot	28% tot	9% tot	15% tot	7% tot	(3% tot)	(3% tot)	(5% tot)	(5% tot)
Partners	GDF	119 996		284 440		257 766	110 000	5 000	5000			
	Damien	165 388	239 911	247 200	220 920	283 566	284 290	275 000	275 000	275 000	275 000	275 000
	WHO	22 000	22 000	176 443	152 500	162 301	167 000	167 000	167 000	9 000	58 800	60 000
	USG/CDC-ICAP			274 000	228 000	167 000	130 000	110 000	110 000	110 000	897 982	702 939
	Global Fund	75 131	211 756	862 372	436 036	3 394820	2149 87	2736795	19811536	19610152	11658162	12719105
		(8%tot)	(19%tot)	34% tot	24% tot	68% tot	58% tot	36% tot	93% tot	93% tot	83% tot	85% tot
	Sub total	382 515	473 667	1 844 455	1 037 456	4 265453	2 841 177	6 683 795	20368536	20004152	12889944	13757044
Beneficiaries		196 830	218 700	243 000	270 000	300 000	330 000	363 000	399 300	439 230	483 153	531 468
Total US$		**969 124**	**1094639**	**2564383**	**1814825**	**4997438**	**3726408**	**7617948**	**21 375836**	**21089382**	**14 059 297**	**15 017332**

ii. Number of health facilities providing TB diagnostic services per 100,000 population;

There has been a rapid increase in diagnostic facilities (CDT- microscopy) in the last two decades, from 30 CDT in 1995 to 200 in 2013 (Figure 32). Which are quite evenly spread over the country (Figure 33). The scale-up between 1995 and 2000 was very rapid with the diagnostic capacity increasing five-fold, from 30 to 150. Since 2005 the coverage remains stable at around 1.8-1.9 facilities per 100,000 population, nearly double the WHO recommended of at least 1 per 100,000 population. Additional CDTs were built using criteria of size of the catchment population, the availability of lab services in the area and the reported burden of TB disease. Looking at the number of CDTs per population by district (Figure 34) indicates there is geographic variation but all districts have at least 1 CDT per 100,000 population. There are currently 3 culture facilities in the country, 0.03 per 100,000 population. All CDTs are by weekly sample transportation connected to a culture facility, those having their own transportation might submit culture samples more often. The national reference lab (LNR) restarted culture in 2005 and DST in 2006. At the university hospital (CHUK) in Kigali culture and DST is being performed since 2011 and at the university hospital in Butare (CHUB) since 2013. There are currently 16 GenXpert machines in country in 13 different districts (Figure 35). There are plans for further scale up of GenXpert under the new NSP to enhance case detection in high risk groups and key populations. The first 6 machines were in country end 2012, with an additional 5 from the EXPAND project (WHO) and 5 from the World Bank installed 2013.

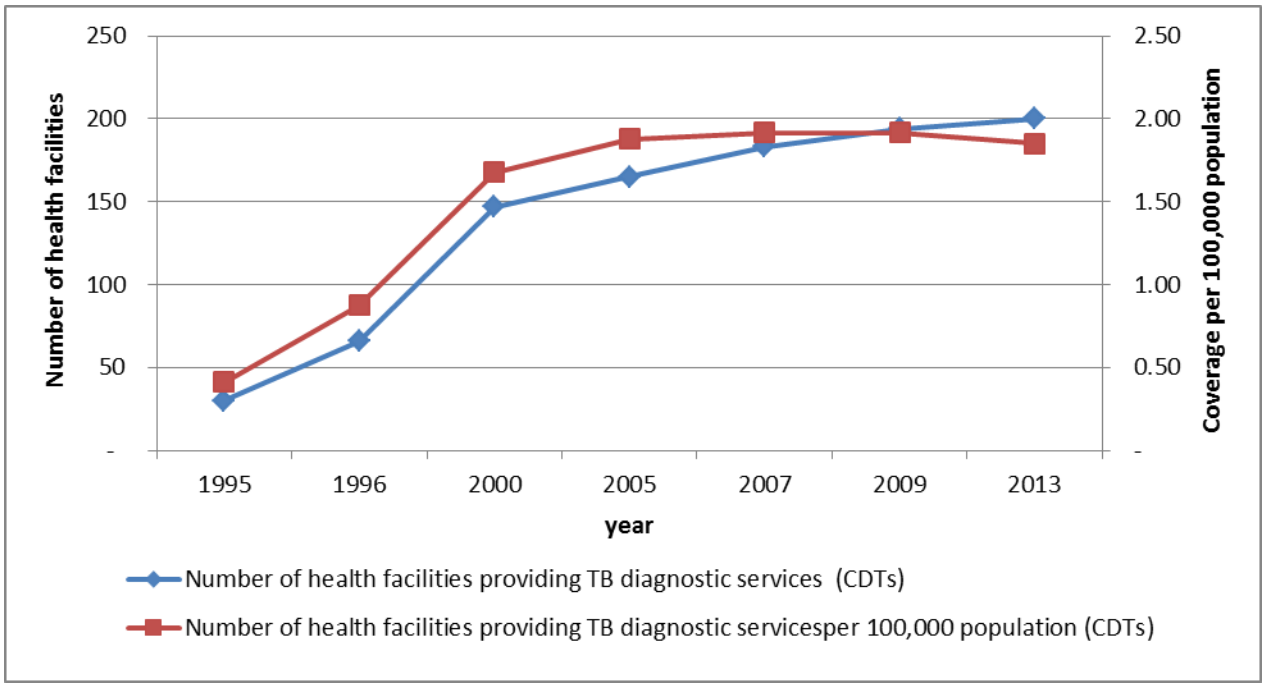


Figure 32 Number of health facilities providing TB diagnostic service (CDT) both in absolute number and per 100,000 population.

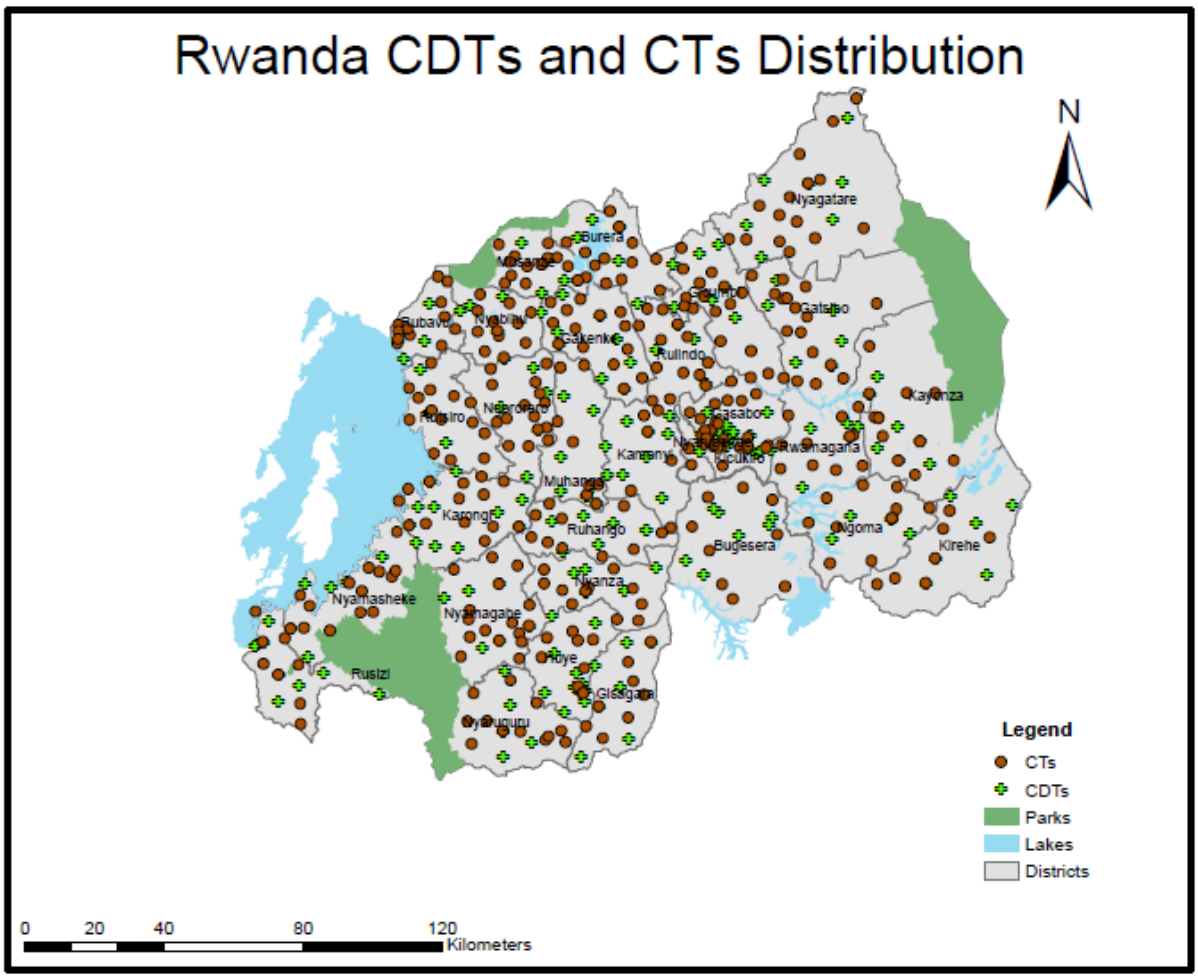


Figure 33 Location of TB treatment (CT) and diagnostic centres (CDT) in Rwanda (2012)

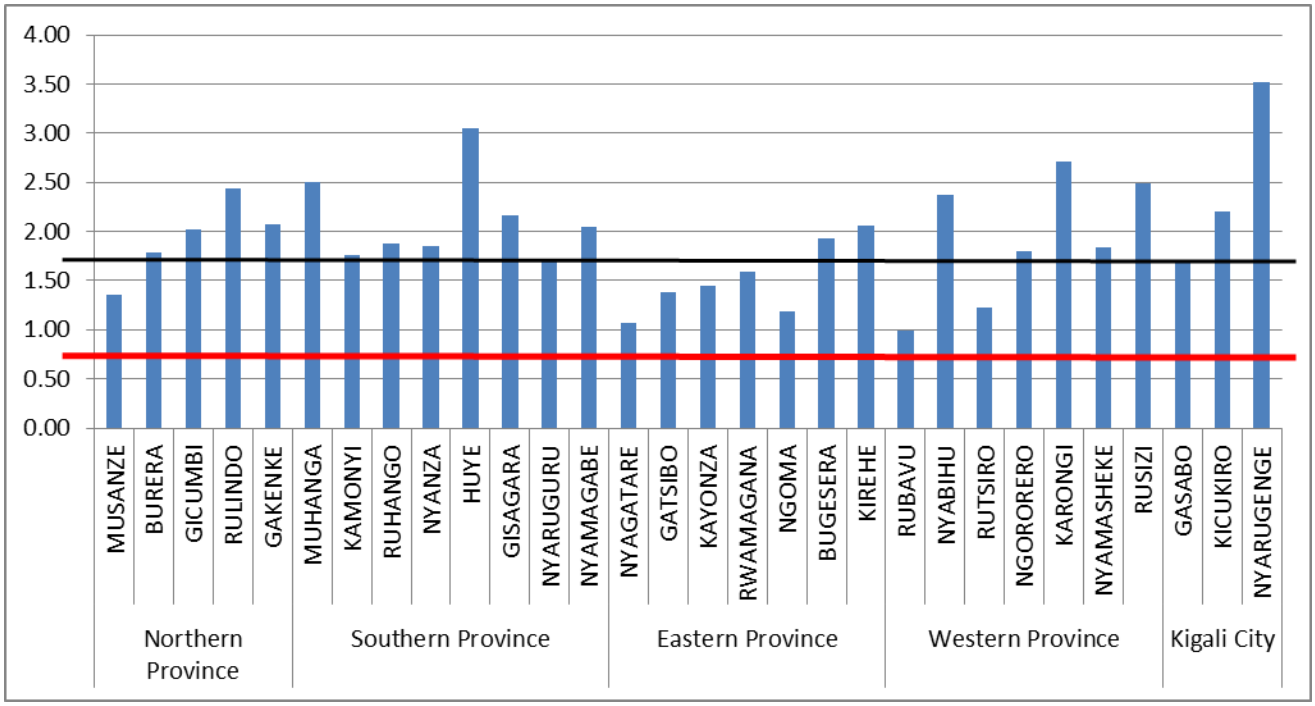


Figure 34 Geographic coverage of CDT (per 100,000 population) at district level in 2013
(red line indicates recommended minimum, black line indicated national average)

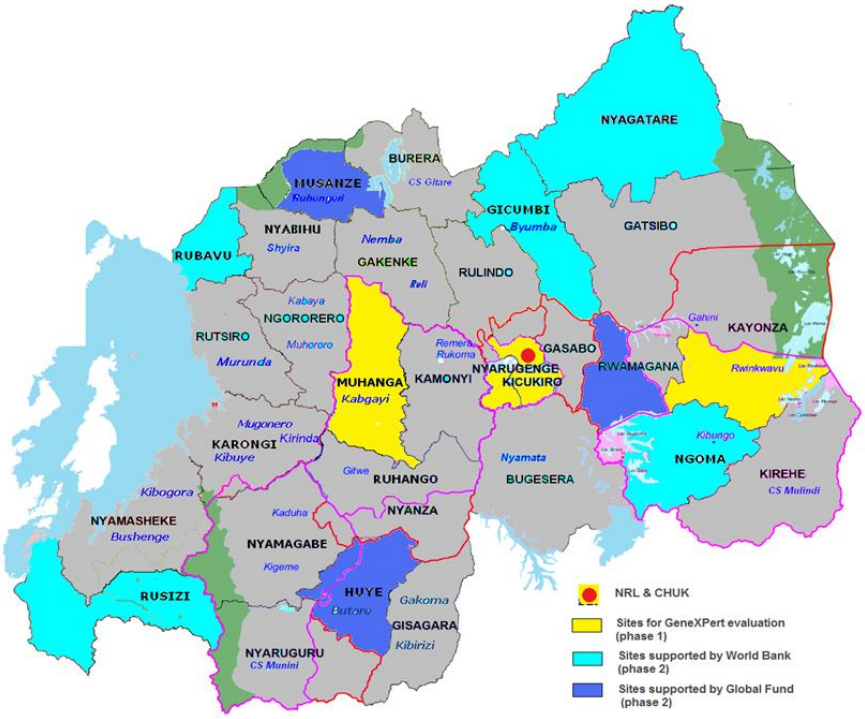


Figure 35 Selected sites for GenXpert under the different supported projects

iii. Number of health facilities providing TB treatment services per 100,000 population;

In 2013 there were 530 health centres providing treatment services, which is 4.9 per 100,000 population. Of these 493 (93.0%) were also providing VCT services. The health facilities are geographically widespread as indicated by the distribution of VCT centres over the country (Figure 36).There was no information available to assess the trend in the built up of health facilities over time. However it is assumed to be similar to the trend in the built up of CDTs (Figure 32).

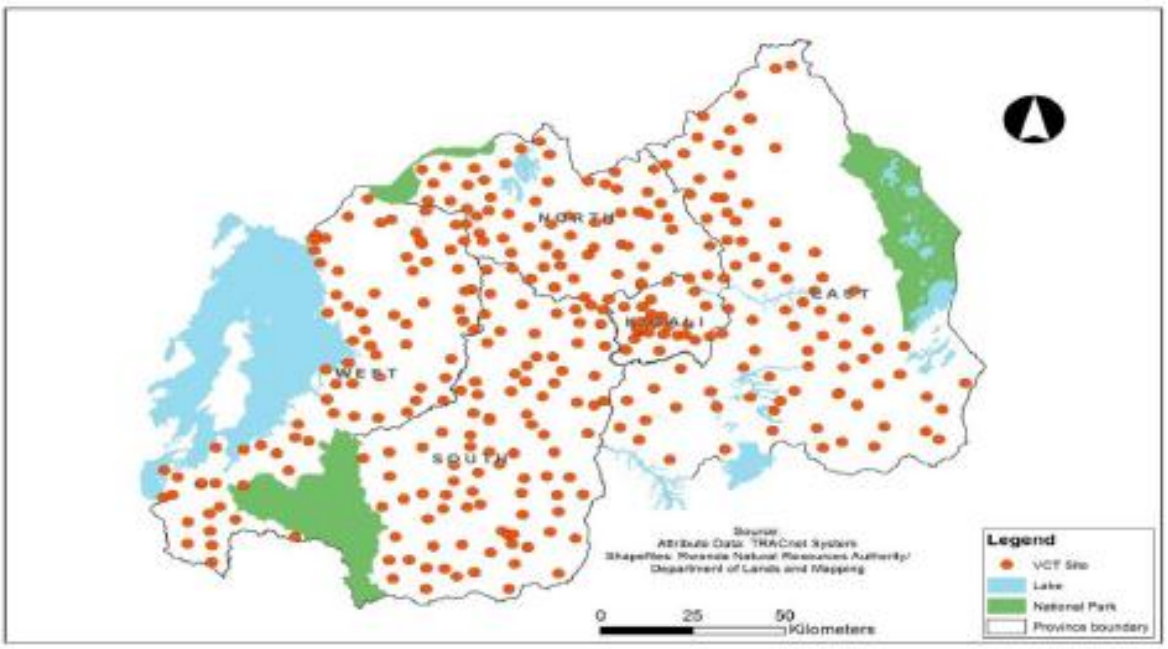


Figure 36 Distribution of VCT services across the country by December 2013
(source: Rwanda - global aids response progress report (GARPR) – march 2014, RBC)

iv. Number of people investigated for presumptive TB (if available data are reliable) and the ratio of presumptive TB to notified TB cases;

Since 2005 there is an increasing number of persons with presumptive TB being investigated from 28, 000 in 2005 to 175,000 in 2011 up to 184,000 in 2013, a 6.5 fold increase. A sharp increase since 2010 is attributable to the policy of engaging CHW actively in TB control. However, as the volume of screening increases, also the number needed to screen (NNS) increased rapidly meaning more people needed to be investigated to find one TB case: a nearly 10 fold increase was seen from 2005 to 2013 from 3.7 to 30.8. This trend should be monitored carefully and the presumptive TB cases diagnosed as TB case should be characterised to try to optimize the screening strategy linked to cost-effectiveness.

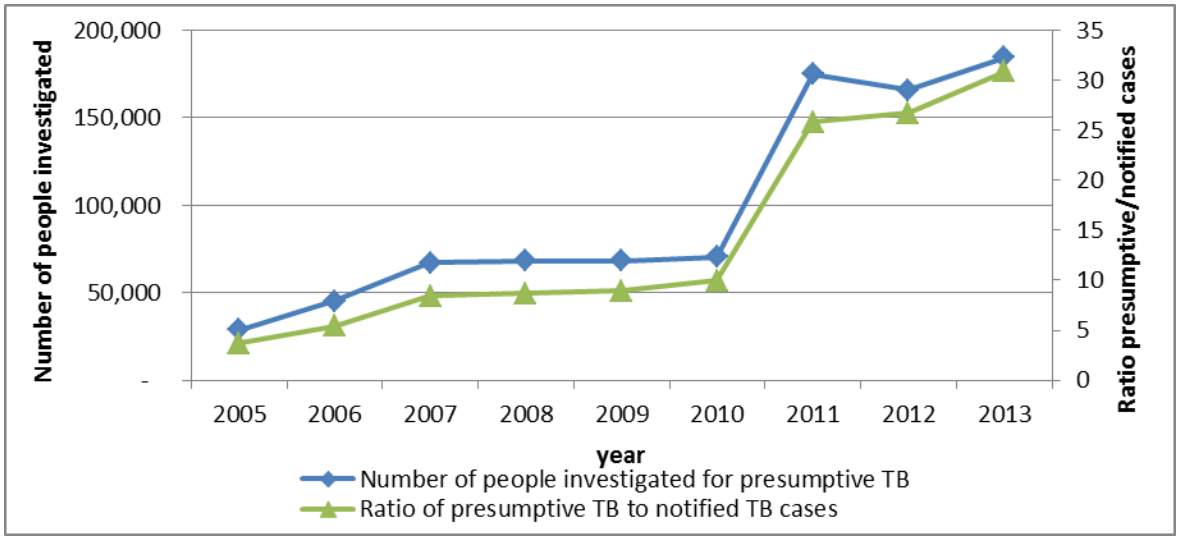


Figure 37 Number of people investigated for presumptive tuberculosis and ratio of presumptive TB to notified TB cases between 2005 and 2013.

v. Performance of community/active case finding (number of cases screened and detected by each mechanism);

There has been a very rapid increase in number of presumptive TB case notified that were referred by CHWs especially since 2010 (Figure 38) when the community TB indicators were added to the PBF scheme and the community DOT system reached nationwide coverage. From a contribution of just 0.5% in 2005 the CHWs now contribute 20% of notified TB cases. In comparison, active case finding in prisons and contact tracing contributes about 3% of notified TB cases (see above).

Treatment outcome for those managed in the community is monitored separately since 2007. Treatment success rate is high and has been over 90% since 2007 and was 94% for 2011, the last year the data were available. This is slightly higher than the treatment success in the general population, which reached 89.7% in 2012 (Figure 39).

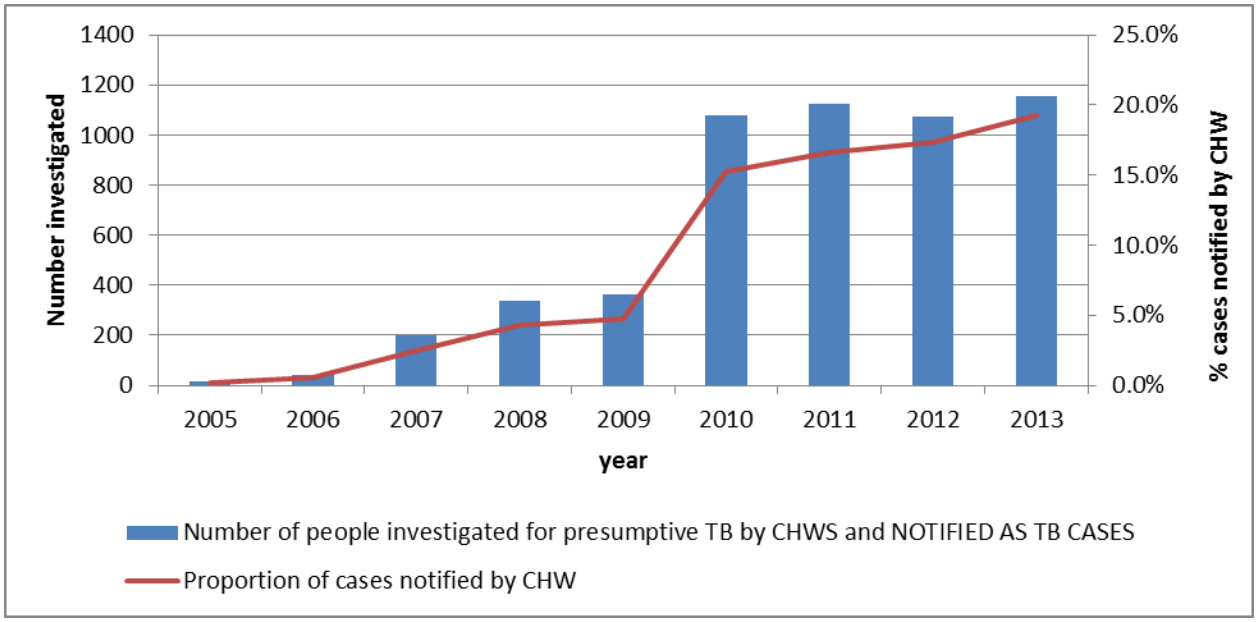


Figure 38 Contribution of Community Health care workers in TB control in Rwanda between 2005 and 2013

Table 10 Treatment outcome for cases managed in the community by CHW

	2007	2008	2009	2010	2011
Registered	544	1,595	2,093	2,469	3,072
Cured+Completed Tx	503	1,532	1,999	2,257	2,888
Failure	9	na	na	60	55
Dead	17	na	na	89	77
Lost to FU	3	na	na	18	26
Tranferred	10	na	na	17	17
No outcome/Not evaluated	2	63	94	28	9
TREATMENT SUCCESS RATE	**92.5%**	**96.1%**	**95.5%**	**91.4%**	**94.0%**

vi. Performance and coverage of public-private mix activities in the country.

