NATIONAL INSTITUTE FOR COMMUNICABLE DISEASES

Division of the National Health Laboratory Service

Microbiologically confirmed tuberculosis 2004 -15

South Africa

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FOREWORD

The National Institute for Communicable Diseases (NICD) has, over the past four years, prioritised surveillance on the burden of tuberculosis (TB) in South Africa, particularly now that TB is the leading infectious cause of morbidity and death in South Africa. Such surveillance is critical to enable informed decision making, not only at national level, but also down to district level. This will better equip us to focus our resources on targeted interventions in communities where the burden of TB is greatest. Furthermore, robust longitudinal surveillance is critical to enable the evaluation of the success of the interventions deployed, and as a barometer to measure the progress being made in South Africa toward the goal of ending TB by 2035.

This first report on the burden of TB in South Africa from the NICD, provides a robust assessment of the current status of TB in South Africa, and highlights successes of the National Department of Health and other stakeholders over the past few years in reducing TB in the country. Although the current year-on-year rate of decline in TB is only half of what we estimate is required to end TB by 2035, it is two- to three-fold higher than the reductions that have been observed globally. The shortcoming in meeting our targets to reduce TB in South Africa might be due to challenges in making inroads among some key populations. Included among these, as identified through our surveillance, are males between the ages of 25-44 years, among whom the reduction in incidence has lagged behind that observed in women of the same age group. We are now able to characterise geographic hotspots where the burden of TB is most concentrated. These need to be prioritised in our efforts to improve TB cure rates, as well as reduce transmission.

The Department of Health has revised its Five Year Plan for TB (2017-2021) and measuring progress will be important. This current report provides a retrospective view until 2015 and is based on an even more exciting development, the online TB Surveillance Dashboard, which can now be used to assess trends into the future. The dashboard is publically available on the NICD website: www.nicd.ac.za.

Major efforts are under way locally and globally to end TB by 2035 and the NICD will work closely with the Department of Health and other stakeholders to improve public health response to this killer disease and strongly promote a data-driven approach as highlighted in the new National Strategic Plan for HIV, TB and STIs.

Prof. Shabir A Madhi

Executive Director, National Institute for Communicable Diseases
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Abbreviations

AIDS	acquired immunodeficiency syndrome
ART	antiretroviral therapy/treatment
CDW	Corporate Data Warehouse
CI	confidence interval
DOTS	directly observed treatment, short course
DRS	Drug-Resistance Survey
DST	drug sensitivity/susceptibility testing
DS-TB	drug-susceptible tuberculosis
EPTB	Extra-pulmonary tuberculosis
GXP	Xpert MTB/Rif assay
HIV	human immunodeficiency virus
ILTF	initial loss to follow up
INH	isoniazid
LIS	laboratory information system
LPA	line probe assay
MDR-TB	multidrug-resistant tuberculosis
MGIT	Mycobacterial Growth Indicator Tube
MTB	Mycobacterium tuberculosis
mPTB	microbiologically confirmed pulmonary tuberculosis
NDoH	National Department of Health
NHLS	National Health Laboratory Services
NICD	National Institute for Communicable Diseases
NSP	National Strategic Plan
NTP	National Tuberculosis Programme
PDoH	Provincial Department of Health
PHC	primary health clinic
PLWHIV	people living with human immunodeficiency virus
PTB	Pulmonary tuberculosis
RR-TB	rifampicin-resistant tuberculosis
SRL	Supranational Reference Laboratory
STI	sexually transmitted disease
TB	tuberculosis
WHO	World Health Organization
XDR-TB	extensively drug-resistant tuberculosis

EXECUTIVE SUMMARY

South Africa is on the World Health Organization (WHO) list of priority countries in the categories of Tuberculosis (TB), Drug Resistant Tuberculosis (DR-TB) and HIV associated TB[1]. In 2005, the situation seemed hopeless, as can be inferred from the aptly titled editorial published in reference to TB control, "Are we losing the battle?"[2]. The period beginning in the early 1990s saw a massive annual increase in TB and a decade later the STOP TB partnership was established to address the escalation of this killer disease. This report by the NICD confirms the change in tide previously reported in the *Lancet Infectious Diseases* journal, which shows a further decline in microbiologically confirmed pulmonary TB (mPTB) incidence in South Africa[3]. This compares well with the global change in TB, which is now showing signs of decline. The new strategy developed by the WHO is focused on ending TB and has set revised and ambitious targets to achieve annual reductions in incidence rates and mortality[4]. However, even with a 10% year-on-year reduction in TB incidence rates, as required by the WHO's END TB strategy, more radical changes will be required in future to control TB globally.

This report provides reason for optimism, with the year-on-year decline in mPTB incidence in South Africa since 2012, with figures of -4.8%, -6% and -4.8% for the years 2013-2015 respectively. Although this represents only half of what is required, it exceeds the global average year-on-year reduction of 2%[4]. Notably, in South Africa, KwaZulu-Natal, which carries the highest absolute burden in the country, has shown the greatest reduction over the three-year period 2013-2015, with a year-on-year reduction averaging 10.5%. Similarly, there has been an acceleration of the year-on-year reduction in the Free State from -2.5% in 2013, -4.8% in 2014 and approaching -9.2% in 2015. Although the broader roll out of antiretroviral therapy (ART) on reducing mPTB incidence has been shown to be an important contributor; this alone will not be enough.