The role of the for-profit private sector is limited in Rwanda. There were 4 private CDT from 2008-2011 (2.1% of all CDT) and currently there are only 3 that report to the NTP (1.5%). They contribute less the 1% (0.3%) of all presumptive TB cases and about 1% of TB cases, which increases slightly from 0.7 to 1.3% since 2008. About a third of health facilities are faith-based, belonging to religious organizations while providing non-profit services to the population.

The health seeking behaviour questions administered during the national TB prevalence survey indicated that if people seek health care for their symptoms, most of them use the public sector, although about 5% visited the private clinic and 10% used the pharmacy (Table 11).

Table 11: Health care seeking among people with presumptive TB as per screening during the National TB prevalence survey

	Total		With any cough		Cough of 2 weeks and more	
	N	%	N	%	N	%
Where did seek health care given symptoms						
Nowhere	3568	75.9	1934	67.7	1097	61.9
Somewhere	1132	24.1	921	32.3	676	38.1
Total	4700	100	2855	100	1773	100
Formal if seek for help somewhere						
Health center	941	83.1	763	82.8	573	84.8
Private clinic	56	4.9	48	5.2	39	5.8
District hospital	154	13.6	118	12.8	97	14.3
Referral hospital	55	4.9	41	4.5	30	4.4
Community health worker	21	1.9	19	2.1	15	2.2
Informal if seek for help somewhere						
Pharmacy	119	10.5	101	11	71	10.5
Traditional healer	73	6.4	54	5.9	39	5.8
Other	43	3.8	38	4.1	21	3.1

Source: Data national TB prevalence survey (2012)

vii. Any quantitative data on diagnostic delays

Delay is not systematically measured although some data are available from studies. One study on risk factors for delay in the diagnosis and treatment of tuberculosis at a referral hospital in Rwanda indicated that "*The median total, health care and patient delays were respectively 57, 28 and 25 days. The health system delay before referral was significantly longer than the delay at our institution (18 vs. 6 days, P<0.0001). Risk factors for a longer health system delay at our institution were smear-negative PTB or EPTB (OR 5.12) and a trial of antibiotics (OR 2.96)*." (Lorent et al., 2008)

viii. Number of people successfully treated for TB out of all notified;

The treatment success rate (TSR) for new smear positive cases increased over last 20 years from around 60% in 1991 to 90% in 2013 (Figure 39). A rapid increase was seen from 2001 onwards, when the TB program expansion and consolidation occurred. During this period also the country transitioned from a capacities management by international donors after the 1994 genocide, to country ownership of capacities management getting progressively experiences. Between 1991 and 2012 the proportion of deaths during TB treatment gradually decreased, from 7.7% in 1991 to 4.3% in 2012 after a peak of 15.7% in 1997, likely linked to the collapse of the health system after the 1994 genocide. During the period of 1998-2001 a very high and fluctuating number of patients were not evaluated. The reason is linked to transitioning management capacities to decentralized level during that time, with not yet fully skilled, experienced staff and not enough personnel and financial means at those decentralized levels. Later, in 2004, quarterly evaluation meetings were set up at district level to closely monitor all patients data including treatment outcome.

Treatment success rate by province (Figure 40) over time shows that all provinces except Kigali have reached 85% treatment success since 2007, while Kigali only reached that level in 2012. In nearly all provinces there appears to be an aberration in TSR in 2001. This is especially visible in Kigali where TSR dropped 5%. The reason for this is likely linked to a specific monthly system to monitor patient transfers that was put in place during that time as the lower TSR was driven by higher transfer out rates

especially in Kigali. Looking in closer detail at the 2010 treatment outcome data for the 3 Kigali districts indicates that two of the three show a peak in transfer out patients that year (Figure 41). Comparing transfer out rates by province between 2006 and 2012 indicates that Kigali had the highest percentage since 2006 which decreased sharply after 2010 (Figure 42).

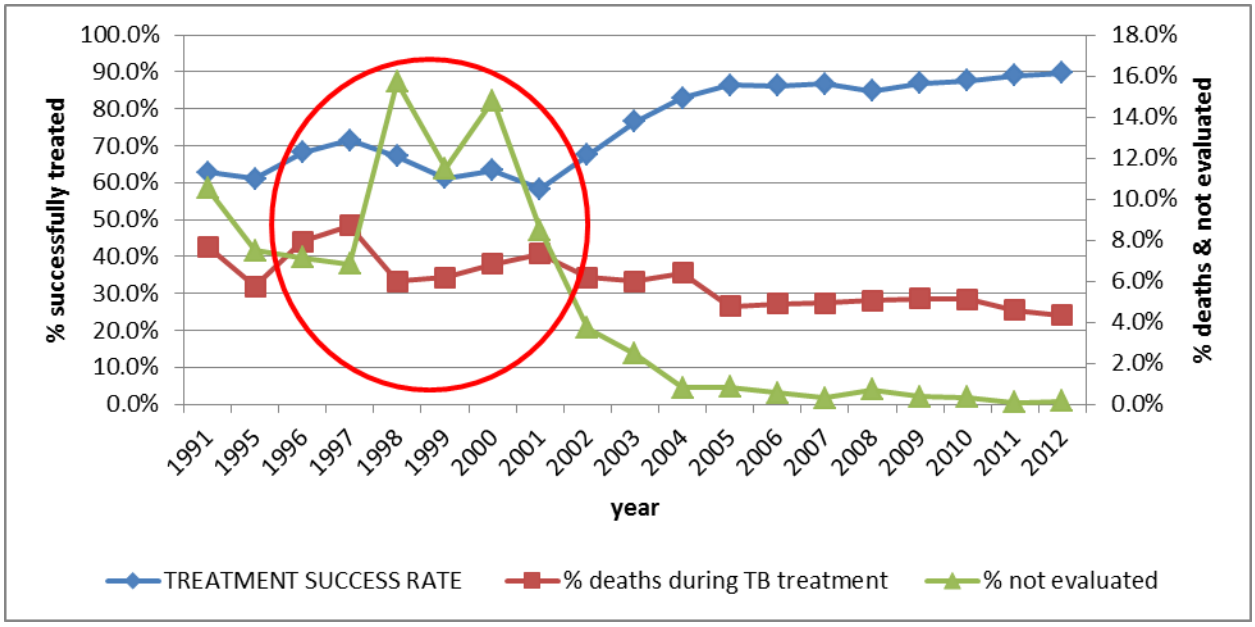


Figure 39Treatment success rate for new smear positive cases, proportion of patients that die during TB treatment and proportion not evaluated between 1991 and 2012.

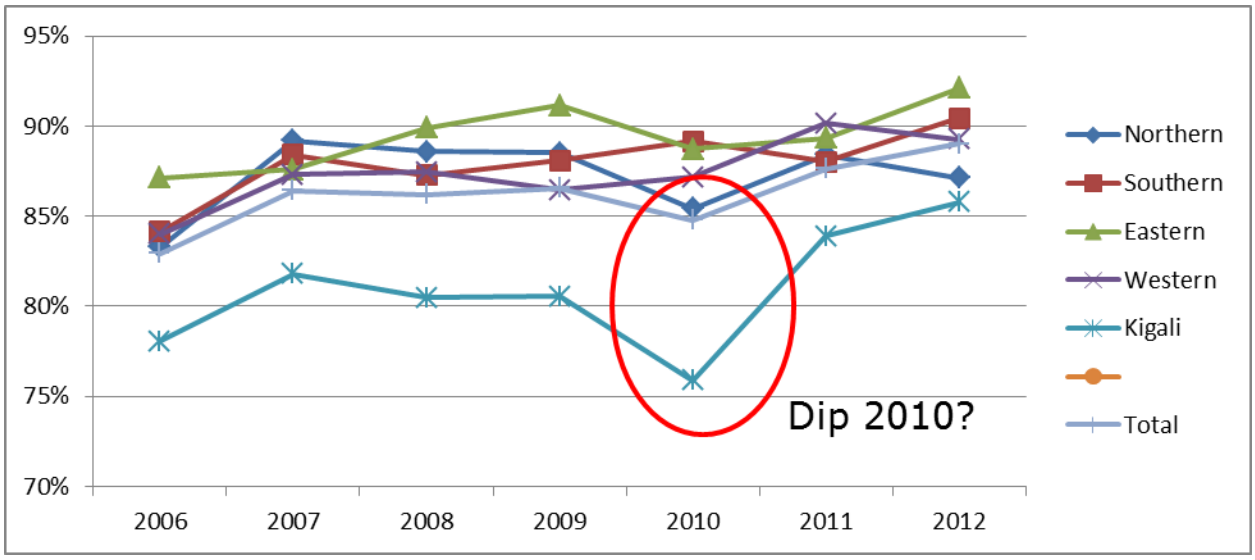


Figure 40 Treatment success rate for new smear positive cases by province between 2006 and 2012.

Besides the treatment success rate for new smear positive cases the program also monitors outcome for cohort of new smear negative/smear not done and EPTB cases combined, for relapse, return after default and failures since 2005. Treatment success has gradually increased in all groups and is between 75-85% for all (Figure 43). The large fluctuation in the TSR for return after default cases is partly due to the small number of cases, 27 in 2012.

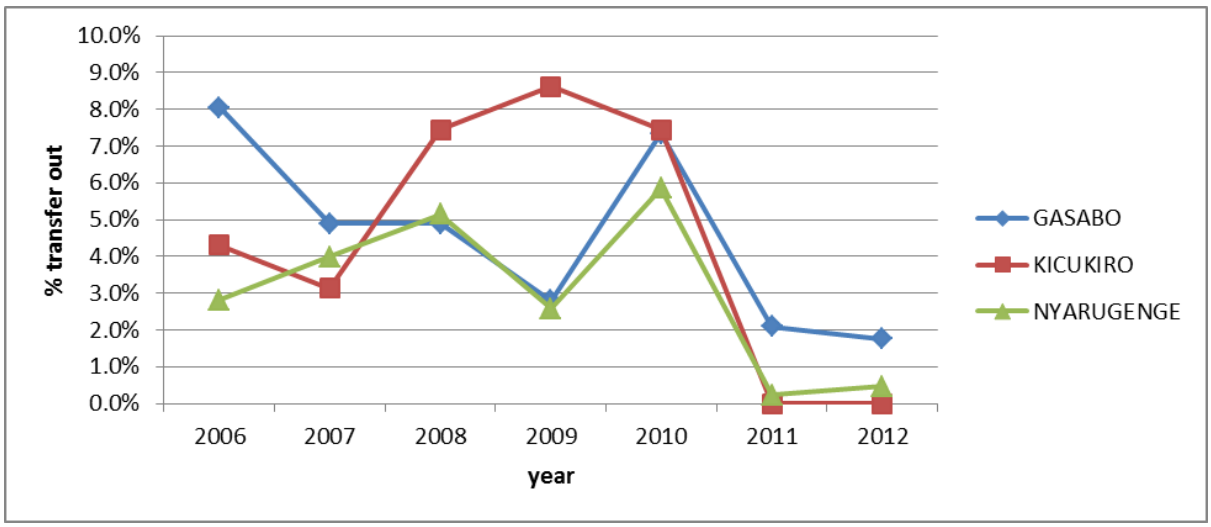


Figure 41 Transfer out rate (%) over time for the three districts of Kigali

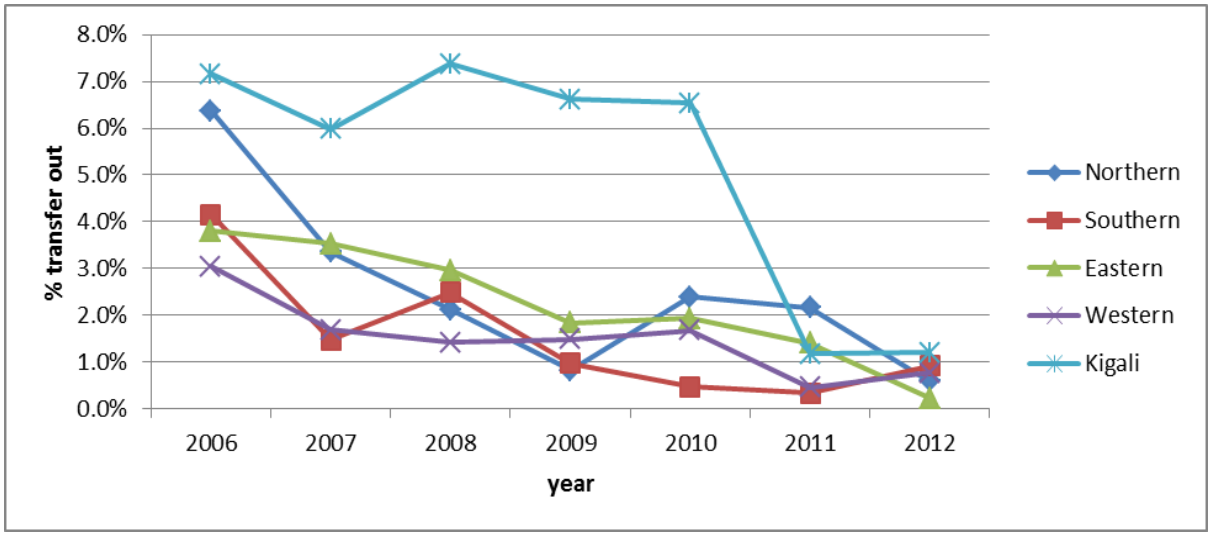


Figure 42 Transfer out rate (%) by province between 2006 and 2012

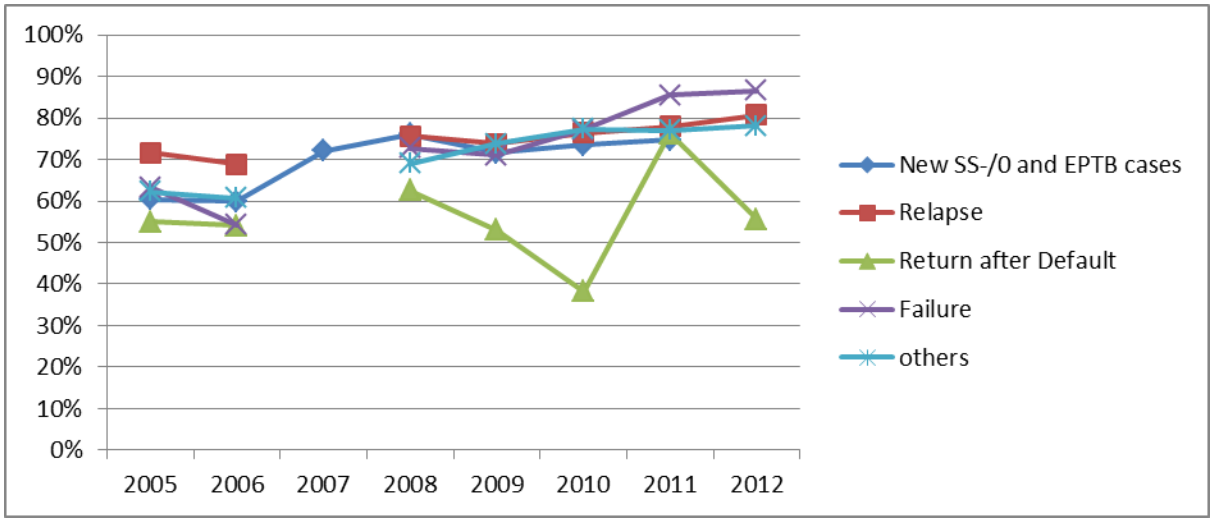


Figure 43 Treatment success rate for different cohorts of TB cases between 2005 and 2012

ix. MDR-TB treatment coverage (comparing numbers detected and treated with the estimated number of cases among notified TB patients and describing the size of waiting lists), and treatment outcomes among MDR-TB patients.

Per national guidelines, all retreatment cases are tested for MDR since 2005. Kigali is considered a high risk area and since 2012 all new SS+ cases undergo DST. In addition to retreatment cases, several others are considered at higher risk for MDR-TB treatment are being cultured. Overall coverage is high for each risk group (Table 12). Despite this increased effort the number of MDR cases detected seemed to decrease and in 2013 'only' 43 cases of MDR-TB were detected (Table 13). The actual number of cases detected during 2013 is 49, six more. During a 5 month period in 2013, the culture system (biosafety cabinet) was not functional following maintenance issues and culture could not be performed at NRL. However samples were collected and kept at NRL and the backlog was cultured in 2014 when the system was fully operational again. In the first 6 months of 2014 54 MDR-TB cases were notified suggesting the downward trend is not present.

Table 12 Coverage in sputum culture, for people at high risk of MDR-TB, Jan - Mar 2014

Types of eligible cases to sputum culture for DST	Number registered	Number cultured	Coverage in sputum cultures (%)
New SS+ at M2	141	134	95.0%
Failure	17	15	88.2%
Relapse	53	50	94.3%
Defaulters	5	5	100.0%
NSS+ in prisons	91	89	97.8%
NSS+ among HCWs	5	5	100.0%
NSS+ among PLHIV	158	137	86.7%
NSS+ in high risk area	240	232	96.7%
NSS+ among MDR-TB contacts	57	5	8.8%
Total	**767**	**672**	**87.6%**

Table 13 Detection of MDR-TB cases in Rwanda from 2005 to 2013

Year	MDR-TB detected	Died before diagnostic	Initiated treatment
2005-6	90	14	76
2007	102	10	92
2008	74	11	63
2009	80	10	70
2010	91	4	87
2011	82	5	77
2012	57	0	57
2013	43	1	42
Total	**619**	**55**	**564**

The question is what the true burden of MDR-TB is in the country. Like general TB, the MDR-TB burden is likely also lower than previously estimated. Results of the last DRS done in 2004/5 indicated a MDR-TB prevalence of 3.9% among new cases and 9.4% among retreatment cases (Umubyeyi et al., 2007) on the basis of which the current WHO estimates are made (Table 14). The 3rd DRS survey is underway and results are expected in 2015 which should confirm the actual MDR-TB burden in the country. This is anticipated to be lower than currently estimated as with the rapid scale up of detection of groups at high risk for MDR-TB the projected numbers cannot be detected. Treatment outcomes are very good among the MDR-TB patients in Rwanda with a treatment success rate of 89% and 2% failing and defaulting and 9% deaths.

Table 14 Estimated burden for MDR-TB in Rwanda as per Global TB report 2013

Estimates of MDR-TB burden 2012*	New	Retreatment
% of TB cases with MDR-TB	3.9 (2.5–5.8)	19 (15–23)
MDR-TB cases among notified pulmonary TB cases	180 (120–270)	63 (51–76)

x. HIV testing, ART and CPT coverage of TB patients, treatment outcomes among PLHIV. This is especially relevant in countries with a high TB/HIV burden.

Roll out of collaborative TB-HIV activities started in 2004 and saw a rapid scale up with a steep increase in coverage of HIV testing among TB patients from just over 40% in 2004 to over 90% in 2008. Since then it has remained very high reaching nearly 95% in 2012. At the same time the HIV prevalence among TB patients declined. Roll out of CPT among HIV+ TB patient reached >80% coverage in 2008. Although ART provision has seen a rapid scale up the activity is still lagging behind with only 70% of HIV+ TB patients provided with ART. The 70% is following the new WHO guidelines whereby all HIV+ TB patients are entitled to receive ART and this is no longer determined by their CD4 count. The rapid scale up was facilitated by the receptiveness of staff and patients to HIV testing and expanded access to testing, care, and treatment. The scale-up of testing resulted in dramatic increases in the uptake of lifesaving HIV care and treatment coinciding with a decline in the risk of death among patients with TB/HIV (Pevzner et al., 2011).

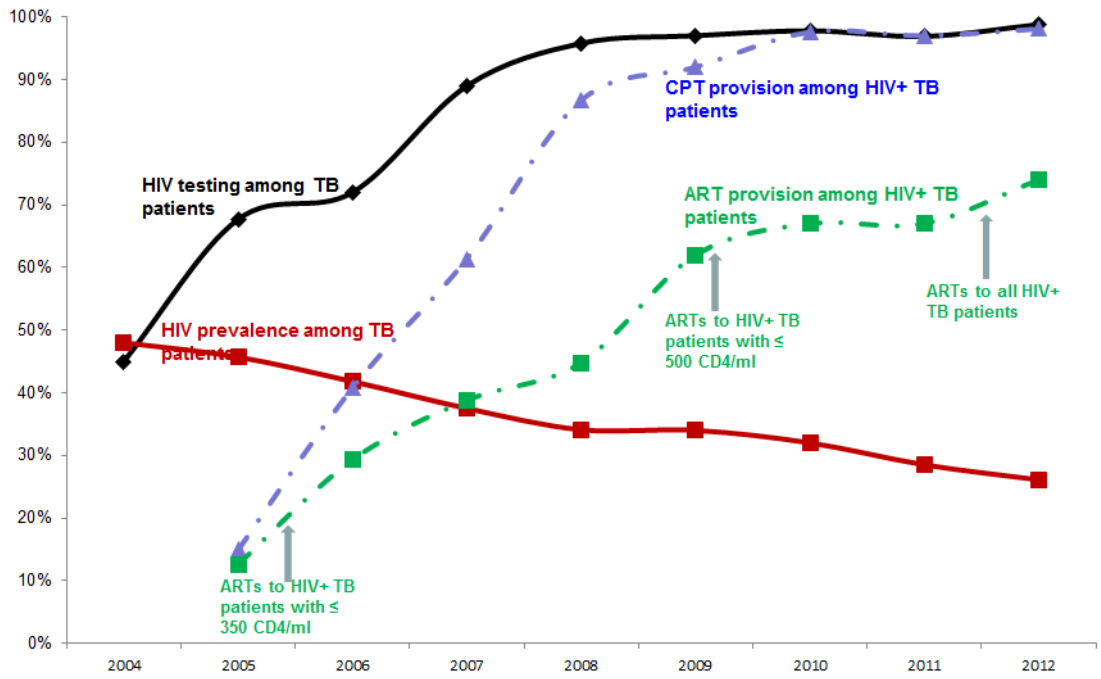


Figure 44 Roll out of TB-HIV joint activities between 2004 and 2012 (source M&E sections NTP)

Since 2010 not only diagnosed TB cases but all persons with presumptive TB are offered HIV testing. Coverage increased rapidly since the start in 2010 and currently 95% know their HIV status. The proportion of persons TB screened who are HIV positive (either newly tested or known HIV positive) decreased since the start of testing and ranges between 4-13% for most districts except for Kigali where it ranges between 20-30% (Figure 45). This is linked to the higher HIV prevalence observed in Kigali as discussed earlier. Treatment outcome for the TB-HIV cohort is routinely reported since 2010. Treatment success increased from 75% in 2010 to 77% in 2012 with the proportion of cases with no outcome registered decreasing form 8 to 2% over the same period.

Table 15 Reported treatment outcome for TB-HIV co-infected patient from 2010 to 2012

Outcome/year	**2010**	**2011**	**2012**
Registered	2222	1888	1601
Cured+Completed Tx	1667	1406	1228
Failure	13	10	40
Dead	318	326	249
Lost to FU	49	42	52
Not evaluated/Transferred	175	104	32
TREATMENT SUCCESS RATE	**75.0%**	**74.5%**	**76.7%**
% no outcome available (not evaluated/transfer)	*7.9%*	*5.5%*	*2.0%*

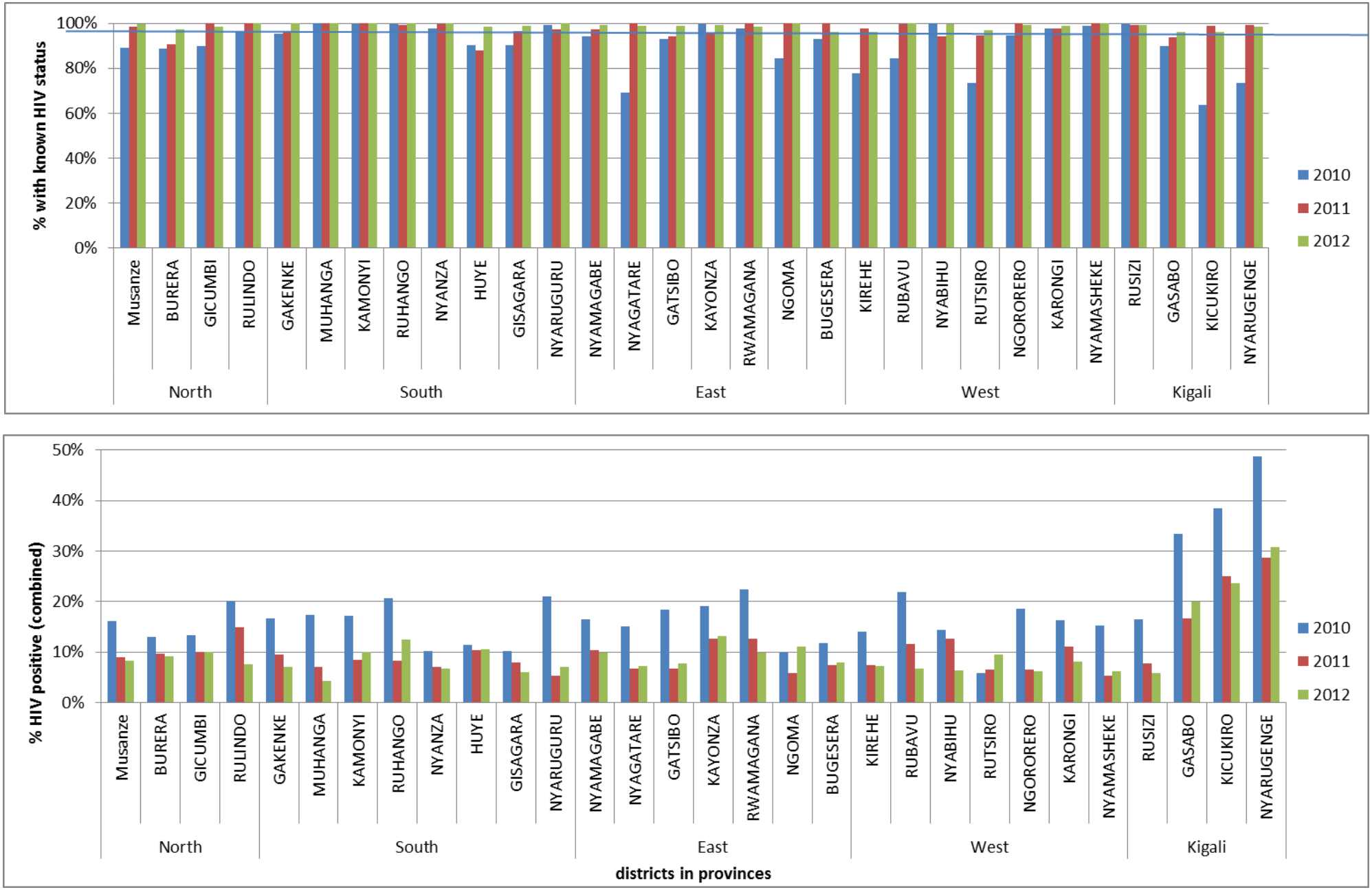


Figure 45 Roll out of HIV testing among presumptive TB cases, those with known status (top graph) and the HIV positive rate (combined - bottom graph).

b) Define and compile data that are relevant to assessment of the extent to which changes in TB disease burden in recent years can be explained by factors that are not specifically related to TB-specific funding and associated interventions. This should include, at a minimum:

i. *Prevalence of HIV among the general population, and ART coverage.*

Since 1990 estimated HIV prevalence was assumed to peak around 1994 after which prevalence decreased to around 3% at which it remained more or less since 2006 (Figure 46). Estimated HIV incidence is assumed to follow a similar pattern, peaking a little earlier in 1991 (Figure 47). Data on the HIV response are available from 2001 onwards showing a rapid increase in number of VCT centres offering testing and number of health facilities providing ART and number of people on ART since 2002 (Figure 48).

A paper from 2006 reviewing the HIV/AIDS epidemic in Rwanda concluded that *"Rwanda may have experienced declines over the long term in HIV prevalence in urban areas, especially in Kigali, and may have stable or slightly rising HIV prevalence in rural areas."* (Kayirangwa, Hanson, Munyakazi, & Kabeja, 2006).

Plotting the number of patients on ART with the AIDS related deaths and estimated HIV sero-positivity assumes a rapid decline in both indicators after ART scale up (Figure 49).

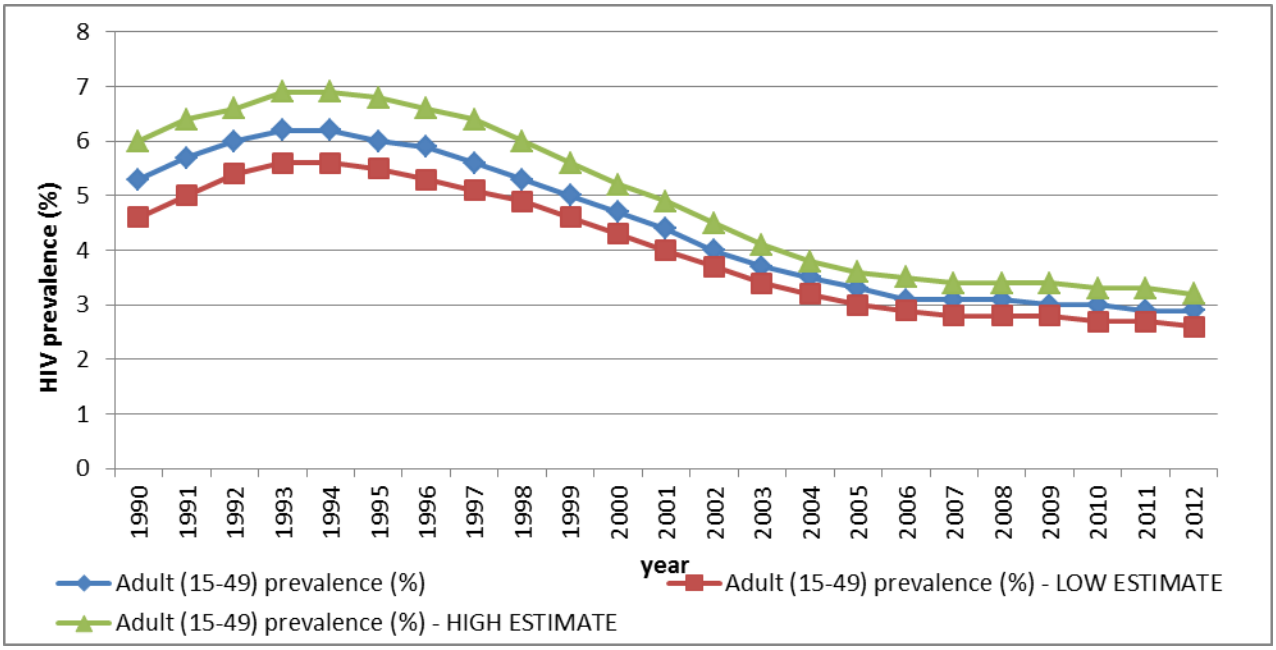


Figure 46 Estimated trend over time in HIV prevalence in adults 14-49 years with low and high estimate bounds
(Source: UNAIDS Report on the Global AIDS Epidemic – 2013)

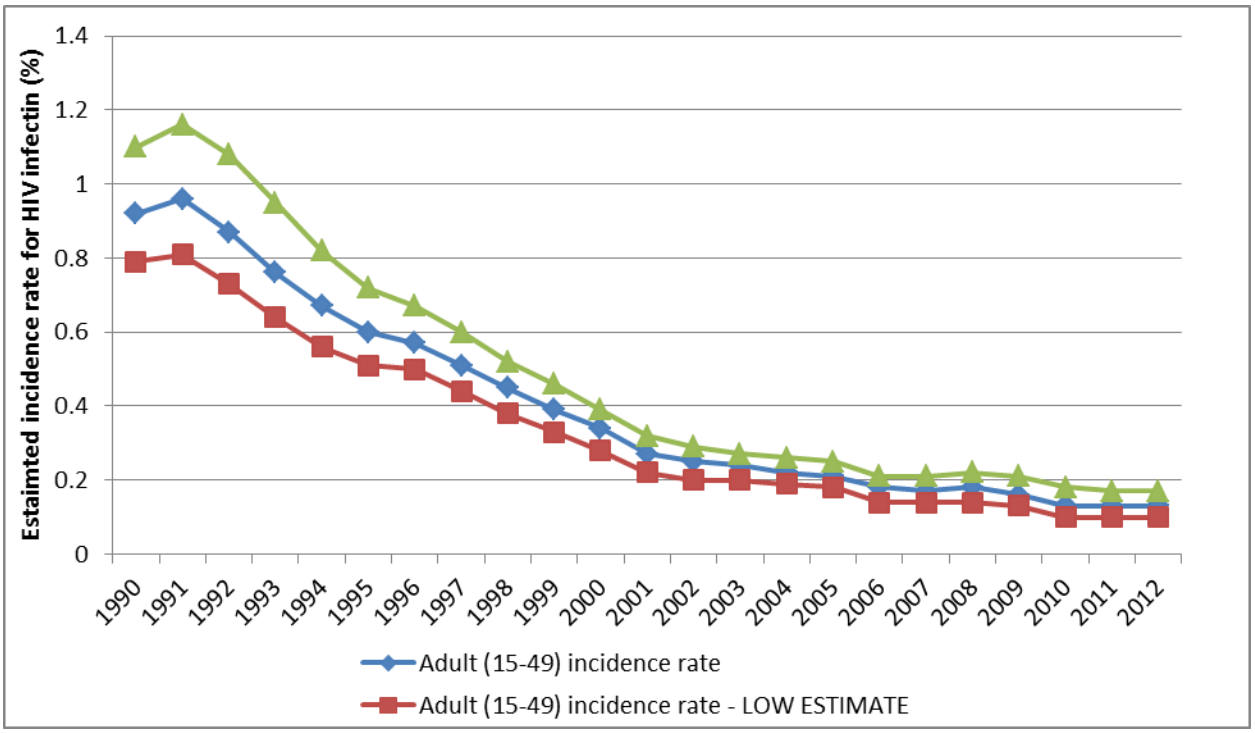


Figure 47 Estimated trend over time in HIV incidence rate in adults 15-49 years with low and high estimate bounds
(Source: UNAIDS Report on the Global AIDS Epidemic – 2013)

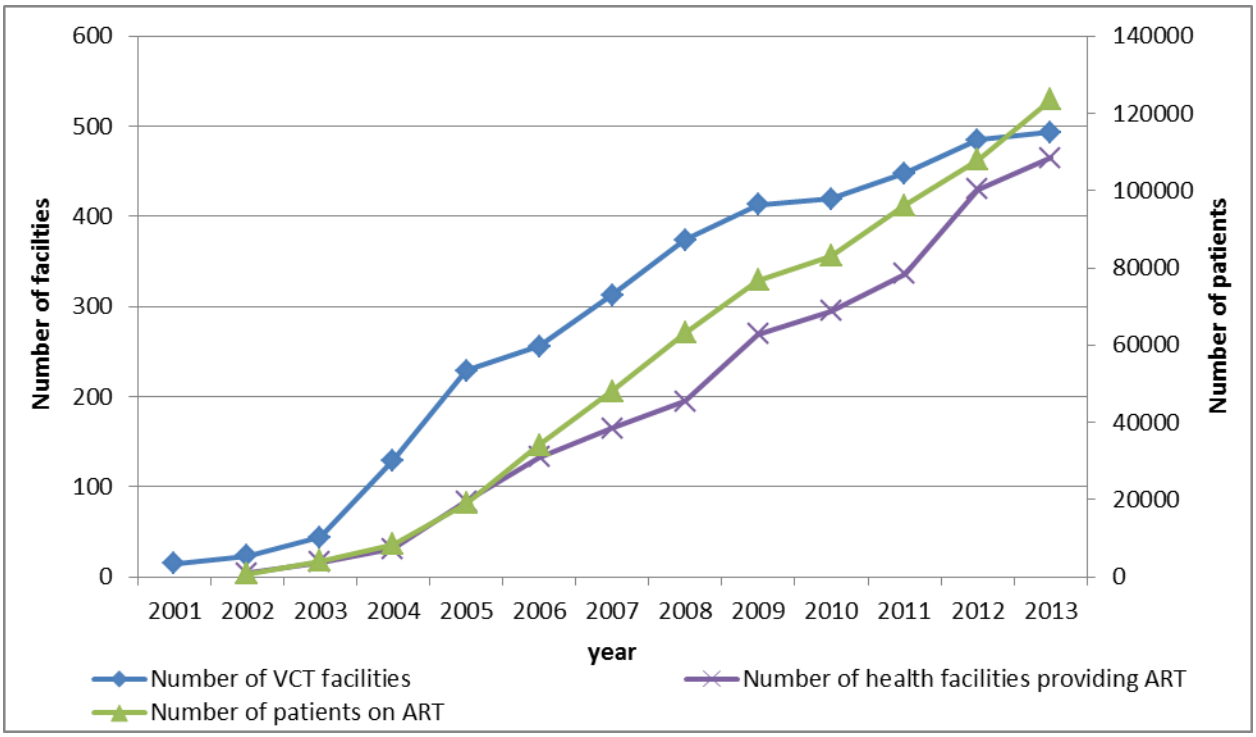
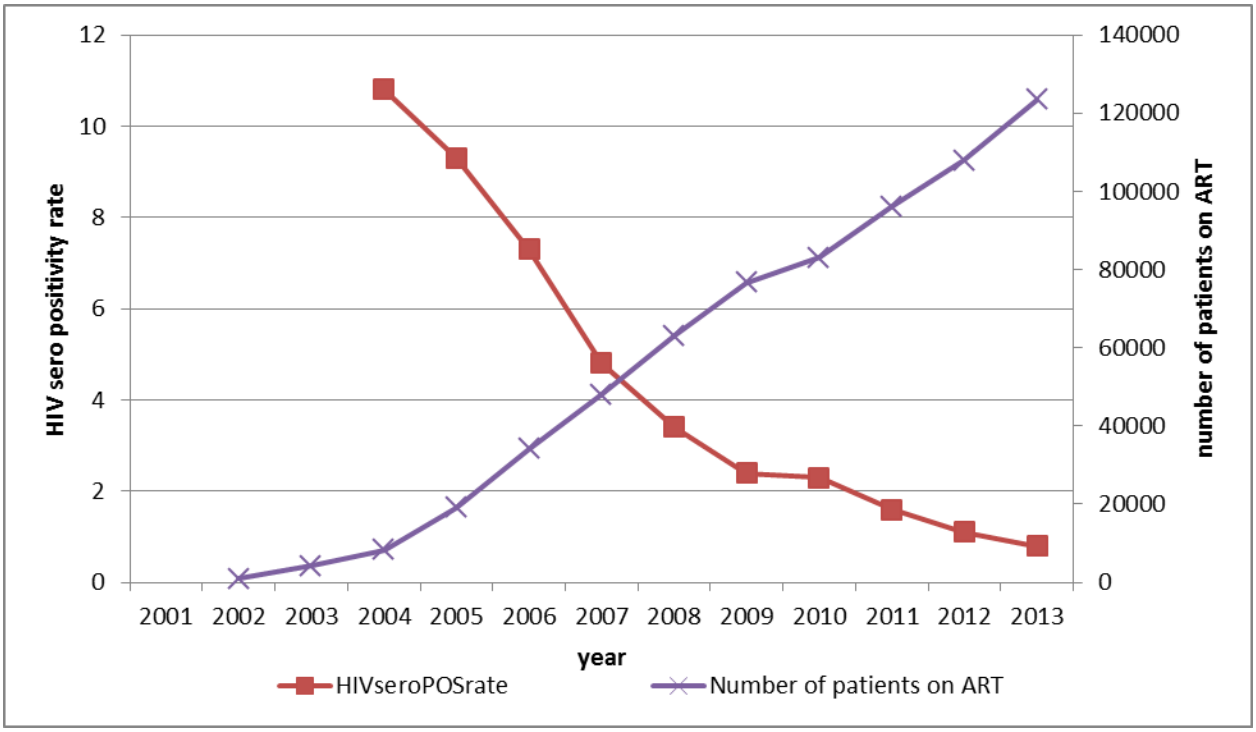


Figure 48 Scale up of the HIV response, trend in facilities providing voluntary counselling and testing (VCT) and anti-retroviral therapy (ART) and number of patients on ART from 2001-2013
(source Annual report HIV program RBC 2012-2013)



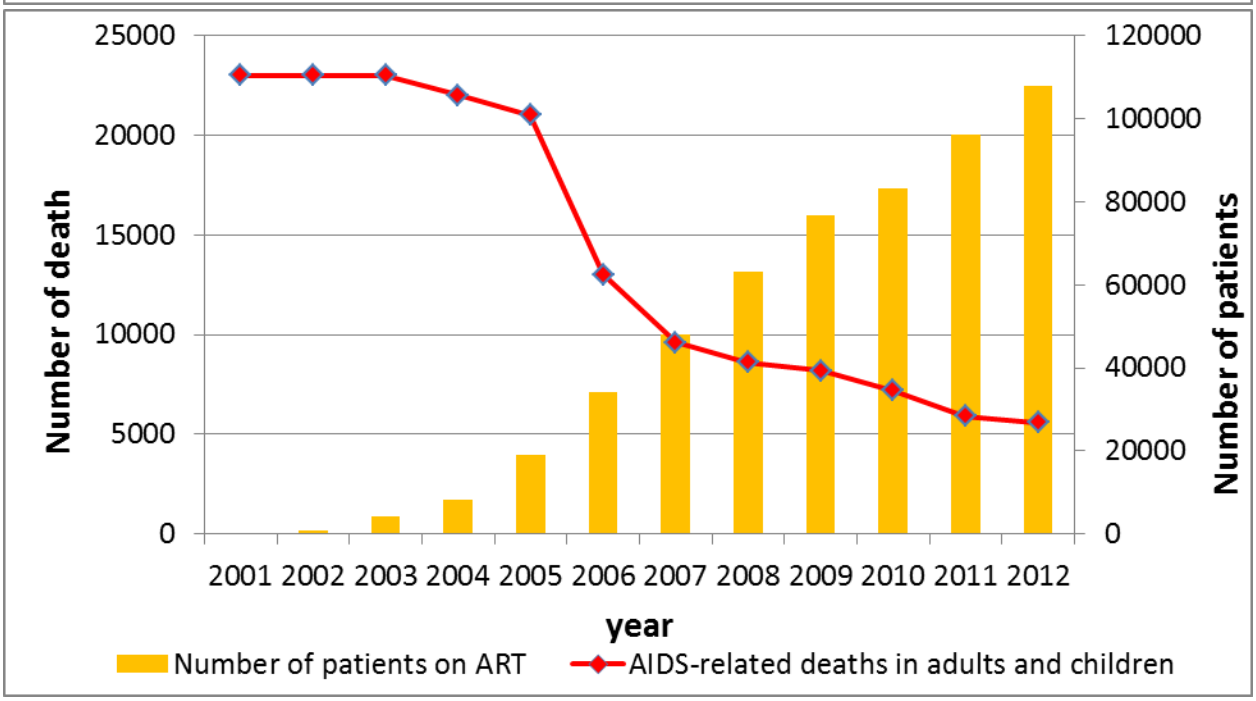


Figure 49 Impact of the HIV response between 2001-2013, trend of the number of patients on ART and the HIV sero- positivity rate (upper graph) and trend of the number of patients on ART and the AIDS related deaths in adults and children
(source Annual report HIV program RBC 2012-2013)

WHO global health data indicate ART coverage of 87% [95% CI 80-93%] in 2012 using the 2010 guidelines (CD4<350) with a coverage of even >95 [87- >95] using the 2006 guidelines (CD4 < 200).[3] ART coverage increase from 70% in 2009 to 87% currently (Figure 50).

[3] Towards Universal Access - Scaling up priority HIV/AIDS interventions in the health sector Progress Report 2010 http://whqlibdoc.who.int/publications/2010/9789241500395_eng.pdf

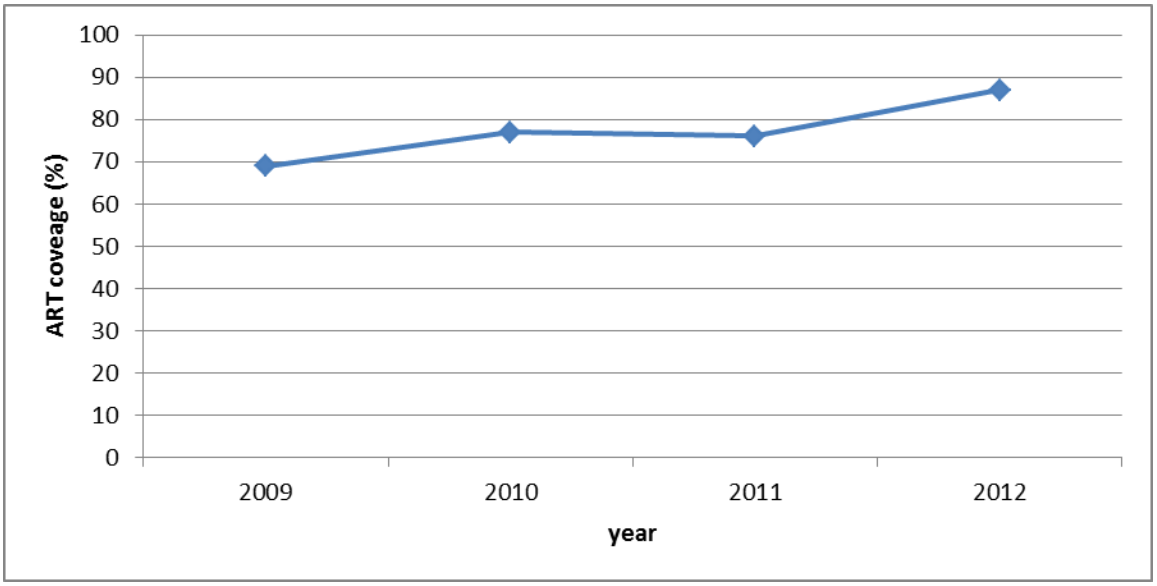


Figure 50 Trend in antiretroviral therapy coverage (% of people with advanced HIV infection) from 2009-2012
(source Worldbank data base (from UNAIDS data) data extracted 21 July 2014)

ii. ***Prevalence of diabetes, tobacco use and under-nutrition.***

The recently concluded STEP survey was a first population based survey into Non Communicable Disease (NCD) in Rwanda and provided valuable insight in prevalence of diabetes and smoking amongst others.

Diabetes

The STEPS survey looked at risk factors for diabetes and reported treatment for diabetes but these results are not yet available. The only figure on diabetes prevalence that was available was from the World Bank indicators reporting a diabetes prevalence of 5.01% among the population ages 20 to 79 years based on the data from the International Diabetes Federation, Diabetes Atlas. The DHS 201 did collected data on obesity which could be used as proxy for diabetes. Among women (15-49 years) prevalence of obesity (BMI>=30) ranged from 0-3.8% outside of Kigali and was double that at 7-8% in the three districts of Kigali. Among men obesity was much lower ranging from 0-0.8% outside of Kigali except for Rwamagama district with 1.8% prevalence. The districts in Kigali showed a prevalence of 1.3-1.8%.

Tobacco use

Tobacco use is moderately high for Africa with 12.9% among the population of 15-64 years currently smoking. Males smoke more frequently than females (19.2 vs 7.2% respectively) (Table 16). Smoking is most prevalent in the oldest age group, with 50% of man and 30% of women smoking in that age group (Table 17). Smoking starts around 18-20 years of age. Most females that smoke do not smoke manufactured cigarettes but locally made ones (Table 16). The data on smoking collected during the 1st National TB prevalence survey conducted in 2012 obtained very similar figures to those from the STEP survey (Annex 5.9). A risk factor study embedded in the National TB prevalence survey indicated smoking is a risk factor for TB (OR 2.63 (0.96-7.18) p=0.059), which due to the low number of cases failed to reach significance. Smoking as risk factor is also internationally known (Lönnroth, Jaramillo, Williams, Dye, & Raviglione, 2009). A comparison made between the TB cases detected during the national prevalence survey

with those routinely diagnosed suggested TB in smokers is under detected (Prevalence survey report).