The new national TB Plan 2017-2021 provides a set of focused interventions to further accelerate the reduction in TB cases in South Africa. This includes, an emphasis on initial loss to follow up and contact tracing of household contacts, which will likely yield important short-term benefits. Additionally, the strong focus on quality improvement as a cross cutting issue will enable sustainable achievements. The Northern Cape, however, is an example of an area where health systems and access are key elements impacting on success. The province demonstrates a concerning increase in mPTB incidence rates, and although it carries a relatively low absolute number of mPTB cases, adjusting for population size, it has one of the highest rates nationally, requiring further investigation.

A striking clue to the success and failure of the achieved reduction in incidence was observed when disaggregating by gender. Most of the declines observed across provinces and reflected nationally have been driven by successes achieved among females between 25-44 years of age with a 33.6% reduction between 2008 and 2015 nationally. These statistics link closely with the large emphasis of the HIV programme, as well as greater health-seeking behaviour among this population group. In stark contrast, the reduction among males in the same age category was only 13.4% for the same period. Specific strategies aimed at this population group are urgently required if South Africa is to reach its End TB goals, including targeted public messaging, increased access through men's health and wellness centres, and male role models. Breaking through this barrier will be challenging, but is likely to see even greater reductions than in the past.

The observation of over three million people diagnosed with mPTB over the reporting period (2004-2015) highlights the magnitude of the TB burden. Much like HIV, the disease is of a chronic nature, with new cases accumulating over time. However, unlike HIV, TB is curable and the majority of the aforementioned three million TB cases have been cured – a statistic often underappreciated. This highlights the significant and direct value achieved by dealing with the TB epidemic effectively. Additionally, the burden of disease is heterogeneous, with 74.2% of the absolute number of cases occurring in just four provinces: KwaZulu-Natal, Gauteng, the Eastern Cape and the Western Cape, with hotspots in the urban metropolitan areas.

In assessing the distribution of rifampicin resistant TB, we build on the most recent TB DRS report 2012-2014 which highlighted Mpumalanga as the province with the highest prevalence of drug resistant TB – again confirmed in the current report. In addition, other high prevalence areas have been identified in KwaZulu-Natal. For both provinces the highest incidence occurred in districts close to the Mozambique and Swaziland borders, showing that greater co-operation with neighboring countries is essential to overcome the challenges faced in combating TB. Similar to what is observed for mPTB cases, there is considerable heterogeneity for drug resistant TB nationally, with KwaZulu-Natal having close to 30% of the rifampicin resistant TB burden. Identifying and targeting responses and providing decentralised services for the management of drug resistant TB will be important to improve adherence and achieve cure.

The current report provides valuable insights that should be closely integrated into TB control planning for the next five years. The current report ends in 2015 and annual updates will be provided to more closely monitor the status of this priority disease in South Africa.

Finally, we are greatly excited to announce the release of an online TB Surveillance Dashboard upon which this report is based and which will provide regular updates which cannot easily be achieved in a report format. The dashboard is accessible from the National Institute for Communicable Diseases' website: www.nicd.ac.za.

INTRODUCTION

Early hopes for the effective control of tuberculosis (TB), and even possible elimination, were thwarted by the growing human immunodeficiency virus (HIV) co-epidemic in the early 1990s. The successful introduction of antiretroviral treatment (ART) in South Africa and its impact on TB incidence has provided renewed hope, however TB control remains a major concern in this country and is now the leading cause of death due to an infectious bacterial agent[5]. The situation in South Africa was aggravated by the emergence of multi-drug resistant TB (MDR-TB). This included outbreaks of extensively drug-resistant TB (XDR-TB) in KwaZulu-Natal[6] and reported cases of "total" drug-resistant TB in the Eastern Cape[7]. Encouraging outlooks for TB control include recent developments in the use of molecular technologies for the rapid and definitive diagnosis of TB and drug resistance in *Mycobacterium tuberculosis* strains from patients[8,9], as well as the prospect of the introduction of two novel anti-TB drugs for TB treatment in the near future[10].

Tuberculosis has plagued the world for centuries. Dating back to 3700 BC, the disease has been found in the vertebrae of Neolithic man in Europe, as well as Egyptian mummies. TB was a major cause of death in Europe with a mortality rate of 500 per 100 000 people per year. *Mycobacterium tuberculosis* is the causative agent of TB, and is transmitted by aerosol infection involving droplet nuclei, 1-4 µm in diameter. These infective particles are expectorated by coughing and other ways of forced expiration by patients with active "open" pulmonary TB. After inhalation of tubercle bacilli by a susceptible individual, a small area of bronchopneumonia develops. Some surviving TB bacilli remain viable but are dormant after primary infection, particularly in areas of high PO2 e.g. apex of the lung, kidney, meninges, ends of long bones, vertebrae and lymph nodes.

During these events, infected persons are usually asymptomatic, but in suitably susceptible individuals, mainly children, the TB organism causes disseminated disease, including TB meningitis, as well as various other forms of extrapulmonary TB. Patients may progress from asymptomatic latent TB infection to active disease when immunity is suppressed as a result of a new predisposing condition (e.g. uncontrolled HIV or diabetes) or due to immunosuppressive therapies (e.g. chemotherapy). Re-infection among adults following exposure to an untreated active TB case is also common in high burden settings like South Africa and contributes to the growing burden of active cases due to the high population prevalence, with a total of 6.19 million people living with HIV[11].

The clinical diagnosis of symptomatic or active TB poses a challenge to healthcare workers as the typical symptoms of a prolonged cough, fever, night sweats and loss of weight do not all occur at an early stage. A patient may present with just a cough or night sweats which are non-specific. Additionally, among HIV infected individuals, symptoms can be minimal making the diagnosis even more difficult. Microbiological diagnosis of TB is thus often required and is the cornerstone of diagnosis and monitoring in TB programmes globally. Smear microscopy was and continues to be widely used but can miss up to 50% of TB cases – especially in high HIV endemic settings. In 2011 South Africa replaced this technology, which dates back to the early discovery of the organism by Robert Koch in 1882, with a highly sensitive and specific molecular test – the Xpert MTB/RIF assay.