Table 16 Smoking behaviour for adults aged 15-64 year by gender

Results for adults aged 15-64 years (incl. 95% CI)	Both Sexes	Males	Females
Step 1 Tobacco Use	**n= 7,223**	**n=2,684**	**n=4,539**
Percentage who currently smoke tobacco	**12.9** (11.8-14.0)	**19.2** (17.4-21.1)	**7.2** (6.3-8.1)
Percentage who currently smoke tobacco daily	**8.9** (8.0-9.8)	**14.0** (12.5-15.5)	**4.3** (3.6-4.9)
For those who smoke tobacco daily			
Average age started smoking (years)	***n=694***	***n=451***	***n=243***
	19.0 (18.5-19.5)	**18.8** (18.3-19.4)	**19.7** (18.6-20.8)
Percentage of daily smokers smoking manufactured cigarettes	**n=709**	**n=458**	**n=251**
	58.0 (53.8-62.2)	**73.5** (69.2-77.8)	**12.4** (7.4-17.3)
Mean number of manufactured cigarettes smoked per day (by smokers of manufactured cigarettes)	**n=703**	**n=454**	**n=259**
	2.5 (2.2-2.9)	**3.3** (2.9-3.8)	**0.3** (0.1-0.4)

(Source STEPS survey of chronic disease risk factors in Rwanda - November 2012 to April 2013)

Table 17 Proportion of smokers (daily and non-daily) and non-smokers by age and gender in Rwanda

Age (Years)	Men			Women			Both Sexes		
	n	D&ND Smoker (%)*	N-smoker (%)*	n	D&ND Smoker (%)*	N-smoker (%)*	n	D&ND Smoker (%)*	N-smoker (%)*
15-24	568	6.5	93.5	943	1.2	98.8	1,511	3.8	96.2
25-34	927	20.5	79.5	1,462	2.9	97.1	2,389	11.2	88.8
35-44	559	23.3	76.7	991	9.1	90.9	1,550	15.6	84.4
45-54	393	37.8	62.2	667	21.6	78.4	1,060	29.0	71.0
55-64	237	49.7	50.3	476	29.2	70.8	713	38.3	61.7
TOTAL	2,684	19.2	80.8	4,539	7.2	92.8	7,223	12.9	87.1

**D&ND Smoker: Daily and non-daily smokers; N-Smoker: Non-Smoker*

(Source STEPS survey of chronic disease risk factors in Rwanda - November 2012 to April 2013)

Under-nutrition

Malnutrition has gradually declined in the last two decades after an increase around the 1994 genocide. Malnutrition prevalence expressed as weight for age has come down to close to 10% The 2010 DHS report indicates described the improvements in the nutritional status of children in the past five years as follows (NATIONAL INSTITUTE OF STATISTICS OF RWANDA, 2010; Figure 41):. The percentage of stunted children fell from 51 percent in 2005 to 44 percent in 2010. The percentage of children wasted declined from 5 percent in 2005 to 3 percent in 2010. Underweight declined from 18 percent in

2005 to 11 percent in 2010. These improvements are attributed to the National Plan to Eliminate Malnutrition, which includes active nutrition screening of children by community health workers (since 2009). Children who are determined to be at risk of malnourishment are referred to a health facility for appropriate treatment using therapeutic milks (F100 and F75), ready-to-use therapeutic food for severe cases, and corn-soy blend for moderate cases. Other sustainable approaches have been initiated and include infant and young child feeding, community based nutrition programs, behaviour change communication (mainly using media), and home food fortification (using micronutrient powders). Although there have been improvements in the nutritional status of Rwandan children in the past decade, there is still a need for more intensive interventions as the prevalence of malnutrition is still unacceptably high.

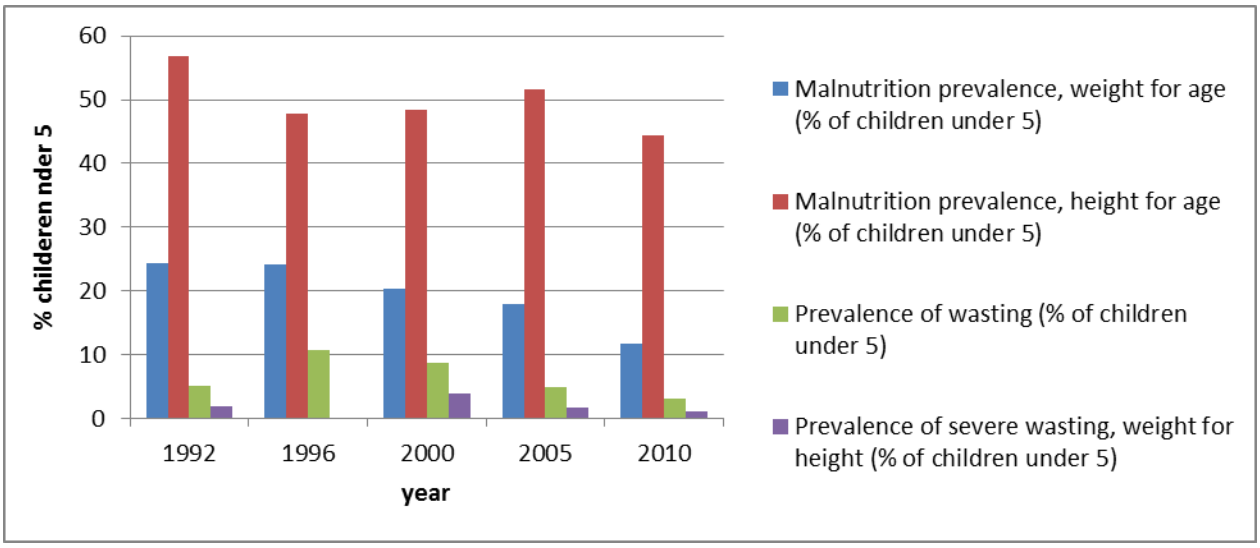


Figure 51 Different indicators of malnutrition prevalence between 1992 and 2010.

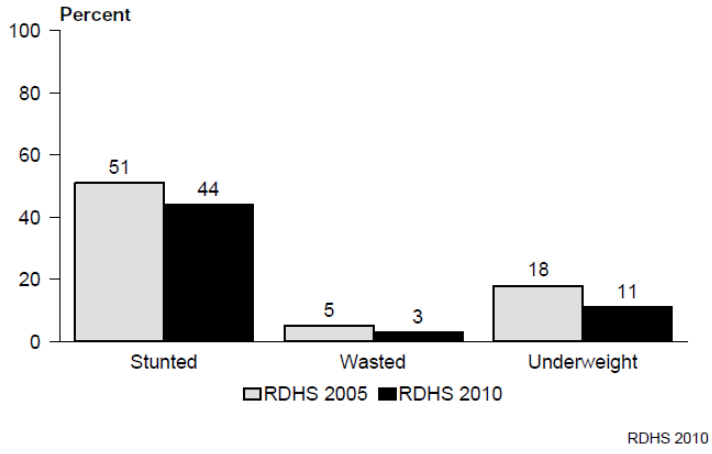


Figure 52 Difference in nutritional status of children under 5 years between the 2005 And 2010 DHS survey

(Source: DHS survey report 2010)

iii. GNI per capita and the % of the population under the poverty line, and the impact of economic crises.

Rwanda saw a very rapid economic development in the last 10 years (Figure 53). Since 1985 GDP and GNI have been on the increases with a steep dip in 1994 after which it gradually built up to 1985 levels again. After a small downward trend from 1999-2002, potentially related to the decrease in foreign investment the country saw a very rapid increase in GDP and GNI from 2003, more than tripling in this period from 200 to 620 USD per capita. In 2006 the decentralization policy was rolled out and PBF indicators for economic development were put in place at the district level. Following the increased economic development, the population below the poverty lines started to decrease but Rwanda is still a poor country with 64% of the population living on less than 1.25 USD per day (Figure 54).

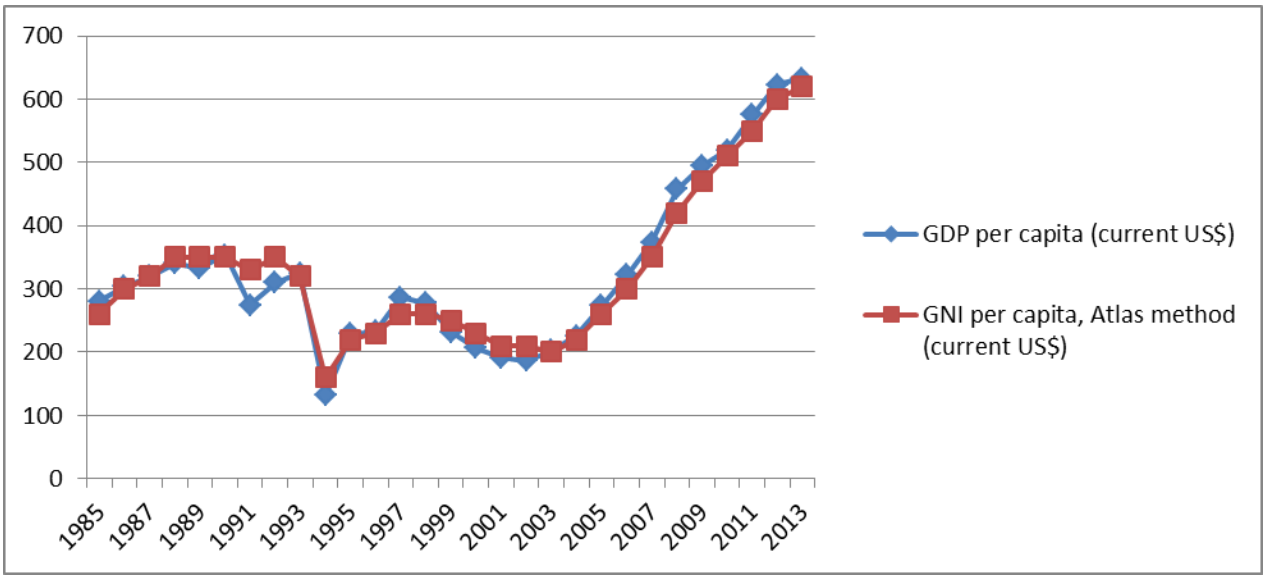


Figure 53 Gross National Income (GNI) and Gross Domestic Product (GDP) per capita in current US dollar in Rwanda from 1985 to 2013
(source World Bank data base - data extracted 21 July 2014)

Using the data from three consecutive Integrated Household Living Conditions Surveys (in French EICV: Enquête Intégrale sur les Conditions de Vie des ménages) conducted over the past ten years, EICV1 in 2000/01, EICV2 in 2005/06 and EICV3 in 2010/11, trends in poverty were evaluated (National Institute of Statistics Rwanda, 2012). At the national level, poverty fell from 58.9% in 2000/01 to 56.7% in 2005/06 and again to 44.9% in 2010/11 (Figure 55). Extreme poverty nearly halved from 40 to just 24% over the same period (Figure 56). In other words, poverty fell much faster in the second five-year period compared to the first. This partly reflects the much faster economic growth in the second five-year period, but it also reflects the fact that inequality fell in the second five-year period while it rose (by a smaller magnitude) in the first. Poverty is most concentrated in the southern part of the country (Figure 57).

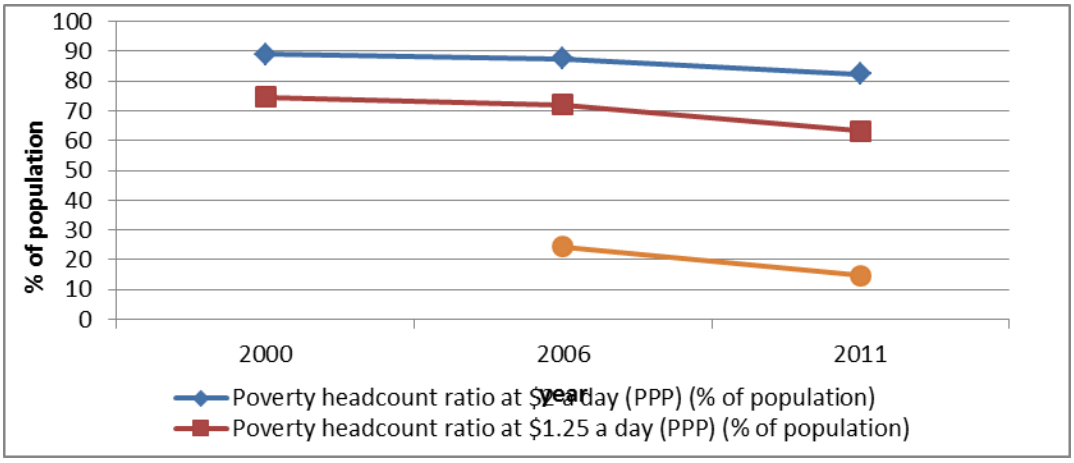


Figure 54 Trend in proportion of the population below the poverty line from 2000 to 2011 *(source Worldbank data base - data extracted 21 July 2014)*

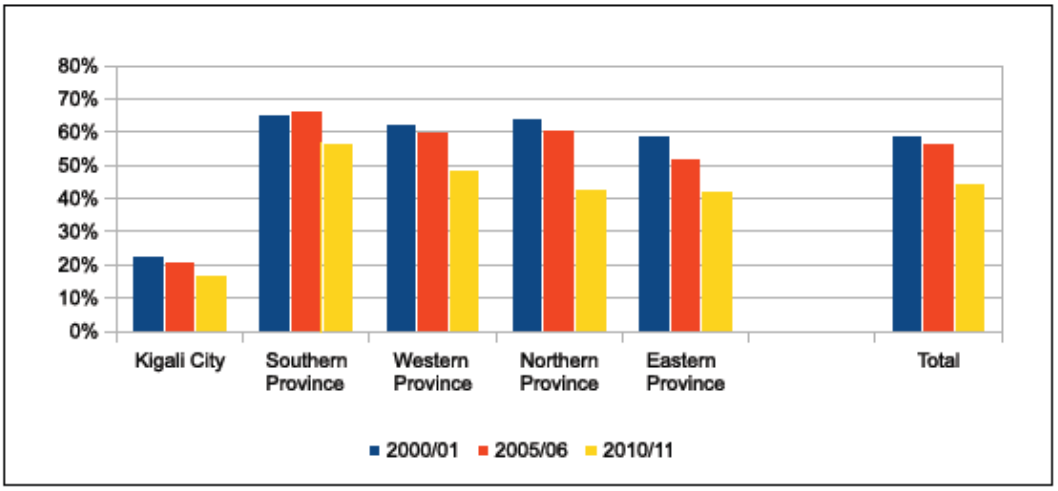


Figure 55 Percentage of the Rwandan population identified as poor in three consecutive household surveys (EICV).

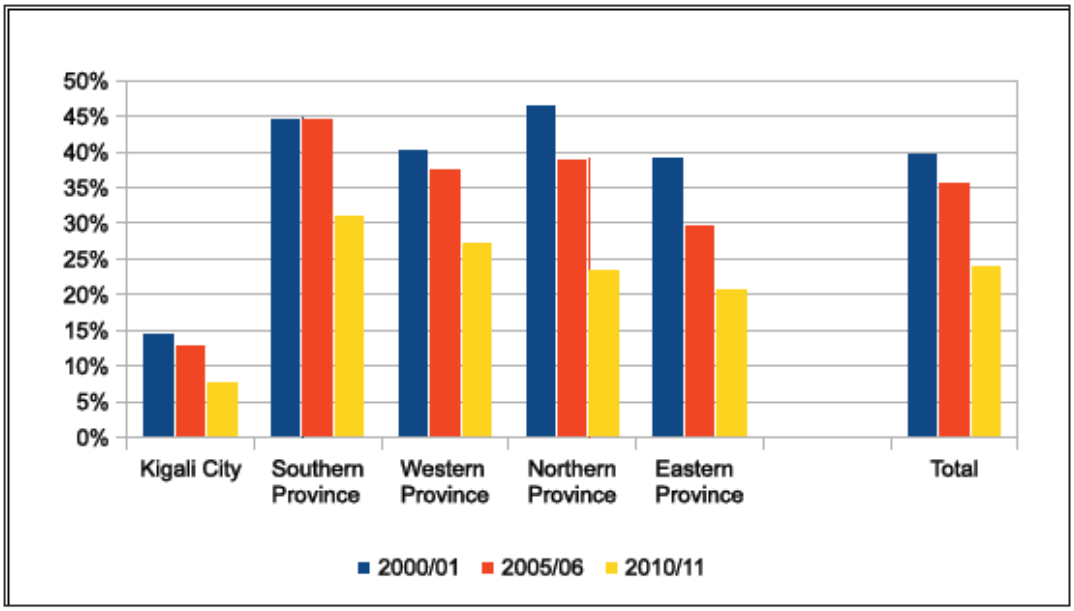


Figure 56 Percentage of the Rwandan population identified as extremely poor in three consecutive household surveys (EICV).

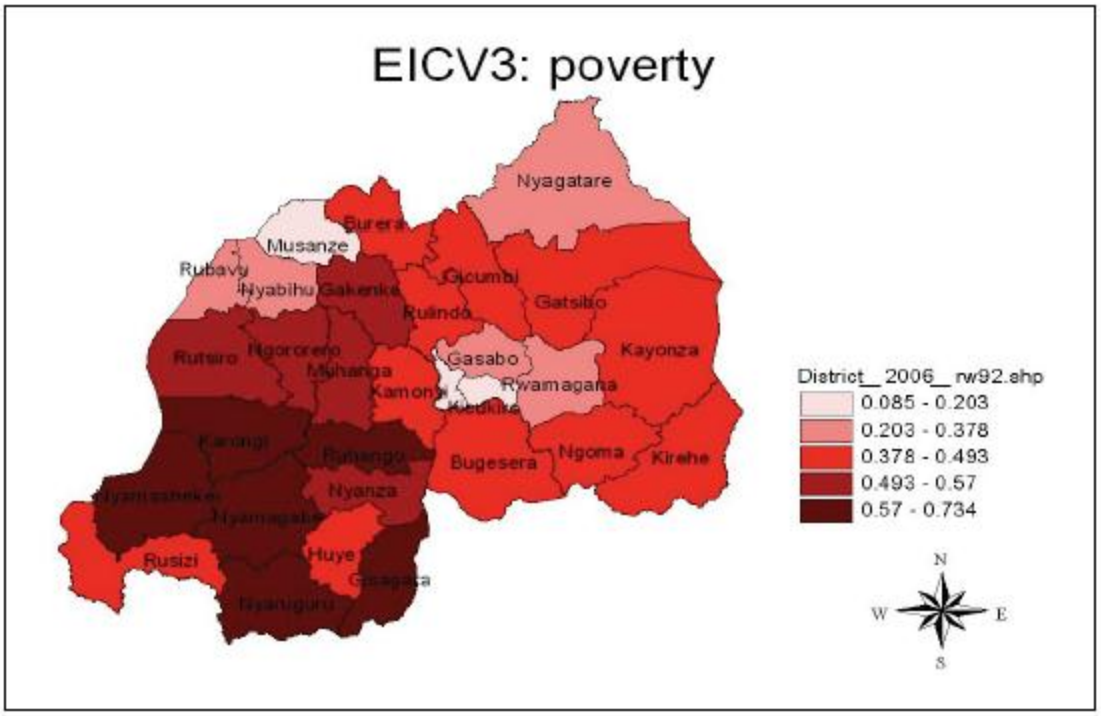


Figure 57 Mapped percentage of the Rwandan population identified as poor
(Source: adapted from report Evaluation of Poverty in Rwanda 2000-2011)

iv. Coverage of financial protection for health care costs (by government health budget or health insurance etc.) and social protection programmes (overall, and for DS-TB and MDR-TB specifically where available) and the percentage of health-care expenditures accounted for by out-of-pocket payments

Rwanda introduced a community health insurance system (CBHI) in 1999 to increase access to health care for its population. For more details on the insurance scheme see annex 5.10. To date there are different insurance systems. In 2012, 96% of its population was covered by health insurance of which 91% in the community based health insurance scheme Mutuelle de Santé (Ministry of Health Government of Rwanda, 2012). Eighty three percent (83%) of the population has access to health care within 2 hours of their home (Ministry of Health Government of Rwanda, 2012). A recent study concluded that Rwanda is approaching universal health coverage (Nyandekwe, Nzayirambaho, & Kakoma, 2014). A study evaluating the impact of the CBHI found that "*When the services are examined separately, each 1% growth of CBHI use was associated with 3.7% more prevention of mother-to-child transmission and 2.5% more voluntary counseling and testing services.*" And concluded that "*high use of CBHI in Rwanda was an important contributor to improving human immunodeficiency virus/acquired immunodeficiency syndrome services in rural health centers in Rwanda*"

Available resources for health have increased substantially over the last decade and a sharp increase in health expenditure per capita was observed from 2002 onwards. The influx of external resources on health was very large after the 1994 genocide and saw a peak in 2005 but has seen a gradual decreased since then except for a small increase in 2009. Out of pocket health expenditure is gradually lowering but has been around 25% since 1995 and currently stands at 21%.

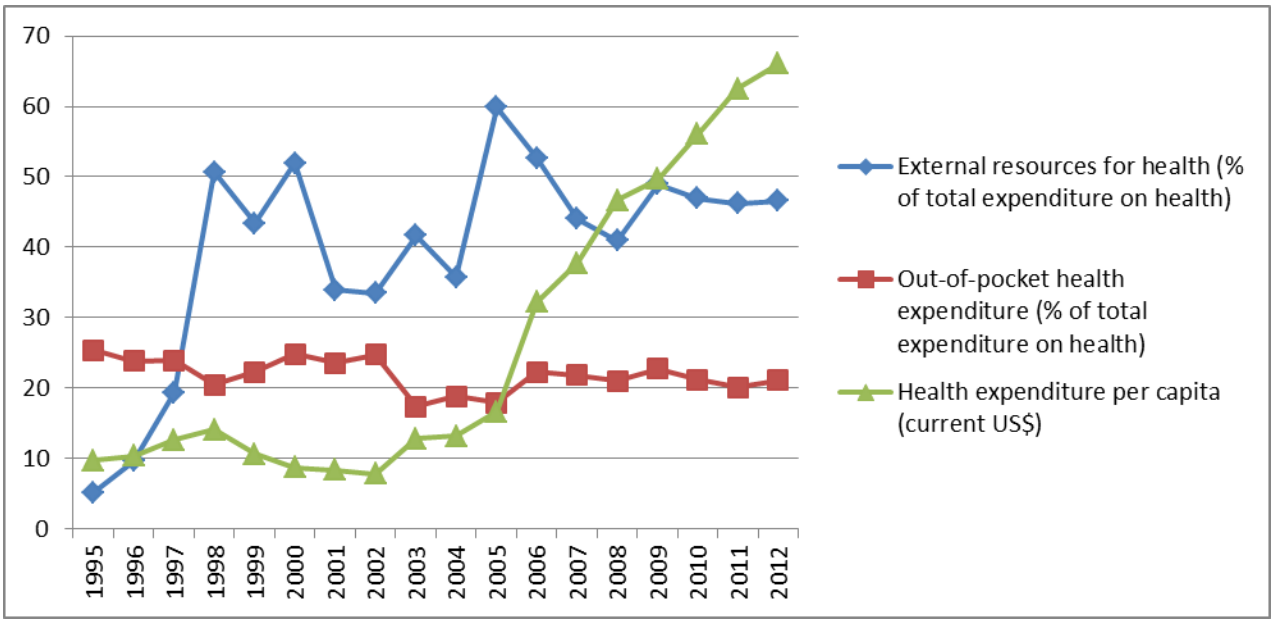


Figure 58 Trend in external resource for health, health expenditure per capita and out-of-pocket health expenditure between 1995 and 2012
(Source: World Bank indicators)

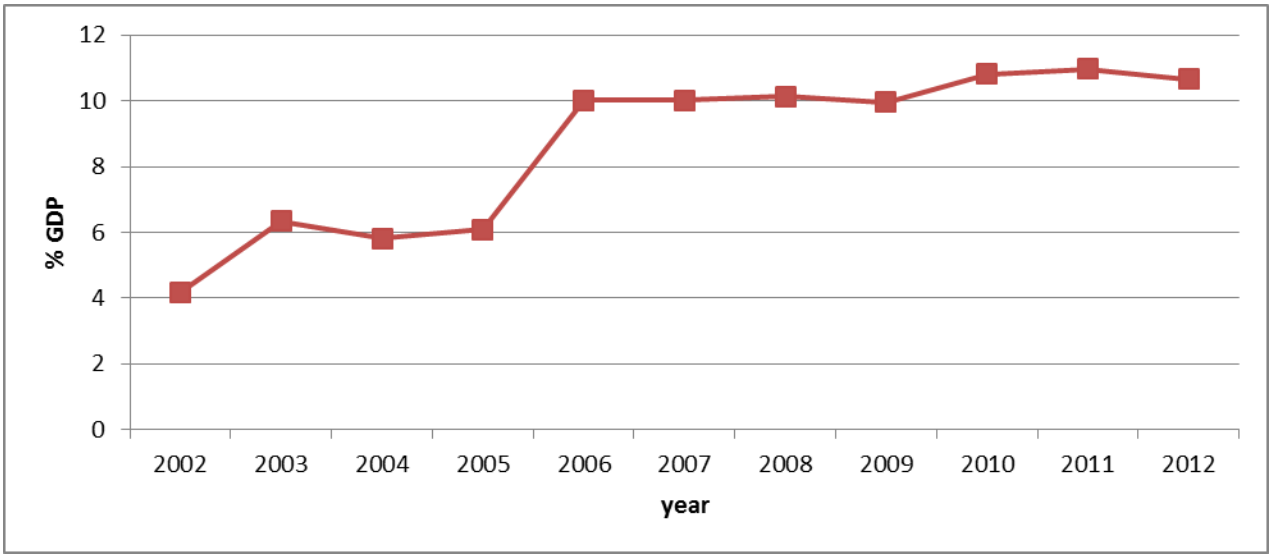


Figure 59 Total expenditure on health as a percentage of gross domestic product
(Source: World Bank indicators)

Economic support for MDR-TB patients

Since the start of the MDR-TB program in 2005 all MDR-TB patients are systematically provided economic support while on treatment. Each MDR-patient received monthly 90,000 RWF (≈132 usd)[4] in-kind (groceries etc.). Patients on ambulatory MDR treatment also receive an additional 15,000 RWF (≈22 USD) for transport. After treatment completion each MDR-TB patients receives 540,000 RWF (≈793 usd) to start a small business (conditional cash transfer). Although no impact study is available the support likely contributes to the high treatment success rate for MDR-Tb patients Rwanda obtains as outlined earlier. A study is ongoing to follow up all previously treated MDR-Tb patients and the result might provide more insight in the use of the financial support provided.