The Xpert MTB/RIF assay (GXP) has an overall sensitivity of 88% (95% CI: 70%-86%) and 79% (95% CI: 84%-92%) in HIV positive individuals; specificity is 99% (95% CI: 98%-99%)[8]. The historic gold standard against which these tests are assessed is mycobacterial culture, which is highly sensitive at detecting active TB. Even though results take up to six weeks for finalisation, culture is still recommended for use in cases where the GXP is negative and the patient is HIV positive. The newer version of the assay is set to change this practice. Despite these great advances in technology, some cases may not be microbiologically confirmed, particularly in cases of extra-pulmonary TB, paediatric TB, and also adult TB patients who are unable to produce sufficient sputum for accurate testing. Thus, although the majority of cases would be detected by microbiological methods, clinically diagnosed cases are important contributors to the total burden of TB.

TB in South Africa has had an interesting evolution; underpinned by the nature of the disease which is easily spread among close and prolonged contacts of active TB cases. Early increases were fueled by historic inequalities and high poverty levels in South Africa associated with overcrowding, malnutrition and in more recent times HIV. In addition, the massive expansion of mining activities linked to economic migration and mine workers often living away from their families in densely populated structures have also played an important role, impacting both TB and HIV control in South Africa.

After South Africa became a democracy in 1994 the country was faced with major challenges in delivering services to all, as well as a rapidly increasing TB and HIV burden. To this end, the National Tuberculosis Control Programme was established, which has since introduced a variety of interventions, including: the phased implementation of the Directly Observed Treatment Short-Course (DOTS) in 1997; the introduction of the four drug fixed dose combination in 2000; conducting the first national Drug Resistance Survey in 2001; the launch of the National Tuberculosis Strategic Plan 2007-2011 in 2007; the

introduction of the new diagnostic assays (MTBDRplus rapid test for MDR-TB in 2008 and the XpertMTB/Rif in 2011 as a replacement for sputum smear microscopy); implementation of the 6-month isoniazid preventive therapy (IPT) programme for all HIV-infected persons (regardless of TST status) in 2010[12]; and, most recently, the release of the findings of the most recent national Drug Resistance Survey in 2015[13].

Despite instituting numerous interventions to control TB in South Africa over the years, the World Health Organization (WHO) estimated 454 000 new TB cases in South Africa in 2015[1] – the fifth highest globally. After adjustments for population size, South Africa has the highest incidence of TB among the 22 high-TB burdened countries in the world. It also has the largest number of HIV-associated TB cases. WHO has previously classified a TB incidence of ≥250 per 100 000 people as a "health emergency" and the estimated incidence in South Africa is three-fold higher than this level.

The TB incidence reported by WHO is an estimated calculation, using several sources of information. To date a survey has not been conducted to determine the population prevalence of TB in South Africa. Several countries have however recently concluded such surveys in other parts of Africa, producing surprising results that suggest a much higher prevalence than reported through routine treatment registers. In many African countries, the latest technologies for the diagnosis of TB are not widely available or accessible and may contribute to the low number of cases reported as compared to the estimates generated through surveys. A prevalence survey is planned for South Africa and will be important in determining the true burden of TB, as well as the proportion of cases remaining undiagnosed in the community.

In 2015, 294 603 cases were registered on treatment[1] – presenting a very different picture from the estimated 450 000 cases by WHO. These variances could be due to poor health access or health-seeking behaviour, incomplete records in registry data, failure to follow up diagnosed cases or death prior to accessing treatment[3,14,15]. In 2015, the National Institute for Communicable Diseases with the National Department of Health published a peer reviewed paper in the ***Lancet Infectious Diseases*** journal using routine laboratory data to determine incidence rates nationally and provincially, and comparing findings with those reported through the current electronic data systems. The paper demonstrated the powerful utility of laboratory data in providing a robust surveillance system for tracking incidence, albeit only for microbiologically confirmed cases. Most importantly, transformation of the laboratory data allows for trend analysis at multiple levels of the healthcare system. These findings were made possible by South Africa's unique position as compared to many other developing and developed countries globally, in having a single integrated laboratory network that covers all public health sector facilities. The National Health Laboratory Service was established in 2001 linking every laboratory in the public sector under a single entity. Services are managed using a single laboratory information system with all data, including laboratory results and demographic information, stored in a corporate data warehouse (CDW).

The publication covered data between 2004 and 2012, and as data for the KwaZulu-Natal province were largely missing due to the lack of a laboratory information system in that province up to 2010, imputation was performed. The results from this study showed that the annual incidence of microbiologically confirmed pulmonary TB (mPTB) had increased nationally from 656 per 100 000 people in 2004, to 854 per 100 000 people in 2008, then subsequently declined to 774 per 100 000 people by 2012. The incidence of PTB varied by age group and gender, as well as between provinces. The impact of HIV infection on the incidence of TB in South Africa was profound, but the upscaling of antiretroviral therapy (ART) was temporally associated with declining PTB incidence, albeit variably across the country. The incidence rates were highest in the Western Cape, Northern Cape and Eastern Cape with rates declining in all provinces since 2009, most markedly in the Western Cape and Northern Cape provinces.

Utilisation of laboratory data to assess trends was a first for South Africa. Assessment of this data confirmed that the declining trend, as observed from the treatment registration data, was indeed true. The following factors were taken into account when developing the laboratory based surveillance system: As a unique identifier is not universally used, record linking was achieved using computer-based probabilistic matching algorithms to reach a case-based record of a patient. Multiple microbiological methods used to diagnose TB can also be used for monitoring progression to cure and the algorithms were adapted to order test types. Lastly, a person could have multiple episodes of TB over the course of their lives and thus episode assignments were developed to arrive at a patient level episode of TB spanning the period 2004 to 2015.

Since the publication of the paper, the algorithms used have been further refined to improve the accuracy of the system resulting in the updated incidence rates now reported for the preceding years. Three additional aspects were considered as important for developing this report: Firstly inclusion of more recent years' data, as the GXP rollout only began in 2011 and the previous findings were reported ending in 2012. Secondly, analysis needed to be performed at a much lower level to be meaningful and impactful in guiding future interventions. Finally, data were available in a format that was easy to access and visually presented in a way that made it easy to understand and interpret. The result was the development of an online TB Surveillance Dashboard, which forms the basis of this report and will officially be made available on World TB Day 2017.

Drug resistant TB is another major concern for South Africa and unlike the lack of a general TB survey, two TB drug resistance surveys have been concluded for South Africa, the first between 2001-2002 and the second between 2012-2014; both

showing relatively low levels of multi-drug resistant TB (MDR-TB), but increasing prevalence of rifampicin mono-resistant TB, as well as high second line resistance in the latter survey. It is unclear, based on these surveys, what transpired in the intervening decade between the surveys. Potentially, the laboratory-based surveillance system that has been developed will be able to answer that question. Unlike the case for all TB where testing was universal, albeit with varying test performance, in the case of drug resistant TB universal testing was not performed. Yet, with the introduction of the GXP in the most recent years, this has been achieved to a large extent. Noting the limitations which are being improved on through the surveillance system, the current report only presents information for rifampicin resistant TB for the year 2015. Future planned annual reports will address this shortcoming and provide regular updates on trends.

The current report comes at a timely phase for South Africa as the National Strategic Plan (NSP) for HIV, TB and STIs 2017-2021 will place a major focus on using data to guide and drive efforts to achieve the END TB strategic targets (Table 1). One of the main targets is to achieve a 10% year-on-year reduction in TB incidence rates. As highlighted earlier, TB incidence rates are not reported routinely, however the current report and the online TB Surveillance Dashboard fill this important gap. Although these only report mPTB incidence rates and not all TB cases, including those which are clinically diagnosed, mPTB incidence rates are robust and objective, providing a suitable surrogate to assess progress towards reducing incidence. Lastly, the current report also serves to address an important priority of the NSP in targeting responses by mapping the burden in absolute numbers and incidence rates from national to sub-district levels.

Table 1: WHO End TB Strategy, milestones and targets

Vision	A world free of tuberculosis – zero deaths, disease and suffering due to tuberculosis			
Goal	End the global tuberculosis epidemic			
Indicators	Milestones		Targets	
	2020	2025	SDG 2030	End TB 2035
Reduction in number of TB deaths compared with 2015 (%)	35%	75%	90%	95%
Reduction in TB incidence rates compared with 2015 (%)	20% (<85/100 000)	50% (<55/100 000)	80% (<20/100 000)	90% (<10/100 000)
TB-affected families facing catastrophic costs due to TB (%)	Zero	Zero	Zero	Zero

METHODS

Sources of data

Laboratory data

The data in this report are sourced from the National Health Laboratory Service's (NHLS) Corporate Data Warehouse (CDW). The CDW collates information from the laboratory information management systems (LIMS) (which is currently in operation in the NHLS laboratories in South Africa) and the legacy LIMS that was previously used by the NHLS. Specimens which are collected from people presenting at public health facilities with signs and symptoms of TB are sent to the NHLS' network of laboratories for testing. A laboratory requisition form containing basic demographic information and the test/s requested accompanies each specimen and is captured into the LIMS.

Population and geographic data

Geographic data in the form of shape files and boundaries with associated population data by gender and five year age group were obtained from the Municipal Demarcation Board and Statistics SA respectively.

Record linking

All data captured in the LIMS are specimen-based; associated demographic information is captured at the time of specimen registration. To identify cases, an algorithm was applied to the registration data to ensure that all tests associated with individual "patients" were assigned a link ID based on the outcome of an algorithm that uses the most frequently populated demographic information for evaluation. This algorithm applied both exact and probabilistic matching to all specimen registrations in the CDW.

The number of records that were input into the probabilistic matching routine were reduced by the application of a preliminary exact matching routine. To further enhance the chances of matching, both exact and probabilistic, the data were first cleansed e.g. standard titles that may have been included in the first name field were removed and if date of birth was not given then it was calculated from the given age at time of registration.

Exact matching was done using attributes for first name, surname and birthdate, and when available, the national ID number. In addition, the hospital folder number from facilities known to use reliable unique patient identifiers was used. These attributes were also used in the probabilistic linking. The population of the address lines was found to be too inconsistent and unreliable for inclusion as a link criterion.

The probabilistic linking evaluated each attribute individually using a "fuzzy logic" function that returned a probabilistic score. The score for each attribute was weighted; this weighting was determined by the reliability of the attribute being used. A final score was assigned and the records were linked and assigned a unique link ID or left unlinked and assumed to be individual cases based on a given threshold. The threshold used was determined during the development and testing of the algorithm and was confirmed to result in conservative linking i.e. it would avoid linking unlikely matches.