[4] 1 RWF = 0.00146961 USD on 22 July 2014

v. *Demographic changes; percentage of population who are less than 15, and those more than 65, years*

The following general description of the population from the report of the national census in 2012 characterised the Rwandan population well (National Institute of Statistics Rwanda, 2014). *The latest National Population and Housing Census (PHC) conducted in 2012 enumerated 10,515,973 residents in Rwanda with a predominantly female population, 51.8% of the total population. Rwanda has one of the highest population densities in Africa with 415 inhabitants per square kilometre. Population density is high in all Districts but varies tremendously from one District to another, from a 178 in Kayonza district in Eastern Province to 2,124 in Nyarugenge district in Kigali. Outside of Kigali Rubavu district in the Western Province has the highest population density with 1,039 inhabitants per square kilometre. The population density which was already high in 1978 (183 inhabitants per square kilometre) has more than doubled in 34 years, reaching 415 inhabitants per square kilometre in 2012. It was in 272 in 1991 and 321 in 2002. Rwandan population is predominantly rural: 83.5% of the resident population (8,778,289 inhabitants) live in rural areas vs. 16.5% in urban areas. Kigali City is the most urbanized Province with 76% of its population residing in urban areas. The second most urbanized Province is the West with only 12% of its population living in urban areas. It is closely followed by the North and the South (9%) and the East (7%). The urbanization rate varies greatly by District, from 1.6% to 88%. All the Districts of Kigali City are virtually entirely urban while in the other provinces only one to three districts have more than 10% of the population living in urban areas. Rubavu in the West and Musanze in the North are the most urbanized Districts outside Kigali City with respectively 37% and 28% of their population living in urban areas. The Rwandan population has regularly increased over time, doubling between 1978 (4.8 million) and 2012 (10.5 million). The increase was steady between 1978 and 1991 and between 2002 and 2012 as reflected by the respective average annual growth rates of 3.1% and 2.6%. In contrast the population growth was slow between 1991 and 2002 (1.2% annually), reflecting the high death toll of the 1990 war and the 1994 genocide. The Rwandan population is young as shown by the age pyramid (Figure 2), reflecting the high level of fertility in the recent past. The elderly accounts for a very small part of the total population, a sign of high levels of mortality. The age-sex structure of the urban population is quite different from the rural one (Figure 3). The pyramid of the rural area is similar to the national one. The urban population is more dominated by adult people in the working age group, a consequence of labour migration from rural to urban areas.*

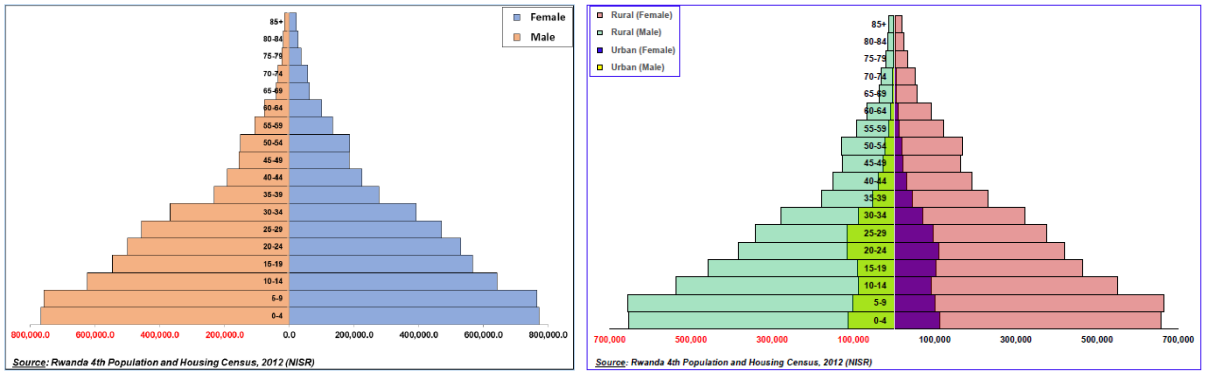


Figure 60 Pyramid of the resident population (left) and urban and rural resident (right) in Rwanda in 2012

Looking at the population under 15 years of age in the last decade indicates a small increase, less than 1%, around 2008/2009. The elderly population is showing an increasing trend since 2006.

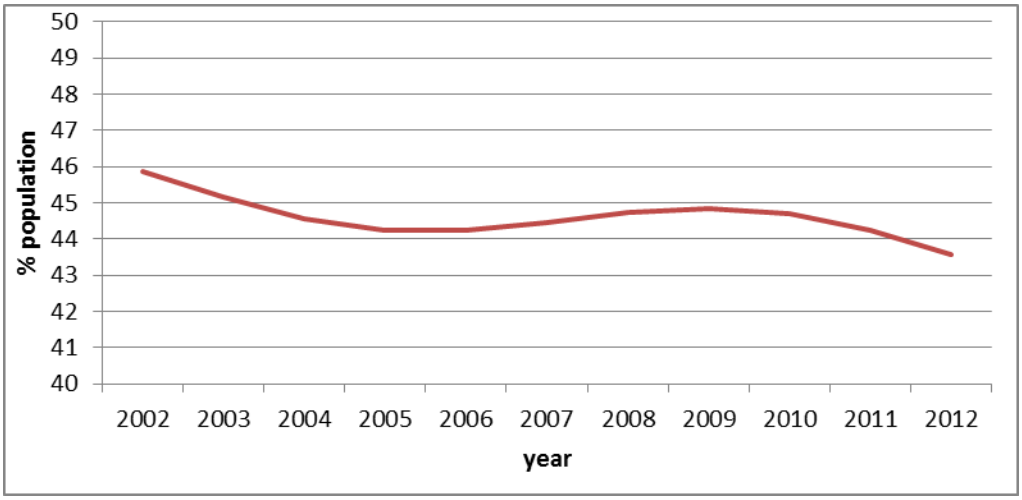


Figure 61 Proportion of the population under 15 years
(source: Global Health Observatory of the World Health Organization, data extracted 21 July 2014)

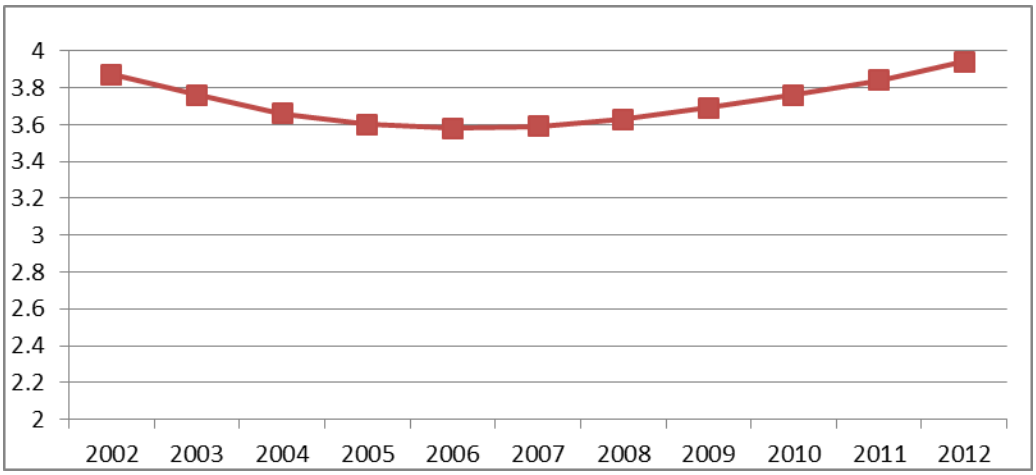


Figure 62 Proportion of the population over 60 years of age
(source: Global Health Observatory of the World Health Organization, data extracted 21 July 2014)

vi. Under-5 mortality rate (as an indicator of the overall performance of the health-care system).

The under-5 mortality in Rwanda has shown a rapid decrease since and 1998 and stands since 2004, falling well below the African regional average. During the 1994 genocide and the aftermath very high rates were observed. Comparing the data from the last three DHS surveys (National Institute of Statistics of Rwanda, 2010) indicates that infant mortality has declined substantially in the past 5 years, from 86 deaths per 1,000 live births in 2005 to 62 per 1,000 in 2007-08 and to 50 per 1,000 in 2010. Under-5 mortality also declined during this period, from 152 deaths per 1,000 live births in 2005 to 103 per 1,000 in 2007-08 and to 76 per 1,000 in 2010. The decrease in infant mortality and under-5 mortality result mainly from the implementation of integrated management of childhood illness in health facilities and communities and also the introduction of new vaccines.

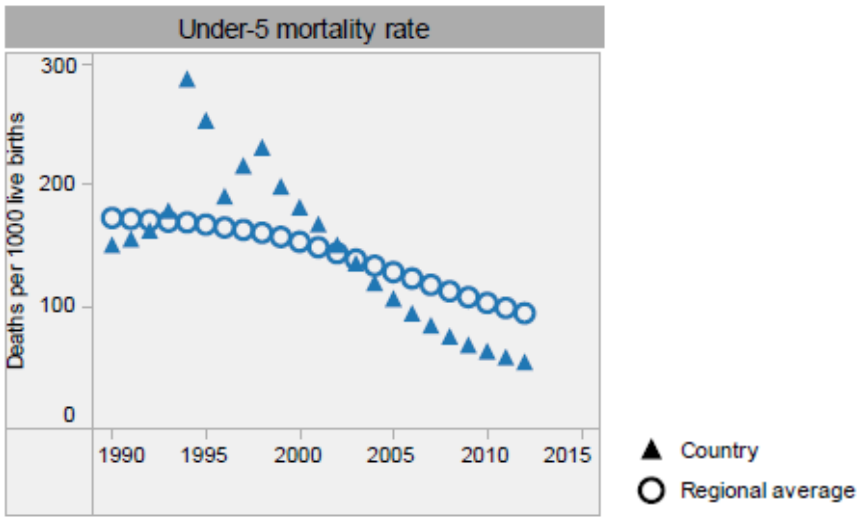


Figure 63 Under-5 mortality in Rwanda and the Africa regional average from 1990-2012
(source: General Health Profile Rwanda, World Health Organization, data extracted 21 July 2014)

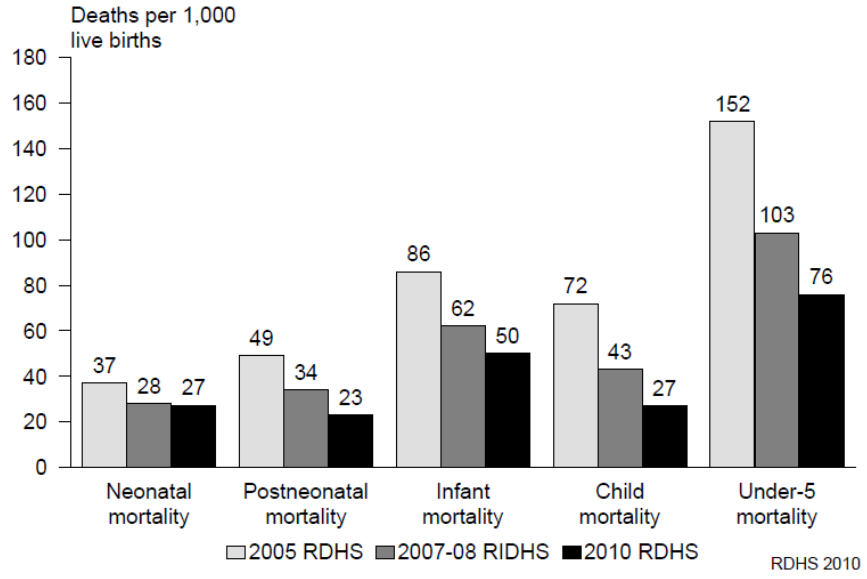


Figure 64 Trend in childhood mortality rates from three consecutive DHS survey
(source: DHS report 2010, National Institute of Statistics of Rwanda, 2010)

vii. Other indicators of performance of the health care system:

For most health indicators on utilization of services Rwanda is reaching higher levels than the African region on average. This with less health workforce than which is on average available in the region (Figure 65).

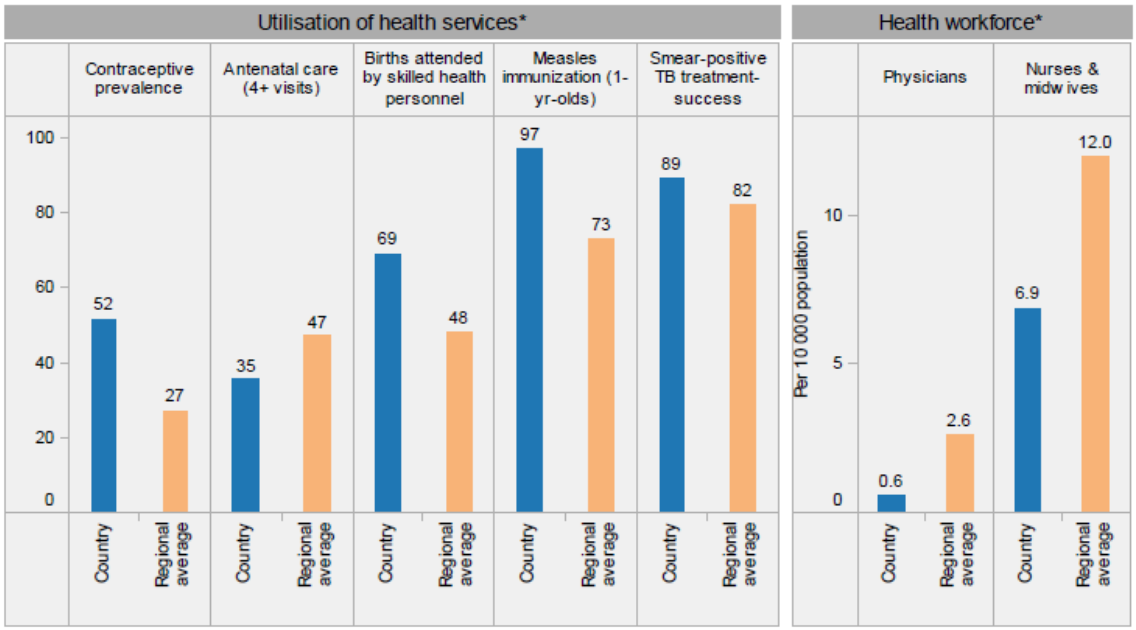


Figure 65 Utilisation of health services and health workforce availability in Rwanda as reported in the WHO global health profile of 2012.
(source: General Health Profile Rwanda, World Health Organization, data extracted 21 July 2014)

Looking at crude death rate (CDR) and life expectancy from consecutive census data indicates that mortality has dramatically declined between 1978 and 2012 (National Institute of Statistics Rwanda, 2014), the developments are described as follows in the main indicator report: "*CDR has decrease from 17.1‰ to 7.7‰, equivalent to a relative reduction by 55.0% over a period of 34 years. The decrease however was not uniform over time. Actually mortality has declined between 1978 and 1991 (CDR dropped from 17‰ to 13‰) before increasing during the following decade (the SBR reached 15‰ in 2002) and decreases again but more substantially in the decade 2002-2012 (the CDR was divided by 2 to fall below 8‰). Rwanda experienced a significant socioeconomic and health transformation over the past 35 years, as clearly illustrated in the trends of the life expectancy at birth. Life expectancy at birth is the best summary health indicator of a population, which can be used to track improvements of the socioeconomic and health status of the population. Life expectancy has increased between 1978 and 1991 (from 46 to 54 years), then decreased between 1991 and 2002 (from 54 to 51 years) before increasing again and very quickly up to 64 years in 2012. The increase between 1978 and 1991 corresponds to a period where population access to health services as well as their living conditions was improved by different interventions: more heaths facilities built and evenly distributed across the country, improvement of immunization coverage (82% in 1991), more access to safe drinking water, improved housing units*[5]*. The decrease of*

[5] SNR (1994) Recensement General de la Population et de l'Habitat au 15 aout 1991, Resultats definitifs. Republique du Rwanda. Ministère du Plan, Service National de Recensement : Kigali

life expectancy at birth between 1991 and 2002 is explained by the 1994 genocide with its direct impacts (a death toll exceeding one million) and indirect impact (impoverishment of the population, social disruption, disruption of the health system...). The increase of life expectancy at birth over the last decade (2002-2012) reflects both the impact of social welfare and health intervention as well as the long term impact of past interventions to mitigate the consequences of the genocide and more generally to improve the quality of life of the Rwandan population."

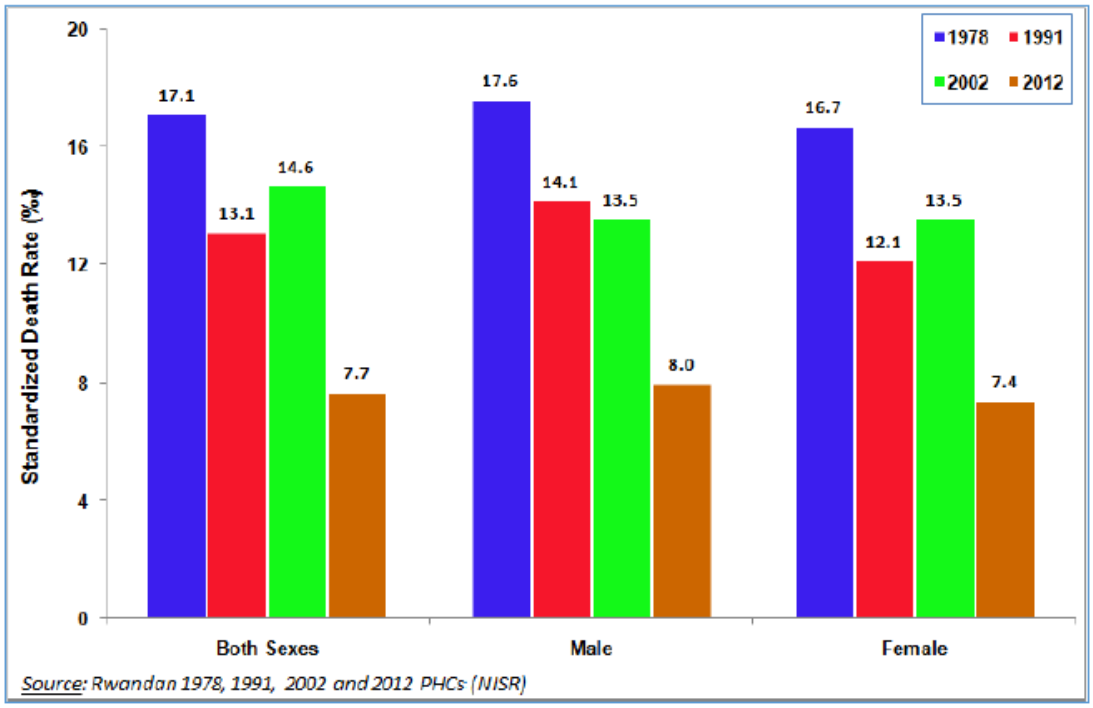


Figure 66 Evolution of the Crude Death Rate (CDR) between 1978 and 2012
(Source Adapted from population and Housing census 2012 – main indicator report)

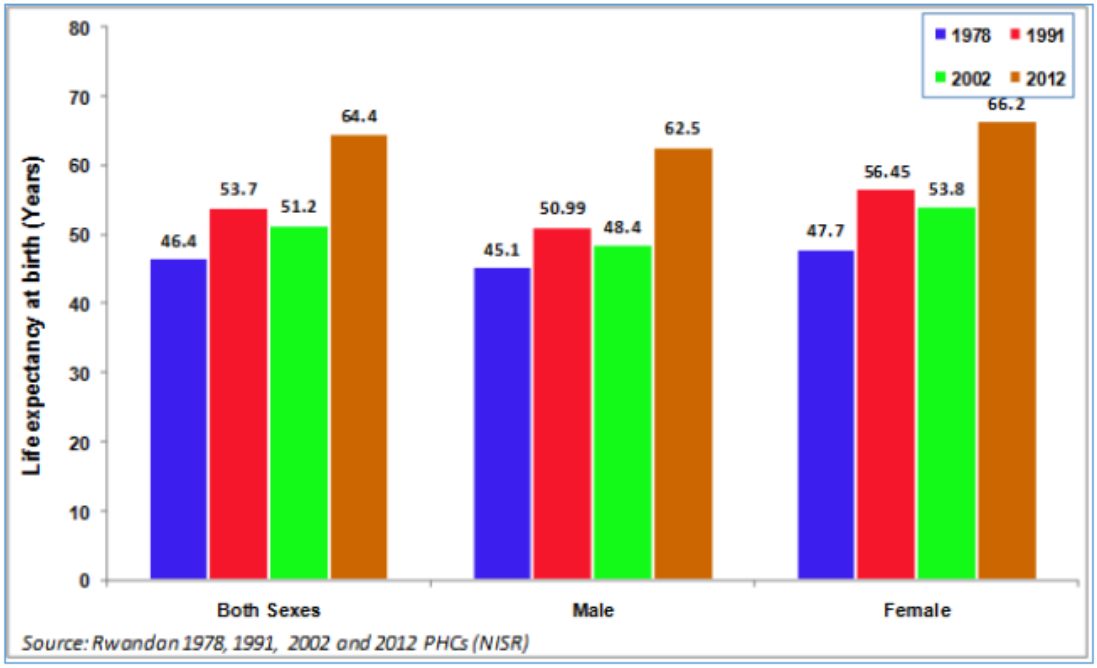


Figure 67 Evolution of life expectancy at birth between 1978 and 2012 by sex
(Source Adapted from population and Housing census 2012 – main indicator report)

2.5 Objective 4: Assessment of investments needed to directly measure trends in disease burden in the future

a) **From the implementation of the WHO TB surveillance checklist: for standards defined in the checklist that are not yet met due to data gaps or data quality problems, identification of the investments required to improve surveillance (including estimated budget).**

The recommendations from the surveillance checklist have been used as input for the development of the national strategic plan and the proposed budget reflected the investments needed for the next five years (Table 18).

Table 18 Investment needed (in USD) in surveillance for the period of the National Strategic Plan 2013-2018

Budget section	Year 1	Year 2	Year 3	Year 4	Year 5	Total for 5 years	% overall budget
4.3. Enhance monitoring and evaluation system	2,349,568	2,213,639	2,308,036	2,249,809	2,253,759	11,374,811	14%
4.4. Enhance operational research	348,575	121,500	24,450	68,250	24,450	587,225	1%

b) **Assessment of whether a baseline or repeat survey (e.g. prevalence survey, inventory study, cause of death survey) is needed and if so what timing would be appropriate.**

As the TB burden dropped below 100 per 100,000 population a repeat national prevalence survey in 5-10 years when the burden is likely reduced even further is not warranted as due to the relative low burden sample side would be enormous. The Global task force does not recommend TB prevalence surveys for countries where the burden is below 100 per 100,000 population. Therefore new methods to measure the impact of TB control should be explored in cooperation with the global Task Force for TB impact measurement. Rwanda has a good surveillance system and the reported case notification rate could be used as a proxy for TB incidence and then case notification data could be directly used to measure impact. The conduct of the surveillance checklist indicated that given the fact that the private sector plays a minor role and there are not reasons to suspect severe underreporting there is no need to conduct an inventory study. What could be further explored in term of case detection would be diagnostic of childhood TB cases as well as characterization of TB cases in the high risk groups to assess how best to further target TB control efforts in the country. Also the country has planned as outlined in the NSP to conduct at regular interval the surveillance checklist and epidemiological review which should be linked to the midterm and end term program review in the future.