Case definitions

TB

For each patient identified by the record linking process, TB confirmed status was determined based on a positive TB result for an Xpert MTB/Rif test, culture, Line Probe assay or smear. A 12-month window period was calculated based on the date of the first confirmatory test with a positive result and used to distinguish new episodes from existing episodes. This approach was based on the understanding that treatment for drug susceptible TB spans six months, and that smear conversion for drug susceptible TB is usually achieved within three months and allows for some delay between diagnosis and entry into treatment.

If a case that was confirmed to have drug susceptible TB was found to develop drug resistance later, the 12-month episode window was extended to 24 months to allow for the extension of treatment.

RIFR TB

For each confirmed TB patient identified, an assessment was made of all testing for rifampicin resistance using any one of Xpert MTB/Rif, Line Probe assay or culture-based drug susceptibility testing (DSTs). A 24-month window period was applied to distinguish new episodes of drug resistant TB (DRTB) from existing ones, again based on the duration of treatment, the time taken to achieve smear conversion and allowing for some delay between diagnosis and treatment. All DRTB cases that were still found to be TB positive within four months of the end of the episode window had the window extended by an additional 12 months as they were considered to be still under treatment. It is important to note that MDR and XDR are subsets of RIFR and MDR cases, respectively.

Statistical analysis

Data from annual population estimates aggregated to sub-districts were linked to the laboratory-confirmed TB data at sub-district level. This enabled calculation of sub-district, district, provincial and national TB incidence rates as well as age/sex standardised incidence rates. Ninety-five percent confidence intervals were calculated for these incidence rates. Incidence trend graphs with fitted trend lines and confidence intervals were plotted for each administrative level. Population pyramids were used to show the age/sex distribution of TB cases nationally and provincially.

RIFR and MDR incidence rates were calculated as a percentage of TB cases, while XDR incidence was calculated as a percentage of MDR cases. Ninety-five percent confidence intervals were also calculated for each of these incidence rates. The resulting TB and RIFR TB data were also used to develop maps showing TB and RIFR TB incidence rates as well as numbers of cases for each province and for the country.

All statistical analysis was undertaken using Stata v14.0 (Statacorp, College Station, TX, USA). All maps were developed using the Esri Maps for Microstrategy plugin (Esri, Redlands, CA).

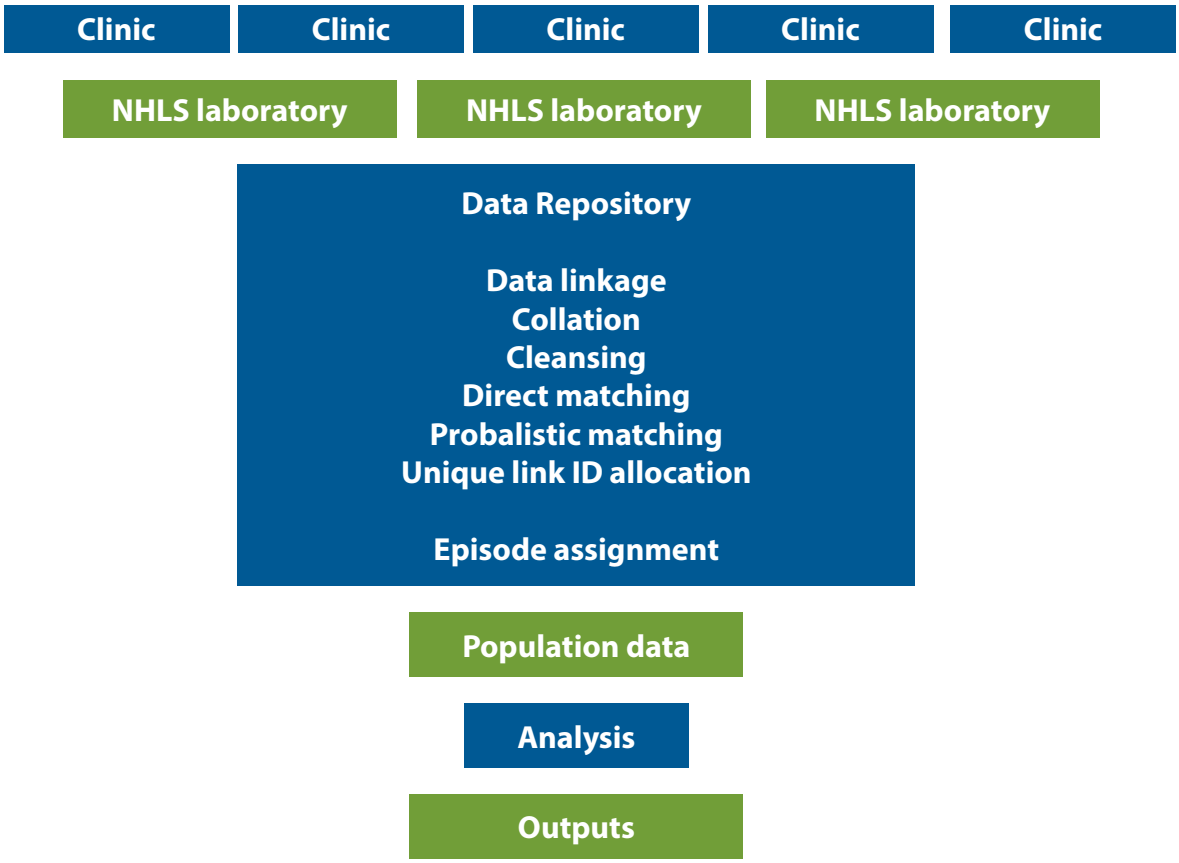


Figure 1: Schematic representation of data flow and processing

RESULTS AND DISCUSSION

NATIONAL

Over the 12 year period, a total of 3 327 876 microbiologically confirmed cases of pulmonary TB (mPTB) were diagnosed in South Africa (Table 2). This total however excludes KwaZulu-Natal for the period 2004-2010 for which data was unavailable. The peak number of mPTB cases was 272 702 nationally in 2008, and during the most recently recorded year (2015), it was 214 543, excluding KwaZulu-Natal which accounted for an additional 66 512 mPTB cases in 2015. The highest burden of mPTB incidences occurred in four provinces ranked by order: KwaZulu-Natal (66 512), Eastern Cape (59 205), Gauteng (44 822), and Western Cape (37 967) (Figure 2). Together they account for 74.2% of the total burden in 2015. Complete data for KwaZulu-Natal were not available prior to 2011 as a laboratory information system covering the whole province had not been introduced before this time. Data had however been modelled for the preceding period and have been published elsewhere[3]. The overall trend in TB has shown a decline in both the number of mPTB cases and in incidence rates (Table 2) with an annual incidence of 689 (95% CI 687-692) per 100 000 people in 2008, compared with 520 (95% CI 519-522) in 2015.

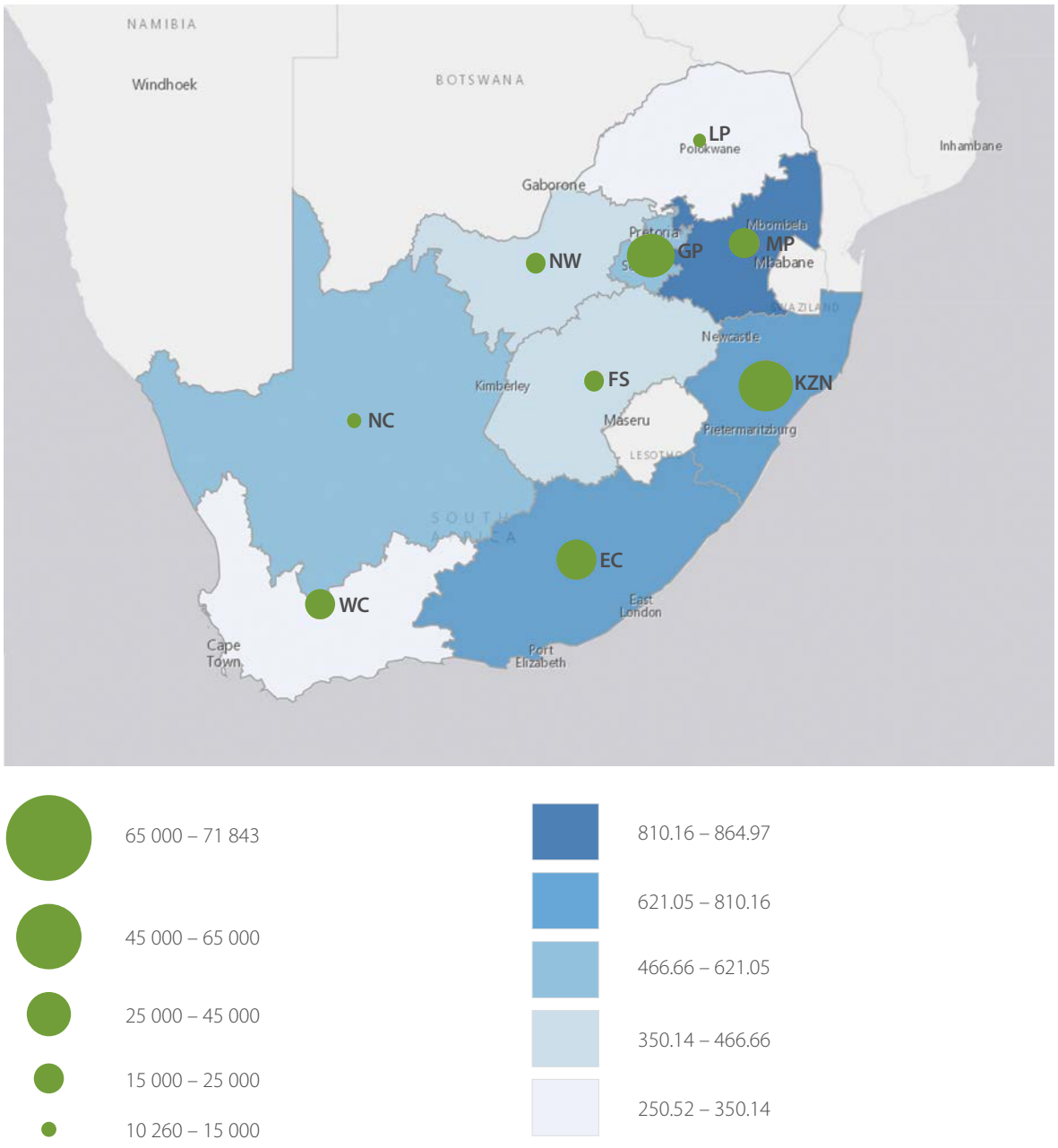


Figure 2: mPTB case burden (circles) and incidence rates (shading), South Africa: spatial distribution, 2015

The total cumulative number of TB cases averted between the peak incidence in 2008 and 2015 was 83 656. As previously reported[3], the most notable reductions observed were closely related to the upscaling of the antiretroviral therapy (ART) rolled out in South Africa. Of greater interest are the trends in incidence rates which provide a population-adjusted evaluation of the success or failure of programmatic interventions aimed at reducing new infections and ultimately control efforts. mPTB incidence in South Africa has previously been shown to be on the decline and the current report confirms the trend beyond 2012 with a national mPTB incidence rate in 2015 of 520 (95% CI: 519-522) per 100 000 people. The annual changes in incidence rates have been -4.1%, -6.0% and -4.8% respectively for the last three years, compared to the 10% required for the WHO End TB strategy. These year-on-year declines are higher than the global average of 1.5% but lower that that required to achieve the 2025 and 2035 targets.