3 Concluding paragraph

Rwanda has a well-functioning TB surveillance system with accurate, complete and internally consistent data, which provide a good overview of the situation in the country and are externally consistent. Data are well kept which makes it easy to analyse the data. Quality and coverage of a vital registration system is low and the country would benefit from a well-developed system to better monitor causes of death. The programme should continue to monitor and try to re-evaluate the quality of diagnostic practices with regards to childhood TB in an attempt to address under-reporting of childhood TB especially in the youngest age group of 0-4 years. A more in-depth analysis of the routine surveillance data to better characterize the actively screened population like contacts, elderly etc. to identify subgroups with the highest screening yield could enhance case finding. When looking at the urgency of conducting an inventory study[6], Rwanda should not prioritize this activity as surveillance coverage is good and feasibility is limited (i.e. there is no indication of severe underreporting and there is no prominent private sector). The TB surveillance system in Rwanda seems to accurately capture TB cases detected as well as the efforts of TB control in the country. Trends in the TB epidemic can be well explained by TB program activities in combination with HIV response and developments within the country (health system, economy etc.). Access to health care is in general good and there is good health system coverage of diagnosis and treatment centres offering integrated TB & HIV services with a key role for health care at the grass root level via community health care workers. The data confirm that the TB epidemic is declining as a result of good program design and implementation of all key recommended TB activities with high performance levels and synergistic efforts in HIV control, the general health sector aiming for equity in health in parallel with rapid economic development. The TB epidemic is becoming more concentrated and supports the expanding focus on risk groups (men, prisoners, PLHIV, contacts) under the new NSP (2013-2018). Besides targeting of risk groups the plan is to increase the sensitivity of diagnostic tools by scaling up of new diagnostics and making chest x-ray widely accessible to capture cases currently not easily detected while at the same time ensure tailored strategies for the different risk groups. However it is important to keep monitoring the yield of these activities as well as the relative contribution of these groups to the overall case load to ensure effective TB control. The lower TB burden makes it more challenging and less cost effective to detect and treat the remaining cases. The program should maintain the current effort, but at the same time develop new strategies to find the missing cases focusing on groups at higher risk – including men. A concerted effort is needed to move towards TB elimination in the decades to come. Rwanda is poised to move in line with the new post 2015 Global TB strategy, to reach less than 10 tuberculosis cases per 100 000 population by 2035 to pave the way for elimination by 2050 (Lönnroth et al., 2010).

It is recommended that the NTP maintains the successful activities that resulted in big achievements made in TB control (TB-HIV collaborative activities, community TB care, prison screening program etc.). The focus should be on finding the "missing" cases without forgetting the "regular" cases. Some more in-depth investigations would be needed to look into some of the unexplained patterns observed during this review, for example: i) the reason for the higher CNR in the two districts outside Kigali, Huye and Muhanga; ii) the reason for the higher M/F ratio in some specific districts; iii) the lower proportion of retreatment cases in Western Province etc.

Some geographical patterns would be more obvious if GIS mapping would be routinely used to investigate observed patterns. The role out of (semi) active case finding in the defined high risk groups should be closely monitored to determine yield and the relative contribution to the notified case numbers. A better characterization of those within the risk groups that are most likely to have TB could assist in even more focused screening and increased yield. The new patient based electronic system that is being rolled out will help the program to do this. This system also allows for easy integration of operational research studies to investigate specific issues and this should be actively used.

The results of this epidemiological review should be published so Rwanda can share the important lessons it learned to the benefit of other countries in the region and beyond.

6 Assessing tuberculosis under-reporting through inventory studies, WHO, February 2013, ISBN: 978 92 4 1504942, WHO reference number: WHO/HTM/TB/2012.12, available via http://www.who.int/tb/publications/inventory_studies/en/index.html

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5 Annexes

5.1 Terms of reference

National health sector and national TB programme reviews, and "Epidemiological stage" for Global Fund concept notes: Terms of reference for TB epidemiological and impact analysis

1. BACKGROUND

An excellent understanding of the level of, and trends [7] in, disease burden and how these have been (and can be) influenced by the implementation of prevention and treatment interventions is of considerable importance to national health programmes, as well as international donor agencies. It can help to ensure the appropriate allocation of funding and ultimately help to save more lives in the future. Epidemiological and impact analysis should be included systematically as part of National Health Sector Reviews and disease-specific programme reviews. Such analyses are also now required as part of the development of "concept notes" that provide the basis for funding applications to the Global Fund in the new funding model introduced in 2013; in this context, the analyses are called the "Epidemiological stage", and should precede the development of the concept note. These terms of reference cover the objectives and associated tasks and expected deliverables for TB epidemiological and impact analyses conducted as part of national TB programme reviews, as inputs to health sector reviews and for the "epidemiological stage" of the Global Fund's new funding model.

2. OBJECTIVES

1. Describe and assess current national TB surveillance and vital registration systems, with particular attention to their capacity to measure the level of and trends in TB disease burden (incidence and mortality).
2. Assess the level of, and trends in, TB disease burden (incidence, prevalence, mortality) using available surveillance, survey, programmatic and other data.
3. Assess whether recent trends in TB disease burden indicators are plausibly related to changes in TB-specific interventions taking into account external factors including economic or demographic trends.
4. Define the investments needed to directly measure trends in TB disease burden in future.

3. TASKS BY OBJECTIVE

Objective 1: Assessment of current national TB surveillance and vital registration systems with particular attention to their capacity to measure the level of and trends in TB disease burden

a) Provide a written description and explanation of the main features of the current national TB surveillance and vital registration systems. These should include the data being captured (e.g. notified cases, treatment outcomes, causes of death); definition of the agencies/individuals responsible for data collection, analysis and reporting and how they interact; mechanisms/processes used to capture and transmit data between different administrative levels and agencies (e.g. standardized forms; paper-based and/or electronic systems) and to assure data quality; timing and timeliness of reporting including lag times that

[7] Analyses of time trends should be attempted as far back in time as possible before the health sector or programme review.

hamper capacity to detect, investigate and contain events such as local epidemics (including events related to the emergence of drug resistance); the type of data available at the national level (e.g. aggregated reports, case-based data); approach to analysis and reporting of data; staffing levels; how systems for capturing TB data are related to/linked with other health information systems (e.g. health insurance, hospital reporting systems, district health information systems). *To help characterize the TB surveillance system, Part A of the WHO TB surveillance checklist (18 questions) should be completed.* [8]

b) Assess the current capacity of national TB notification and vital registration systems to provide a direct measure of TB disease burden using the WHO TB surveillance checklist (Part B). *The ultimate goal is to measure TB incidence and mortality directly from notification and vital registration data, respectively; Part B of the checklist consists of a set of 13 standards and associated benchmarks that allow assessment of the extent to which existing surveillance systems (notification and vital registration) meet these standards.* (NB the first standard in the checklist relates to case definitions. In this context, there should be an assessment of whether the 2013 WHO revised case definitions and reporting framework have been adopted and implemented, and at what scale, and any actions needed to introduce or fully implement them).

c) Summarize the main strengths of the current surveillance system and the weaknesses/gaps that need to be addressed, based on the findings from a) and b).

(*Suggested data sources* [9] : Interviews with relevant staff; national and sub-national case-based or aggregated TB notification data, national or sample vital registration data, results from facility audits (e.g. Service Availability and Readiness Assessment, SARA) or reviews of the quality of recorded data, results from drug resistance surveillance including drug resistance surveys, research literature). A comprehensive list of data sources is provided in the user guide that accompanies the checklist).

Objective 2: Assessment of the level of, and trends in, TB disease burden

This assessment includes review and compilation of published estimates of TB morbidity and mortality that are already available to assess the level of, and trends in, TB disease burden (at least nationally and when feasible sub-nationally and among sub-populations); analysis of TB notification data; and interpretation of available data.

a) Analysis of the level of, and trends in, TB mortality.
   i. Analysis of trends in TB mortality among HIV-negative individuals. This is best done using data from a national or sample civil registration system of vital statistics with cause of death data that meet the standards defined in the WHO TB surveillance checklist. Each year, WHO publishes estimates of TB mortality among HIV-negative people from 1990 onwards for all countries in the annual global TB report (the global TB report also identifies the countries for which mortality among HIV-negative individuals has been estimated from vital registration data and mortality surveys, and the countries for which estimates rely on other methods).
   ii. Analysis of trends in the distribution of contributory causes of AIDS deaths (with particular emphasis on TB), if data are available. From 2012, estimates of TB mortality among HIV-positive people are being produced using the TB component of Spectrum, and published on an annual basis by WHO and UNAIDS.

[8] http://www.who.int/tb/advisory_bodies/impact_measurement_taskforce/meetings/en/

[9] It is likely that some of the suggested data are not yet available. The identification of these data gaps is important and they should be identified in a specific section of the final report, along with clearly defined next steps for addressing these gaps.

(*Suggested data sources*: WHO TB database, AIDSinfo database, records from national or sample civil registration of vital statistics with cause of death data from NTP/MoH databases, results from mortality surveys, research literature).

b) Analysis of the level of, and trends in, TB prevalence. If data are available from a baseline and at least one repeat survey, then there is strong evidence about trends in disease burden. If results from two surveys conducted about 10 years apart are not available, estimates of trends are available from WHO but uncertainty intervals are wide. The results from a recent survey can be used to assess the current level of TB disease burden and may also provide important evidence about the effectiveness of current TB programmatic efforts and actions needed to improve TB care and control.

(*Suggested data sources*: results from surveys of the prevalence of TB disease, WHO TB database, research literature)

c) Analysis and interpretation of the level of, and trends in, TB case notifications (e.g. for the last 5-10 years).

i. Plot time series of case notifications and analyse results, including to assess trends and to identify if there is any evidence of reporting problems (e.g. missing data or sudden changes in time-series of reported new episodes of TB at national and first subnational level e.g. state or province). Analysis of results should take into consideration any changes in reporting policies and practices, and case definitions.
ii. Analysis of the geographic distribution of case notification rates among sub-national areas and how this has changed over time, and exploration of reasons for observed trends and geographical heterogeneity. These include, but are not limited to, the availability of TB diagnostic services, case finding activities, changes in the ratio of TB cases to the number of people investigated for "presumptive" TB (note that data on the number of people investigated for TB are often not quality-assured and duplicate entries from multiple visits by the same person may exist), health systems characteristics, determinants of/risk factors for TB (e.g. overall levels of income and poverty, HIV prevalence).
iii. Analysis of trends in the proportions of notified cases: (a) by type of TB disease - bacteriologically confirmed and extra-pulmonary TB; (b) by age group, including the proportion of cases among children (0-4, 5-14); (c) by category (retreatment out of the sum of new and retreatment cases).
iv. Trends in age- and sex-specific case notification rates, the average age of newly notified cases, and the extent to which these can be explained by demographic or other factors.
v. Analysis of the level of (and ideally trends in) under-reporting from national inventory studies if these are available before the assessment.
vi. Any data available on TB in high risk groups such as people living with HIV, the elderly, people with diabetes, people with compromised immune systems, prisoners, miners, etc.; numbers, denominators; and if available proportions and trends.
vii. Other miscellaneous analyses that may be relevant in specific settings (to be determined by the epidemiologist(s) undertaking the assessment).

(*Suggested data sources*: National and sub-national case-based or aggregated TB notifications, laboratory data, results from inventory studies to measure TB under-reporting (and under certain circumstances estimate incidence), laboratory data, research literature, national databases with information about overall health system characteristics and determinants/risk factors related to TB)

Objective 3: Are recent trends in TB disease burden plausibly related to changes in TB-specific interventions accounting for other external factors?

Funding for and implementation of high-quality TB-specific interventions should result in detection of people with TB and curative treatment; in turn, this should have a direct impact on TB mortality (cutting case fatality rates compared with no treatment or substandard treatment). Shortening the duration of disease through detection and treatment of cases will also reduce the prevalence of TB disease, and therefore, transmission. There will be an impact on TB incidence if transmission can be reduced sufficiently and/or if preventive treatment of people with latent TB infection is effectively implemented on a large scale. At the same time, a range of factors besides TB-specific interventions influence levels of TB disease burden, by affecting population susceptibility to both TB infection and the risk of developing TB disease once infected. These include overall levels of wealth and the distribution of wealth (measured e.g. as GNI per capita, the proportion of people living in poverty), the overall coverage and quality of health services and the prevalence of HIV and other risk factors for TB. Having considered trends in disease burden in Objective 2, it is important to assess whether these trends can partly be related to changes in TB-specific interventions (and associated funding).

a) Define and compile data that are relevant to assessment of the extent to which changes in TB disease burden in recent years (e.g. for the last 5–10 years) can be explained by TB-specific interventions/programmatic efforts. This should include, at a minimum:

i. Government and international donor funding for TB care and control;
ii. Number of health facilities providing TB diagnostic services per 100,000 population;
iii. Number of health facilities providing TB treatment services per 100,000 population;
iv. Number of people investigated for presumptive TB (if available data are reliable) and the ratio of presumptive TB to notified TB cases;
v. Performance of community/active case finding (number of cases screened and detected by each mechanism);
vi. Performance and coverage of public-private mix activities in the country. Coverage should be expressed where possible both as % of the country (geographic) and type, the % of providers covered (e.g., 30% of estimated pharmacies and 50% of estimated private pulmonologists);
vii. Any quantitative data on diagnostic delays (due to patient, private sector, or public sector delays);
viii. Number of people successfully treated for TB out of all notified;
ix. MDR-TB treatment coverage (comparing numbers detected and treated with the estimated number of cases among notified TB patients and describing the size of waiting lists), and treatment outcomes among MDR-TB patients. This is especially relevant in countries in which MDR-TB cases account for a relatively large share of the total number of TB cases;
x. HIV testing, ART and CPT coverage of TB patients, treatment outcomes among PLHIV. This is especially relevant in countries with a high TB/HIV burden.
(*Suggested data sources*: WHO TB database, NTP database and reports, Service Availability and Readiness Assessments (SARAs), results from inventory studies that show the level of TB under-reporting, research literature, grey literature, national TB prevalence surveys, WHO HIV/AIDS data and statistics, AIDSinfo database, MOH and NGO databases, http://www.foreignassistance.gov for USAID funding data).

b) Define and compile data that are relevant to assessment of the extent to which changes in TB disease burden in recent years can be explained by factors that are not specifically related to TB-specific funding and associated interventions. This should include, at a minimum:

viii. Prevalence of HIV among the general population, and ART coverage. (*Suggested data sources*: WHO HIV/AIDS data and statistics, AIDSinfo database);
ix. Prevalence of diabetes, tobacco use and under-nutrition. (*Suggested data sources*: WHO HIV/AIDS data and statistics, AIDSinfo database, WHO Global Health Observatory)

x. GNI per capita and the % of the population under the poverty line, and the impact of economic crises. (*Suggested data sources*: World Bank Indicators);

xi. Coverage of financial protection for health care costs (by government health budget or health insurance etc.) and social protection programmes (overall, and for DS-TB and MDR-TB specifically where available) and the percentage of health-care expenditures accounted for by out-of-pocket payments (*Suggested data sources*: Research literature, national health accounts, social protection/welfare programme information on coverage of target groups, as relevant and available from WHO at www.who.int/nha; research literature)

xii. Demographic changes; percentage of population who are less than 15, and those more than 65, years (*Suggested data sources*: UNPD database)

xiii. Under-5 mortality rate (as an indicator of the overall performance of the health-care system).
(*Suggested data sources*: WHO Global Health Observatory)

Objective 4: Assessment of investments needed to directly measure trends in disease burden in the future

a) From the implementation of the WHO TB surveillance checklist: for standards defined in the checklist that are not yet met due to data gaps or data quality problems, identification of the investments required to improve surveillance (including estimated budget).
(*Suggested data sources*: same as in 1.b, NTP reports)

b) Assessment of whether a baseline or repeat survey (e.g. prevalence survey, inventory study, cause of death survey) is needed and if so what timing would be appropriate. An appropriate amount of time should be ensured between repeat surveys (for example, a repeat TB prevalence survey should normally be done about 10 years after the previous one). Guidance on countries where prevalence surveys are recommended is available from the Global Task Force on TB Impact Measurement.

4. DELIVERABLES

A comprehensive report addressing all tasks under the three objectives of the epidemiological and impact analysis outlined in this document with a conclusion section on:

a) The robustness of estimates of TB incidence, prevalence and mortality and their sources of uncertainty.
b) Whether it is plausible that TB control interventions have contributed to changing the course of the TB epidemic, accounting for other external factors.
c) Whether there are specific geographical areas or subpopulations (vulnerable/those with poor access) or sectors (e.g. mining, prisons/detention, etc.) in which the burden of disease is especially high and that warrant increased attention including greater investment of financial resources and/or reallocation of resources to focus on more effective, higher impact interventions.
d) Investments needed to improve evidence about trends in disease burden in future.

5. PROFILE REQUIRED

- A senior epidemiologist or statistician with extensive quantitative skills and a proven track record of producing results and communicating them well (including in scientific publications in peer reviewed journals);
- Excellent understanding of TB epidemiology, TB policies and interventions, and health systems;
- Extensive experience in working with national TB health programmes and offering technical assistance.

6. TIME REQUIRED

This depends in part on the extent to which the person(s) conducting the analysis are already familiar with the country where the assessment is being done and the associated data, their previous experience of conducting such analyses, but also the availability and expertise of national M&E counterparts who will participate in this exercise. For someone familiar with the country and the data and with previous experience of such work, it is estimated that 2 weeks of in-country work are required. An additional 2 weeks of preparatory work might be necessary depending on the country context.

Guidance on and related examples of schedules for previous missions that covered the Terms of Reference described are available from WHO and KNCV on request.

5.2 Distribution list

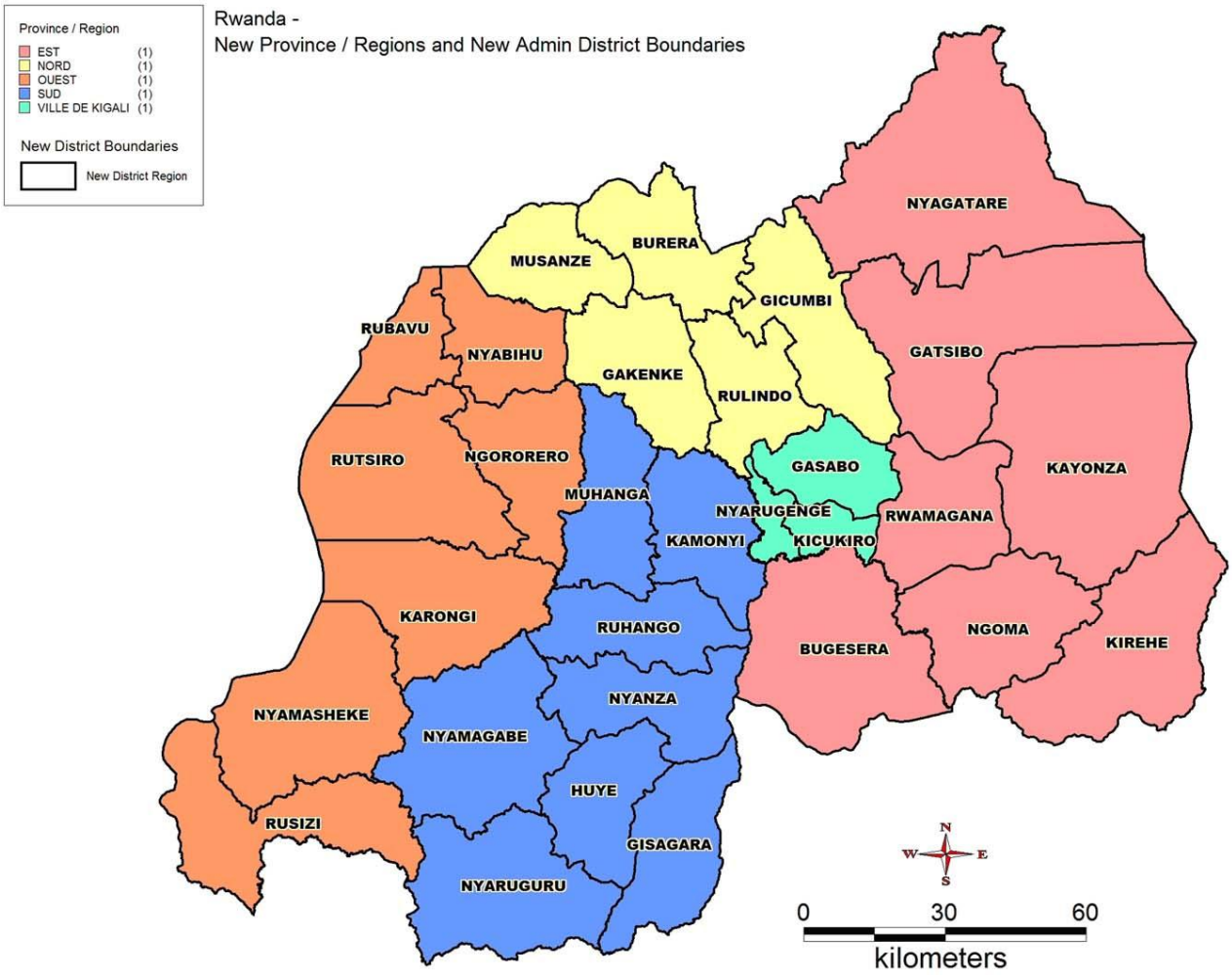
Name	Function	Organization
Dr Michel Gasana	Director	TB & ORD division, RBC
Dr Claude Bernard Uwizeye	TB & TB/HIV Evaluation & Research Specialist	CDC-Rwanda
Dr Patrick Migambi	Director IC	TB & ORD division, RBC
Mr Evariste Gasana	Epidemiologist, head M&E unit	TB & ORD division, RBC
Mr Fidèle Gakuba	TB Program Focal point	MoH/SPIU
Ersin Topcuoglu	Head M&E TBCARE I	PMU, TBCARE I
Edith Vink	Secretary	KNCV Tuberculosis Foundation
Nico Kalisvaart	M&E/surveillance & data management consultant	KNCV Tuberculosis Foundation
Katherine Floyd	Head TME	WHO - TME
Irwin Law	TME team	WHO - TME

5.3 List of key events in Rwandan TB control

year	key events TB control
1995	restart of TB program
1996	start TB control in prisons, start scale up of CDT, training & supervision scale up
1997	ACF prisons
1998	ACF prisons
1999	*not known*
2000	*not known*
2001	*not known*
2002	ART delivery via 4 hospitals in the country; treatment outcome evaluation meetings at district level? (or in 2004)
2003	TB-HIV activities started (countrywide - whole package); First specific TB training for doctors since 1995; laboratory training
2004	PBF pilot in Rwanda; sensitization of OPD clinicians to look for chronic coughers (focus on duration of cough)
2005	start TB-HIV collaborative activities formally guidelines published; (HIV testing TB patient, CPT, ART (for those CD4<350) but also ICF among PLHIV; TB screening among PLHIV; start community DOT (3 districts); MDR treatment started (GoR funded); sensitization of prisoners & prison authorities on TB risk; school sensitization program; transport system for slides from CT to CDT

2006	**daily** regimen also in continuation phase (before 3 times a week); start quarterly reveiw meetings in Kigali; GLC approval
2007	18/30 covered for community TB DOT; quarterly review meetings countrywide at district level; IC guidelines (aCDT level)
2008	
2009	PBF for TB funded; ART (for those CD4<500); development TB IC guidelines; start prison screening at entry & sensitization
2010	PBF for TB started; full coverage of community DOT; HIV testing for all presumptive TB cases; triage of coughers at OPD & HIV clinics; NSA - community scale up of activities; change of suspicion criteria from 3 to 2 weeks cough; change of slide positivity criteria 1/3 slides is positive TB case (before 2/3 slides)
2011	ART given to all TBHIV co-infected irrespective of CD4 count
2012	
2013	change to 2 slides for TB diagnosis; IC guidelines at CT level
2014	routine reporting via HMIS (aggregated); pilot patient-based reporting, case finding focus on high risk group (new approach)

5.4 Map of Rwanda indicating provinces and the names of districts



Source www.minaffet.gov.rw

5.5 Reference Karibushi 2000: Tuberculose dans les prisons du Rwanda 1996-1999

557-PS Tuberculosis in prisons of Madrid: follow-up of cases and coordination between programs inside and outside prison

S Fernández,[1] M Ordobás,[1] K Fernández de la Hoz,[2] M García-Solís,[2] P Gómez-Pintado,[2] A Arce.[1] [1]Consejería de Sanidad y Servicios Sociales, Comunidad de Madrid; [2]Subdirección General de Sanidad Penitenciaria, Madrid, Spain

Introduction: Since 1996 the 7 prisons of Madrid report released tuberculosis cases to the Regional Public Health Services, in order to continue their clinical follow-up. We compare the results of therapy among cases treated in prison with those released and followed outside.
Methods: Two groups were analysed: cases for whom release was reported in 1997 by prisons of Madrid and who started treatment in 1996 or 1997, and jailed cases whose treatment began in 1997 and remained in prison for one year at least. Proportions, means and SD were calculated for different variables. Their association with treatment outcome was also assessed.
Results: Thirty-eight released and 34 jailed cases were investigated. Both groups were similar for the main variables of the study. Treatment outcome was for released and jailed cases respectively: complete therapy 18.4% and 64.7%; death 10.5% and 11.8%; lost to follow-up/missing 42.1% and 8.8%; treatment still on course 28.9% and 14.7% ($P < 0.001$). The only variable associated with therapy completion was stay in prison during treatment (OR = 16.9; 95% CI 4.0–78.3).
Conclusions: Compliance with therapy is better in prison, where it is given with direct observation of drug ingestion (DOT). Reporting released cases improves treatment completion and decreases the number of cases lost to follow-up.