Table 2: mPTB case burden and incidence rates by year, South Africa: 2004-2015

Year	n	Incidence/100000 (95% CI)	Annual change in cases (n)	Annual change in incidence (%)
2004	214 166	572(569-574)	-	-
2005	260 855	687(685-690)	46 689	20.1
2006	269 197	700(697-702)	8 342	1.9
2007	260 406	668(665-670)	-8 791	-4.6
2008	272 702	689(687-692)	12 296	3.1
2009	252 467	629(627-632)	-20 235	-8.7
2010	251 951	619(616-621)	-516	-1.6
2011*	343 960	667(665-669)	-$	-$
2012*	317 439	606(604-609)	-26 521	-9.1
2013*	309 088	581(579-584)	-8 351	-4.1
2014*	294 590	546(544-548)	-14 498	-6.0
2015*	281 055	520(519-522)	-13 535	-4.8

*includes data for KwaZulu-Natal

$ Annual change restarted with addition of KwaZulu-Natal data

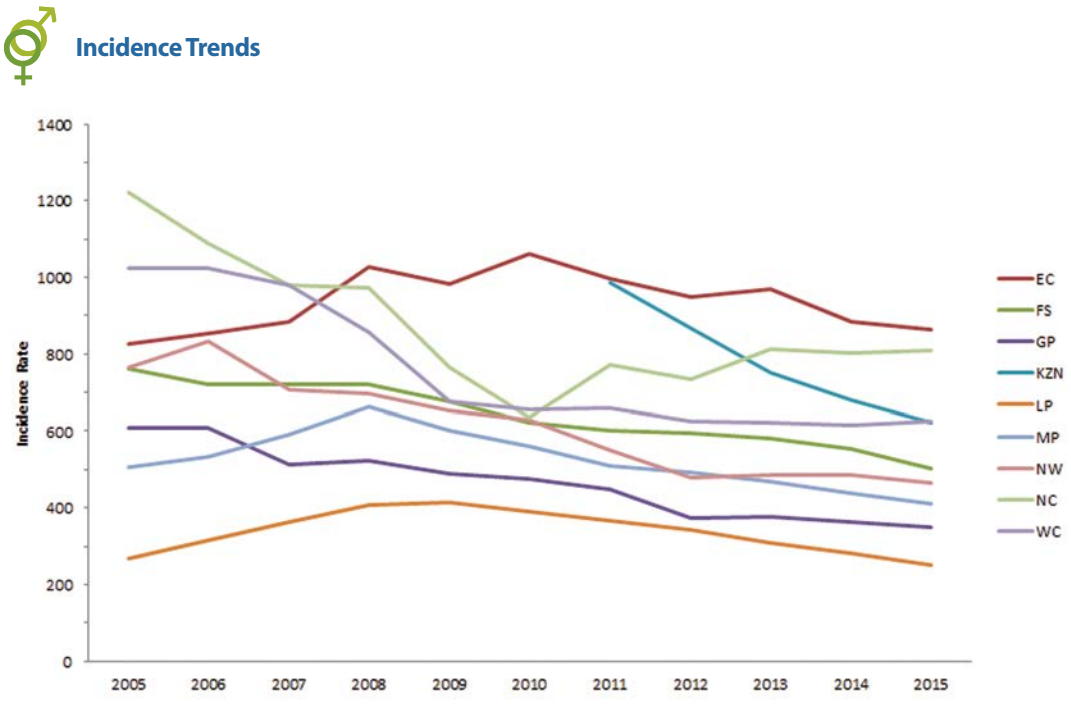


Figure 3: Trends in mPTB incidence rates by province, South Africa: 2004-15

Incidence trends by province have shown similar consistent declines in recent years, though variation in incidence rates did

occur (Figure 3, Table 3). In 2015, the most recently reported year, the province with the lowest incidence rate was Limpopo (251; 95% CI: 246-255) which is more than three-fold lower than the Eastern Cape (865; 95% CI:858-872), the province with the highest incidence rate. However, all provincial incidence rates were above 250 per 100 000 people, the level which WHO has previously declared to be a health emergency. Northern and Western Cape had the highest incidence rates in 2004/05 and have shown very similar trends with sharp declines up to 2010; the former showing increases in the subsequent period coinciding with the implementation of the GXP, while for the latter province the trend has been flat, ending in 2015. Although the KwaZulu-Natal data in the current report dates only from 2011, modelled data previously published indicated that it too is one of the provinces with the highest incidence rates and the downward trend only began in 2011 (2nd highest). This province has shown the largest year-on-year declines since 2011 (988; 95% CI: 982-995) and in 2015 (621; 95%CI: 616-626) was down to the 4th highest in terms of incidence rates a 37.1% reduction in mPTB incidence rate over the 4-year period.