578-PS Tuberculose dans les prisons du Rwanda, 1996–1999

B Karibushi, G Kabanda. Programme National Intégré de lutte contre la Lèpre et la Tuberculose. Tél: (25) 76521. Fax: (250) 78875. e-mail: pnilt@rwandatel1.rwanda1.com

Introduction : Suite au génocide de 1994, près de 130 000 personnes ont été incarcérées dans les prisons du Rwanda. Entre 1996–1998, des flambées épidémiques de tuberculose pulmonaire apparaissent. Le Ministère de la Santé met en place une stratégie visant à couper la transmission de la maladie et à réduire sa prévalence.
Objecif : Il s'agit de démontrer l'efficacité de la stratégie mise en place :
- combinaison dépistage actif et passif
- traitement directement supervisé au régime de 4RHZ7E7/4RH3.

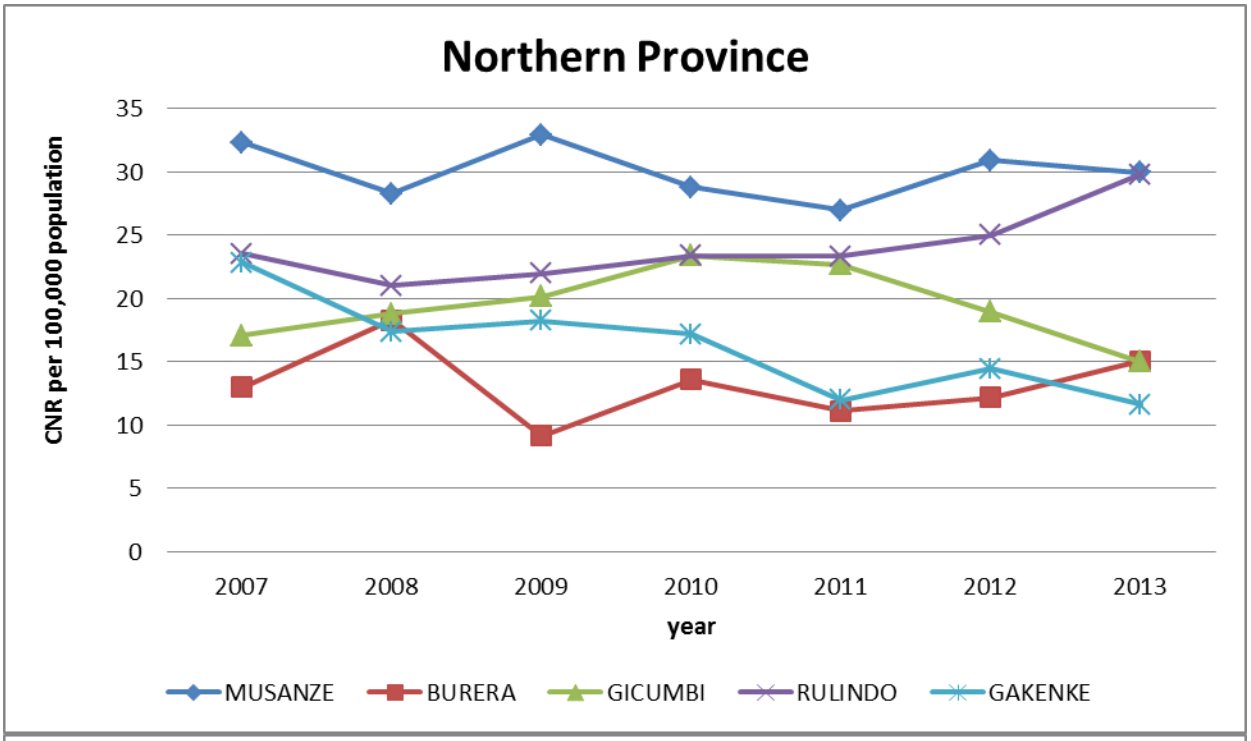
Méthode : Entre 1996–1998, 8 centres de diagnostic et de traitement de la tuberculose ont été créés dans les prisons avec une population de plus de 4000 détenus par prison. Dans le même temps, les hôpitaux des districts et centres de santé assurent le dépistage et le traitement de tuberculose aux prisonniers tuberculeux de leur circonscription respective.
Resultats : 1949 cas de tuberculose ont été dépistés dans 8 prisons comptant une population carcérale de 57 961 détenus, soit une prévalence de 3,8%. Au cours du 1er trimestre 1999, 66 cas ont été dépistés dans 3 prisons de la capitale contre 148 cas au cours du 1er trimestre 1998 et 964 cas au cours de toute l'année 1998. Ainsi, par projection, l'on devrait s'attendre à 264 cas d'ici fln 1999, soit une diminution de 72,6% par rapport à 1998. En 1996, le taux de succès thérapeutique était de 86% et celui de guérison bactériologique 67,2%. En 1997, le taux de succès thérapeutique était de 86,1% et celui de guérison bactériologique de 72,2%.
Conclusion : Au regard des résultats obtenus, nous pouvons affirmer que la combinaison du dépistage actif et passif ainsi que le traitement directement supervisé constituent des stratégies efficaces de lutte contre la tuberculose dans les prisons avec une population carcérale élevée.

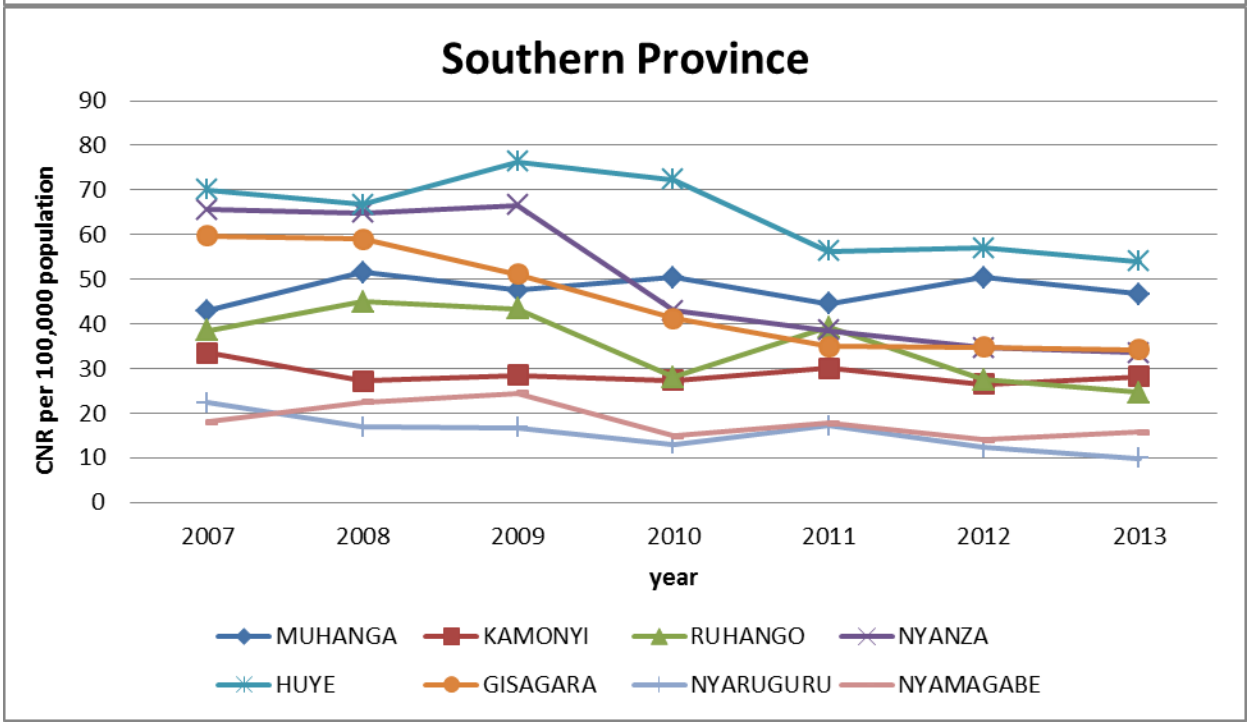
582-PS The profile of TB in the penitentiary system of Rio de Janeiro, Brasil

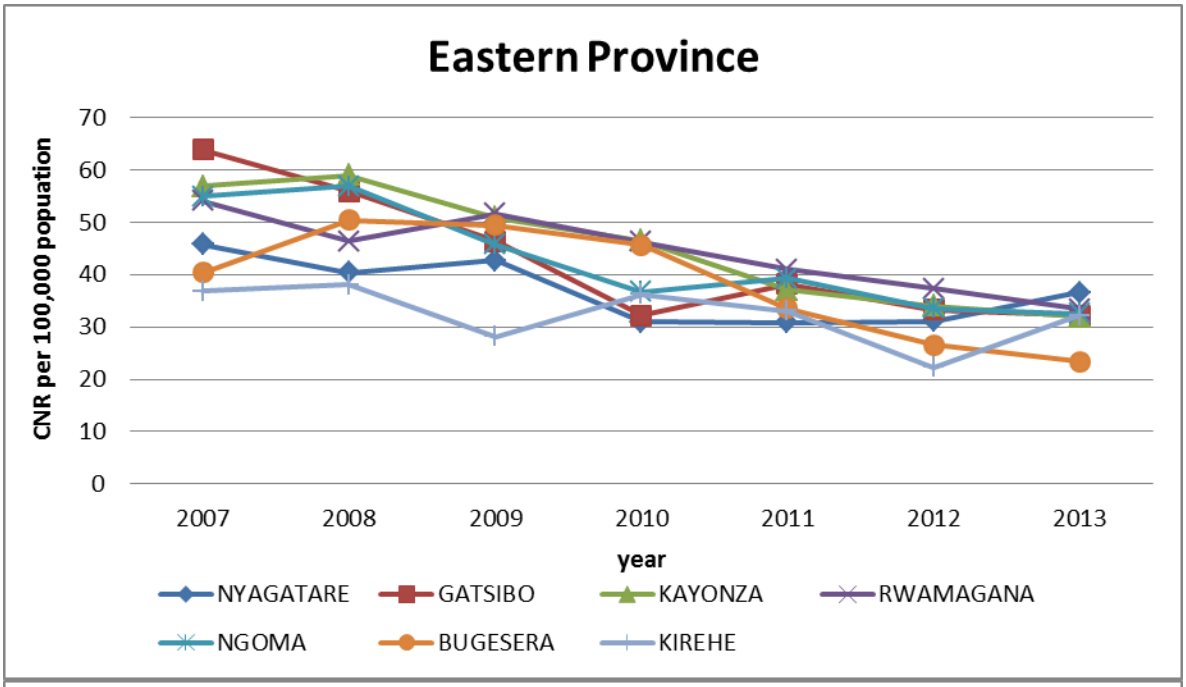
M M M Souza, M J M Costa, A S Toledo, J Pires, J Ribeiro, E Biondi. Penal Sanatorium (Sanatorio Penal), Superintendence's Health of Secretary of State's Justice, Penitentiare Sistem Department (DESIPE)-Rio de Janeiro-Brasil

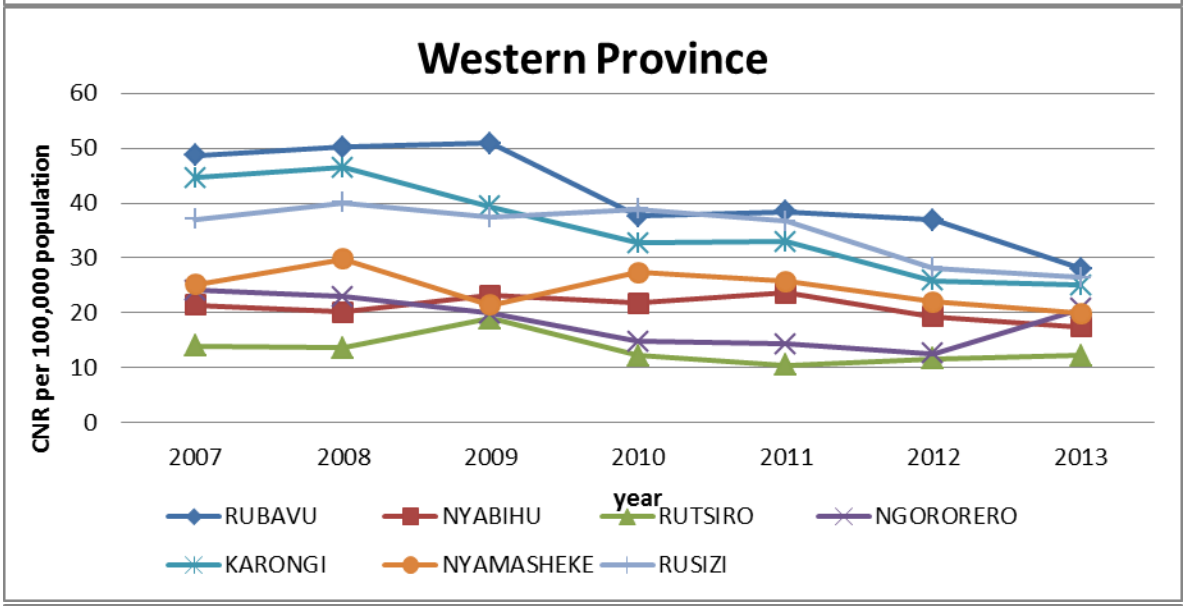
We analyzed 369 records of patients admitted in the period between January 1997–June 1998, to the Penal Sanatorium-RJ. All patients were male, with an average age of 28 years, most of whom (85.31%) had an educational background of elementary and secondary school (1° Grau) at most. The use of drugs was reported by 46.78% (131/280) of the patients: cocaine (82.25%) and marijuana (41.93%). Homo/bisexual activity were reported by 17.97% (39/203) of the inmates. HIV serum test was positive in 16.60% (48/289). TB contacts were mentioned by 22.09% (38/172). Among these inmates, 32.43% referred to a contact in prison. Previous TB treatment was reported by 38.84% (141/363). Pulmonary involvement occurred in 91.59% of the cases, 75% of which were extensive (unilateral with cavity or bilateral) and only 25% presented unilateral lesion without cavity. Bacilloscopy was positive in 58.56%.
Conclusion: The detection of cases in most advanced forms and the elevated rate of repeated treatment, suggests difficulty in early diagnosis and problems in giving patients continuous care. This not only reinforces the necessity of maintaining directly observed treatment (DOT), but also justifies the creation of centers of early detection as well as the implementation of DOT in all penitentiaries.

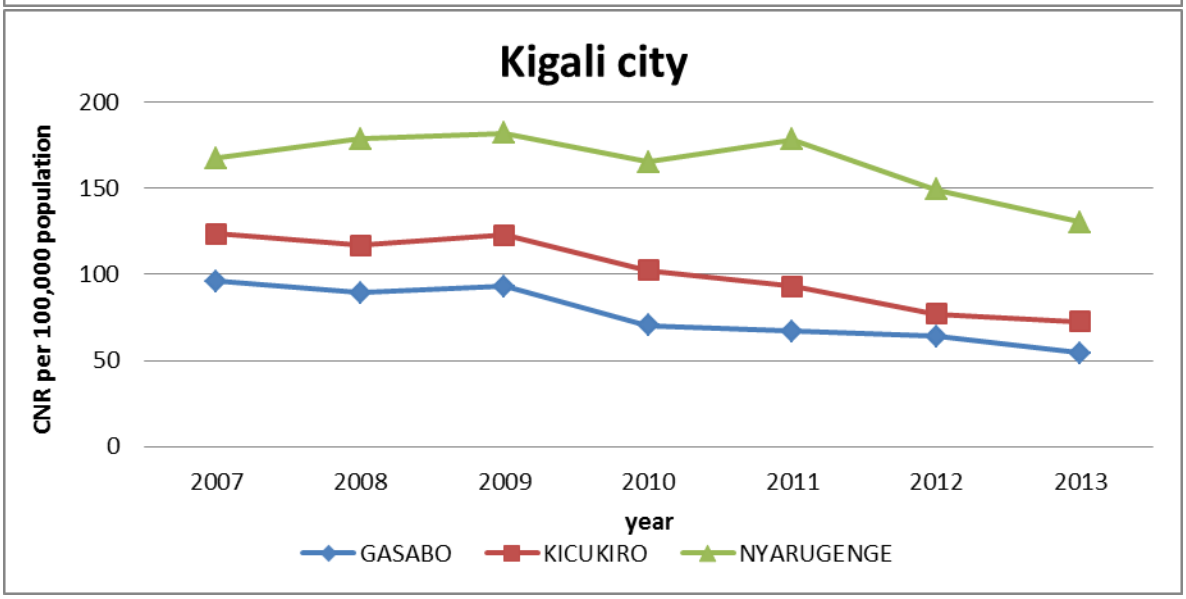
5.6 CNR for new smear positive by district over time in graphs and maps



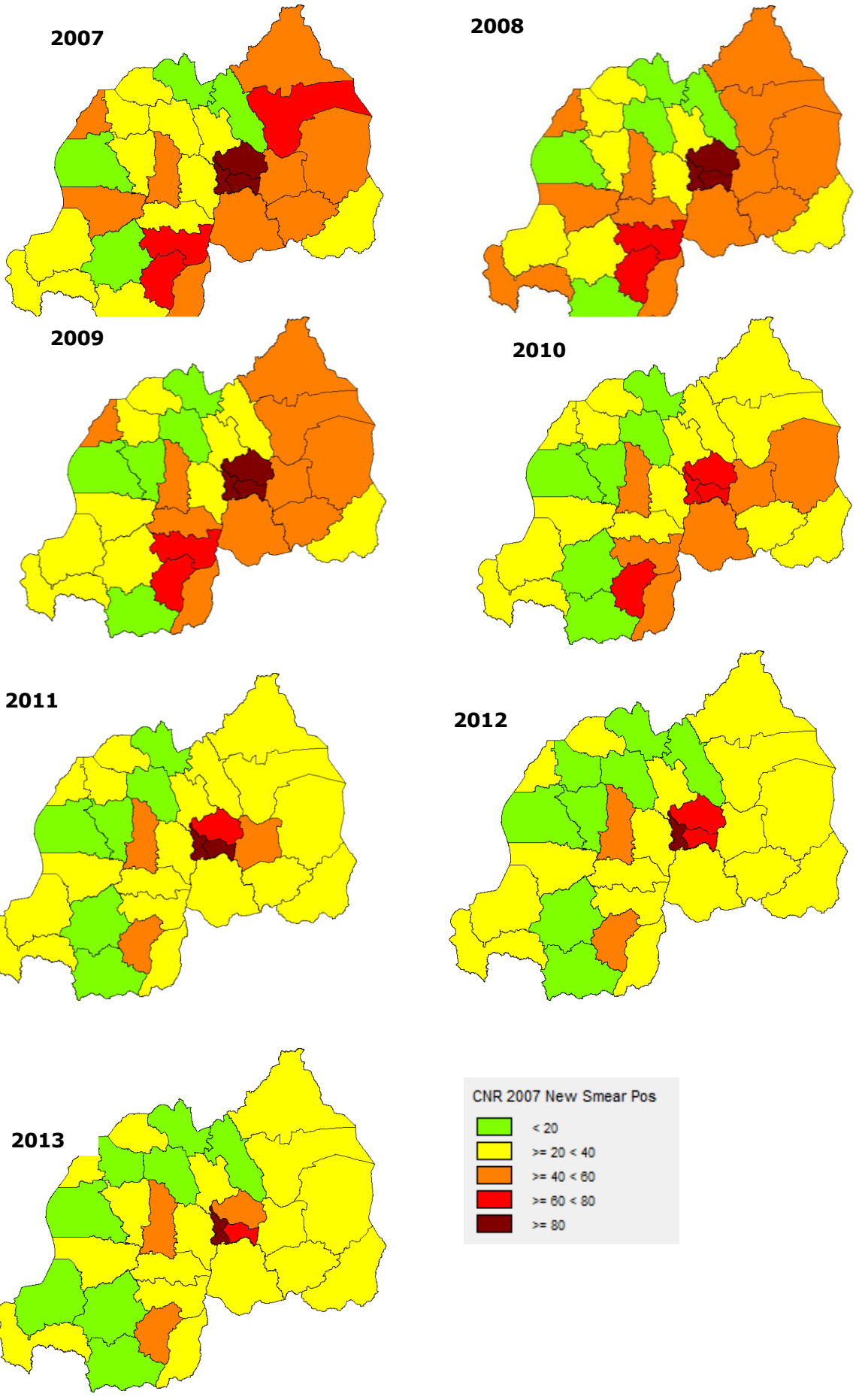



Eastern Province
CNR per 100,000 popuation
70
60
50
40
30
20
10
0
2007
2008
2009
2010
2011
2012
2013
year
NYAGATARE
GATSIBO
KAYONZA
RWAMAGANA
NGOMA
BUGESERA
KIREHE


Western Province
CNR per 100,000 population
60
50
40
30
20
10
0
2007
2008
2009
2010
2011
2012
2013
year
RUBAVU
NYABIHU
RUTSIRO
NGORORERO
KARONGI
NYAMASHEKE
RUSIZI


Kigali city
CNR per 100,000 population
200
150
100
50
0
2007
2008
2009
2010
2011
2012
2013
year
GASABO
KICUKIRO
NYARUGENGE

Mapped CNR for new smear positive by district over time



5.7 District wise data on factors potentially affecting the TB epidemic (demographic, HIV prevalence, access to care, child health indicators

		DEMOGRAPHICS				NEW SMEAR POSITVE CNR PER 100,000 population							TB-HIV presumptive TB		HIV prevalence			HIV knowledge	
Province	District	Population	Population density (Inhabitants per Square km)	%Population that is urban	Average number of person per sleeping room	NewSS + CNR 2007	New SS+ CNR 2008	New SS+ CNR 2009	New SS+ CNR 2010	New SS+ CNR 2011	New SS+ CNR 2012	New SS+ CNR 2013	% presumptive TB cases with known HIV status (2012 routine data)	% HIV infected among presumptive TB cases (2012 routine data)	HIV prevalence overall (DHS 2010)	HIV prevalence in Women (DHS 2010)	HIV prevalence in Men (DHS 2010)	% with comprehensive knowledge on AIDS (Women) (DHS 2010)@	% with comprehensive knowledge on AIDS (Men) (DHS 2010)
KigaliCity	NYARUGENGE	284,561	2,124	75.2	2.3	167.5	178.5	182.0	165.2	178.1	149.4	130.2	98.4%	26.6%	8.3	9.8	6.8	77.3	38.3
	GASABO	529,561	1,234	69.0	2.2	95.8	89.4	93.2	70.4	66.9	64.0	54.2	96.2%	19.5%	6.4	8.7	4.1	71.7	70.7
	KICUKIRO	318,564	1,911	87.9	2.2	123.5	116.8	122.9	102.5	93.0	76.9	72.5	96.0%	21.3%	7.9	10.1	5.5	71.9	73.8
Southern Province	NYANZA	323,719	482	7.9	2.5	65.6	64.9	66.5	43.0	38.5	34.6	33.5	100.0%	6.5%	2.1	2.1	2.2	73.1	54.3
	GISAGARA	322,506	475	1.6	2.5	59.7	59.1	51.1	41.2	35.0	34.7	34.2	99.0%	5.8%	1.1	1.4	0.9	52.1	43.1
	NYARUGURU	294,334	291	2.0	2.5	22.3	16.8	16.7	13.0	17.1	12.2	9.9	100.0%	6.6%	0.9	1.3	0.5	55.4	41.6
	HUYE	328,398	565	16.1	2.3	70.0	66.8	76.3	72.3	56.3	56.9	54.0	98.6%	10.0%	3.5	4.2	2.7	67.7	60.3
	NYAMAGABE	341,491	313	7.3	2.5	18.0	22.4	24.5	14.8	17.7	14.1	15.7	99.3%	9.1%	2.8	2.9	2.8	48.5	50.8
	RUHANGO	319,885	510	8.1	2.5	38.5	45.0	43.3	28.0	39.2	27.5	24.7	100.0%	11.5%	2.5	3.4	1.6	80.2	58.8
	MUHANGA	319,141	493	15.9	2.2	43.0	51.6	47.5	50.4	44.5	50.4	46.7	99.9%	4.2%	2.9	3.9	1.6	58.7	53.3
	KAMONYI	340,501	519	11.5	2.4	33.4	27.2	28.5	27.3	30.1	26.4	28.1	101.1%	9.3%	3.1	4.4	1.7	62.1	29
Western Province	KARONGI	331,808	334	6.9	2.4	44.6	46.4	39.4	32.8	33.0	25.9	25.1	99.0%	7.7%	3.3	3.4	3.3	55.9	41.7
	RUTSIRO	324,654	281	2.2	2.5	14.0	13.6	18.9	12.2	10.6	11.7	12.2	97.0%	9.0%	3.4	3.7	3	52.5	28.4
	RUBAVU	403,662	1,039	37.0	2.4	48.7	50.1	50.9	37.6	38.4	36.9	28.1	99.9%	6.5%	2.8	4.3	1.3	38.9	35.3
	NYABIHU	294,740	555	13.8	2.4	21.4	20.2	23.1	21.7	23.7	19.3	17.4	99.8%	6.1%	2.7	2.1	3.4	35.6	61.7
	NGORORERO	333,713	491	3.7	2.4	24.2	22.9	19.9	14.8	14.3	12.6	20.8	99.3%	6.1%	2.1	2.6	1.4	34.8	51.5
	RUSIZI	400,858	418	15.8	2.3	37.1	40.0	37.4	38.9	36.6	28.2	26.4	99.3%	5.5%	2.8	2.8	2.8	36.9	48.3
Northern Province	RULINDO	287,681	507	3.0	2.3	23.6	21.0	22.0	23.4	23.4	25.0	29.8	100.0%	7.1%	1.7	2.3	1	72.3	52.2
	GAKENKE	338,234	480	2.8	2.3	22.9	17.4	18.2	17.2	12.0	14.5	11.6	100.0%	6.7%	1.4	0.5	2.5	36.8	41.2
	MUSANZE	368,267	694	27.7	2.2	32.4	28.3	32.9	28.8	27.0	31.0	30.0	99.7%	7.9%	2.7	3.3	2.1	44	55.4
	BURERA	336,582	522	1.8	2.4	13.0	18.3	9.2	13.6	11.1	12.2	15.1	97.4%	8.7%	3.5	6	0.6	34.4	46.6
	GICUMBI	395,606	477	8.7	2.4	17.1	18.8	20.2	23.4	22.7	19.0	15.0	98.5%	9.3%	3.4	3.9	2.9	55.5	54.5
Eastern Province	RWAMAGANA	313,461	460	8.6	2.3	54.0	46.3	51.6	46.3	41.0	37.3	33.4	98.4%	9.5%	4.6	5	4.2	67.8	53.4
	NYAGATARE	465,855	242	10.2	2.6	45.8	40.4	42.7	30.9	30.8	31.1	36.6	98.9%	7.2%	1.9	2.4	1.4	69.7	64.1
	GATSIBO	433,020	274	5.5	2.5	63.8	56.0	46.3	32.2	38.2	33.3	32.2	98.8%	7.4%	0.9	1.2	0.5	54.2	75.3
	KAYONZA	344,157	178	9.9	2.5	56.9	59.0	50.9	46.5	37.1	34.0	32.0	99.1%	12.4%	3.7	4.4	2.9	54.4	59.4
	KIREHE	340,368	287	3.0	2.5	36.8	38.1	28.2	36.2	33.1	22.3	32.2	96.0%	6.4%	1	1.5	0.5	45.3	56.6
	NGOMA	336,928	388	4.5	2.4	54.9	56.8	45.8	36.8	39.3	33.5	32.6	99.9%	10.2%	2.6	3.1	2.1	46	34.5
	BUGESERA	361,914	280	8.0	2.5	40.4	50.5	49.4	45.7	33.6	26.5	23.4	96.3%	7.5%	1	0.8	1.1	52.8	27.5
	NYAMASHEKE	381,804	325	1.6	2.4	25.1	29.8	21.5	27.4	25.7	22.0	19.9	100.0%	5.9%	3.6	3.8	3.5	62.4	39.6

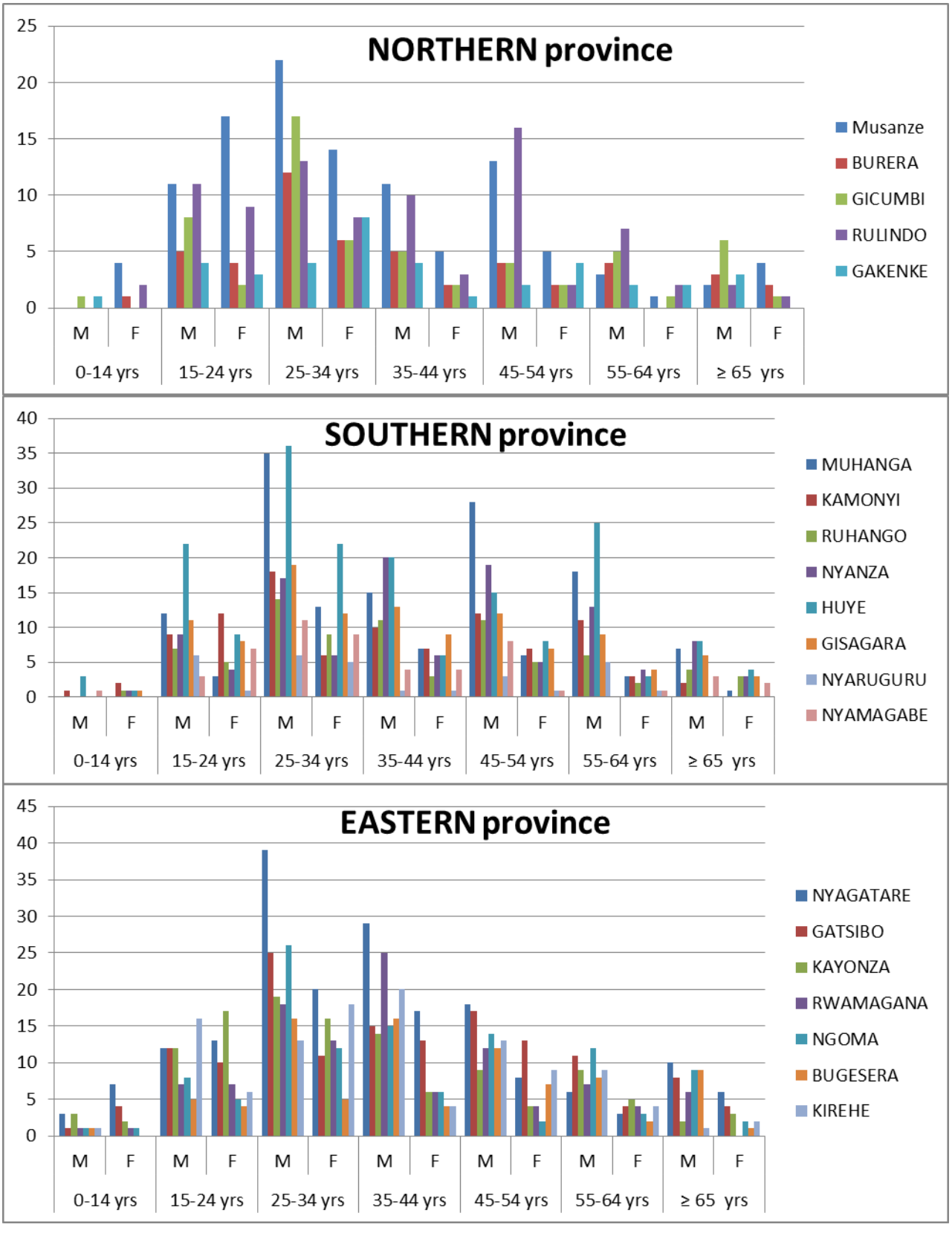
@ Comprehensive knowledge means knowing that consistent use of condom during sexual intercourse and having just one uninfected faithful partner can reduce the chance of getting the AIDS virus, knowing that a healthy-looking person can have the AIDS virus, and rejecting the two most common local misconceptions about AIDS transmission or prevention.

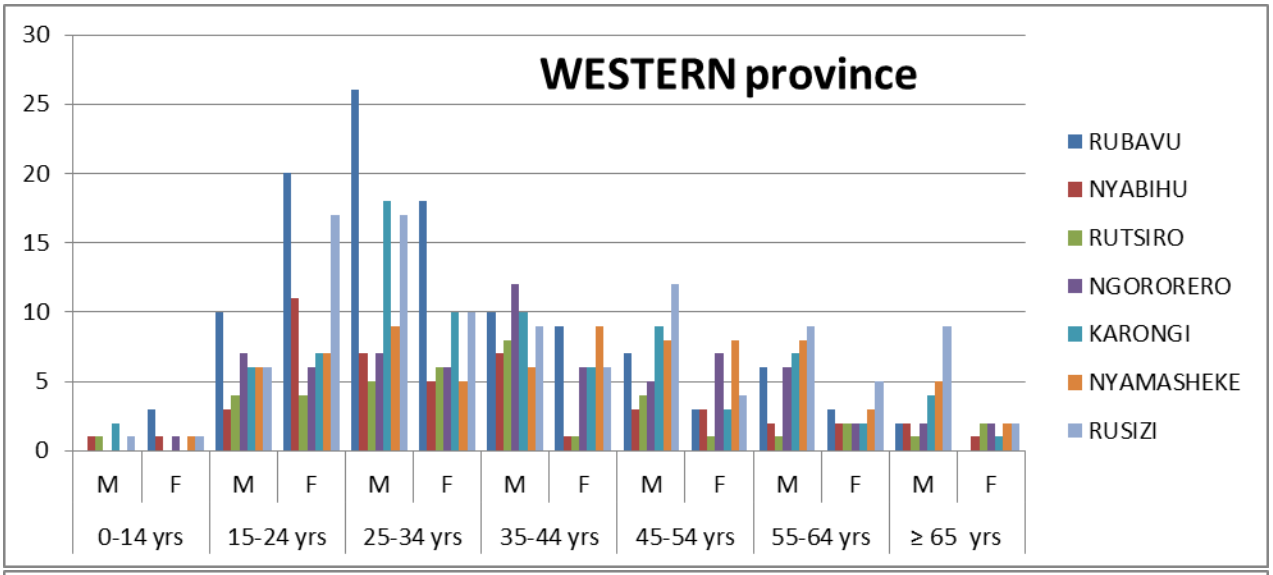
		Tobacco use				access, usage and spending on health care									Child health indicators			
Province	District	% Women (15-49yrs) using a type of tobacco (DHS 2010)	% Women (15-49yrs) smoking cigarettes (DHS 2010)	% Men (15-49yrs) using a type of tobacco (DHS 2010)	% Men (15-49yrs) smoking cigarettes (DHS 2010)	CDT coverage (per 100,000 population)	% Households with at least one member covered by healht insurance (DHS 2010)	% Women reporting at least one problem to access health care (DHS 2010)*	number of OPD visit per capita (Women) (DHS 2010)	Number of inpatients admission (per 1000 population) (Women) (DHS 2010)	number of OPD visit per capita (Men) (DHS 2010)	Number of inpatients admission (per 1000 population) (Men) (DHS 2010)	Annual per capity expenditure on OPD and admisison (Women) (DHS 2010)	Annual per capity expenditure on OPD and admisison (Men) (DHS 2010)	Under five Mortality (DHS 2010)	% Children with all basic vaccinations#	% chidlren under 5 years stunted (below -2SD)	% chidlren under 5 years severly stunted (below -3SD)
KigaliCity	NYARUGENGE	3.1	1	17	17	3.51	77.7	33.8	1.7	72	1.5	29.5	14.36	14.41	51	94.4	28.3	6.5
	GASABO	2.8	0.7	13.8	12	1.70	69	45.3	2.7	127	2.2	34.3	18.96	16.84	93	98.2	23.8	10.9
	KICUKIRO	0.9	0.5	13	12.1	2.20	70.5	55.2	1.9	108	1.6	34.4	12.89	9.96	79	94.7	18.9	4.4
Southern Province	NYANZA	2.1	0.3	16.1	14.1	1.85	76.3	60	1.4	80	1.1	34	1.99	3.59	94	100	26.4	2.8
	GISAGARA	15.5	0.7	28.8	19.4	2.17	73	87.9	3.2	96	2.7	41.3	3.92	3.54	133	85.4	47.6	17
	NYARUGURU	4.3	0.7	18.7	11.8	1.70	87.5	74.4	2.6	106	2.4	61.4	1.53	5.75	105	85.2	45.4	17.2
	HUYE	8.9	1.2	31.5	21.7	3.05	78	69.1	3.9	146	3.9	49.7	3.25	3.49	106	94.4	45	14.1
	NYAMAGABE	1.2	0.2	13.7	10.7	2.05	75.8	80.6	1.5	72	1.3	45.3	1.79	1.65	88	96.3	53.5	21.8
	RUHANGO	2.7	0.2	17.6	11.1	1.88	64.7	72.3	1.2	97	0.9	45.9	2.94	2.66	65	100	20.7	6.9
	MUHANGA	3.9	1.2	18.4	15.2	2.51	91.9	64.3	1.6	65	1.8	46.1	3.4	3.55	81	87.3	46.7	18.3
	KAMONYI	2.2	0.2	27	21.1	1.76	73.1	78.5	1.1	65	0.8	24.3	2.14	1.93	82	96	45.3	15.2
Western Province	KARONGI	0.4	0	9.1	7.7	2.71	93.4	49	1.1	71	0.9	59.8	1.48	1.36	68	93.9	56.7	22.1
	RUTSIRO	1.3	0.2	9	6.9	1.23	78.1	43.3	1.1	95	0.7	45.7	1.23	1.37	75	84.5	60.3	28.1
	RUBAVU	0	0	7.6	6.3	0.99	69.8	70.9	1.1	99	0.9	31.7	2.82	3.14	96	69.2	54.9	21
	NYABIHU	1.6	0.3	12.4	11.3	2.37	72.3	57	1.8	154	1.9	69.3	2.77	4.15	128	87.3	51.5	22.2
	NGORORERO	0.8	0	17.2	14.1	1.80	81.4	52	1.6	160	1.1	41.8	2.91	3.73	79	76.8	53.4	23.8
	RUSIZI	1.5	0	6.9	5	2.49	92.2	64.3	2.9	186	2.1	99.7	4.67	3.8	84	69.1	40.9	16.1
Northern Province	RULINDO	4.1	0.6	15.7	10.4	2.43	64.1	61.9	1.6	69	1.1	29.2	1.93	1.76	94	95.2	42.9	11.1
	GAKENKE	5.7	0	16.8	12.5	2.07	89.5	55.5	2.9	75	2	70.5	2.92	1.97	96	91.1	63.6	28.4
	MUSANZE	3.3	0.6	16.1	13.7	1.36	87.5	46.5	0.9	71	0.7	32.5	1.23	1.5	131	100	45.3	17
	BURERA	4.5	0	14.2	9.8	1.78	93.2	53	1.2	111	1.1	70.7	1.83	1.93	110	87.7	52	20.2
	GICUMBI	4.7	0.5	15.1	6.6	2.02	90	59.7	1.6	82	1.2	66.3	1.65	1.91	104	93.6	46.6	16.8
Eastern Province	RWAMAGANA	1.8	0.5	21.4	18.2	1.60	68.9	45.1	1.2	85	1	31.7	8.63	10.96	87	93.1	29.2	7.5
	NYAGATARE	6.8	0	17.9	12.1	1.07	65.3	55.6	1.4	64	1.2	29.2	2.79	2.25	123	95.6	42.2	16.6
	GATSIBO	5	0.4	22	11.3	1.39	59.4	78.9	1.3	88	1	27.6	2.35	1.92	113	94.8	51.5	26.6
	KAYONZA	3.2	0.5	17.6	11.4	1.45	84.1	62.5	1.9	73	1.4	43.1	4.82	2.83	129	94.7	44.5	18.5
	KIREHE	5	0.5	15.4	9.2	2.06	80.9	56.8	1.6	96	1.3	48.8	2.37	6.4	126	84.9	50.7	22.5
	NGOMA	5.2	0	15.2	12.7	1.19	78.9	67.9	1.6	114	1.1	40	3.3	2.5	154	86.4	50.2	20.7
	BUGESERA	4	0	16.2	12.6	1.93	62.6	83.9	2.2	117	1.4	67.2	4.26	4.83	135	96.8	38	12.5
	NYAMASHEKE	1	0	9.1	8.4	1.83	90.1	63.1	2.1	141	1.6	56.5	4.09	3.82	88	89.6	33.2	9.8

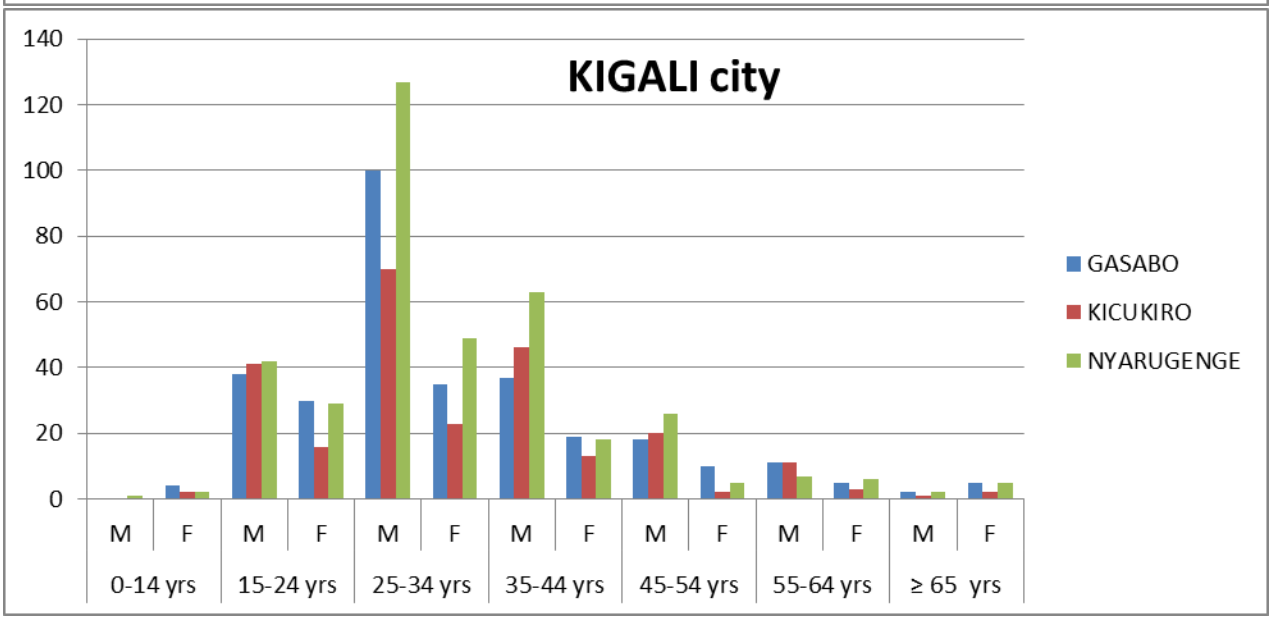
* type problems reported: getting permission to go for treatment; getting money for treatmetn; distance to health facility; not wanting to go alone.

BCG; measles and three doses each of tetravelent/pentavalent and polio vaccine

5.8 Male and female Tb case notification rate by age group for new smear positive in the years 2013 by province




WESTERN province
30
25
20
15
10
5
0
M F M F M F M F M F M F M F
0-14 yrs
15-24 yrs
25-34 yrs
35-44 yrs
45-54 yrs
55-64 yrs
≥ 65 yrs
RUBAVU
NYABIHU
RUTSIRO
NGORORERO
KARONGI
NYAMASHEKE
RUSIZI


KIGALI city
140
120
100
80
60
40
20
0
M F M F M F M F M F M F M F
0-14 yrs
15-24 yrs
25-34 yrs
35-44 yrs
45-54 yrs
55-64 yrs
≥ 65 yrs
GASABO
KICUKIRO
NYARUGENGE

5.9 Reported smoking among the general population by age group and gender as reported during the National TB prevalence survey (2012)

Table a: Reported smoking among the general population by age group and gender

		Smoker		Non-Smoker	
Male	*15-34*	25	9.9%	228	90.1%
	35-54	43	32.3%	90	67.7%
	55+	28	34.6%	53	65.4%
	Male total	**96**	**20.6%**	**371**	**79.4%**
Female	*15-34*	4	1.1%	358	98.9%
	35-54	19	10.3%	166	89.7%
	55+	25	24.8%	76	75.2%
	Female total	**48**	**7.4%**	**600**	**92.6%**
Overall	*15-34*	29	4.7%	586	95.3%
	35-54	62	19.5%	256	80.5%
	55+	53	29.1%	129	70.9%
	Overall total	**144**	**12.9%**	**971**	**87.1%**

Source: Data National TB prevalence survey

Table b: Smoking among TB cases and matched controls

	TB case						p-value
	TB control		TB case		Total		
	N	%	N	%	N	%	
Ever smoked							
No	156	89.7	18	10.3	174	100	0.125
Yes	62	82.7	13	17.3	75	100	
Currently smoke							
No	179	89.9	20	10.1	199	100	0.022
Yes	39	78.0	11	22.0	50	100	
Frequent smoke							
No	185	87.7	26	12.3	211	100	0.886
Yes	33	86.8	5	13.2	38	100	

Source: Data National TB prevalence survey

5.10 Development of health insurance in Rwanda

Development of health insurance in Rwanda

The first form of Community Based Health Insurance originated in Rwanda as early back at the 1960s. In 1966 the former Kibungo province initiated the health mutual association called "Muvandimwe" and the former Butare province initiated Umubano Mu Bantu, both which served to increase accessibility to health care at the community level. In the period immediately following the 1994 genocide, with the support of international organizations, Rwanda"s healthcare system was free at the point of access as a response to the post-genocide emergency. In 1997, user-charges for health services were reintroduced and data from the Health Information System indicated that most households struggled to cover the out of pocket payments associated with accessing healthcare services. In fact, the utilization rate of health services in 1996 was only 0.28 contacts per year per capita, a quarter of the World Health Organization standard of 1 contact per capita per year in developing countries. Thus, the reintroduction of user charges posed a significant financial barrier to the access of healthcare services. In 1999, to help overcome these barriers, the government of Rwanda introduced Community Based Health Insurance (CBHI) in 3 districts (Kabgayi, Kabuyare and Byumba) as part of a pilot phase. The initial scheme covered approximately 52 health centers and three district hospitals. In December 2004, after the success of CBHI in these pilot districts, Rwanda developed the strategic policy document, "Community based health insurance in Rwanda" and policy framework for CBHI. In 2005, the Rwandan Government decided to extend the CBHI scheme to all the 30 districts and in 2006, initiated by Ministeral instruction. The main objective of the CBHI policy was to enable those in the informal sector to become part of a health insurance system to improve financial accessibility to health services and protect households against the financial risks of falling ill. Beginning in 2006, each household paid a premium of 1000 RWF per member of the household. The poor and relatively well-off were therefore contributing the same amount into the CBHI fund (CBHI policy, 2010), making contribution to CBHI regressive in design. To reduce inequity, the Government of Rwanda adopted a new CBHI contribution scheme based on social economic stratification in 2010. In this new approach the population is subdivided in different socio-economic categories based on the household wealth. The category determines the premium contribution that each household member must pay into the insurance pool. All households are divided into categories, adopted from the Ubudehe program. This stratification process serves to both improve the longterm financial viability of the CBHI scheme and to improve the equity in contributions. For the first year of implementation (July 2011-June 2012) CBHI has achieved an enrollment rate of **90.7%** of the total population.

(source http://www.moh.gov.rw/fileadmin/templates/Docs/CBHI-Annual-Report-2011-2012f-3__1_.pdf)