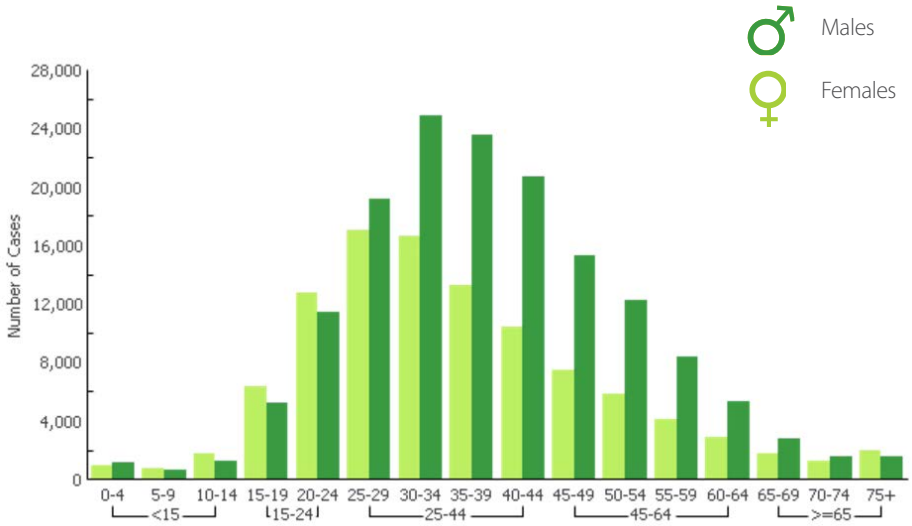


Figure 4: Age and gender population pyramid of mPTB cases, South Africa: 2015

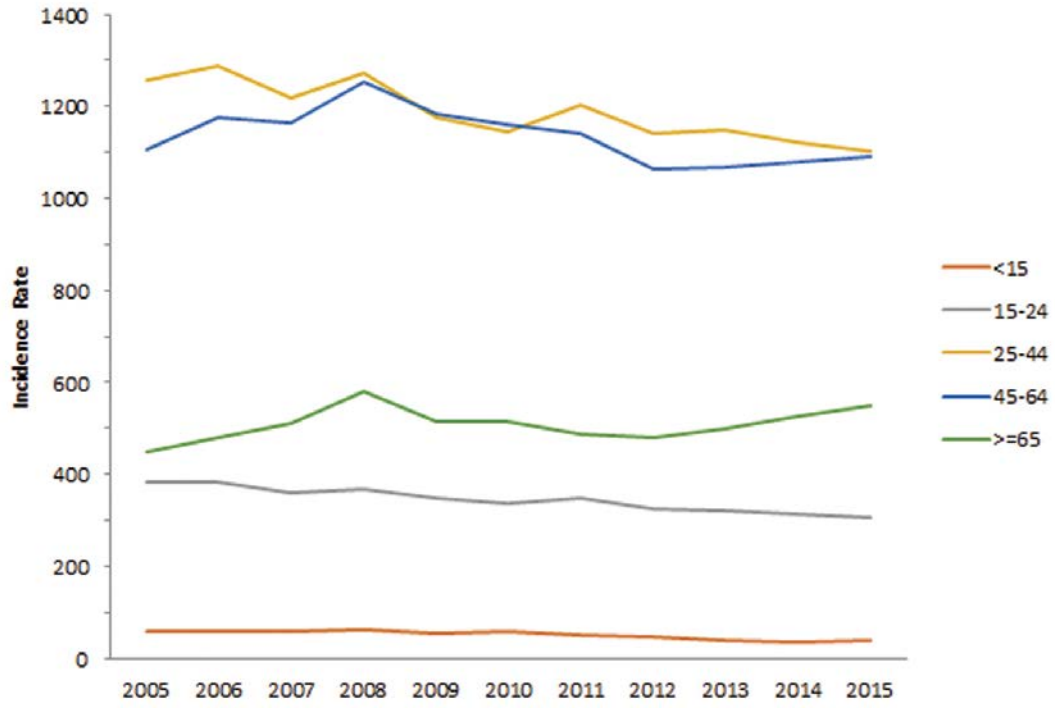
The most affected age groups with mPTB were those in the economically active 25-44 year age group with an overall male dominance in 2015 (Figure 4). The absolute number of cases was, however, higher among females in the younger age groups and is reflective of the pattern seen with HIV-infected persons. The encouraging finding of a declining mPTB incidence rate is primarily driven by large declines in incidence rates in females (25-44 year age group) with a 33.6% decline in incidence rates between 2008 (1059; 95% CI: 1051-1067) and 2015 (703; 95% CI: 698-709) nationally (Figure 5).

In contrast, the changes in incidence rates among males in the most affected 25-44 year age group remained relatively small for the same period (13.4%) starting at 1 272 (95% CI:1 263-1 281) and declining to 1 101 (95% CI:1 094-1 108) per 100 000 people respectively. These numbers are four times higher than the WHO threshold of 250 per 100 000 people for a health emergency. The age/gender specific incidence rates show a marked difference between the 25-44 year age group (703; 95% CI: 698-709) and the 45-64 year age group (439; 95% CI: 433-445) for females in the most recent year. Another interesting finding is the small but consistent upward trend in incidence rates over time in the >65y age group among most females and this may be reflective of HIV-infected people living longer and having TB at later stages of life, as would occur in the non-HIV/AIDS population. Alternatively, this finding could reflect reactivation disease among patients who are HIV negative and were exposed during the peak incidence periods in the 1990s and 2000s.

Table 3: mPTB case burden and incidence rates by province, South Africa: 2004-2015

Year	Eastern Cape (EC)		Free State (FS)		Gauteng (GP)		KwaZulu-Natal (KNZ)		Limpopo (LP)		Mpumalanga (MP)		North West (NW)		Northern Cape (NC)		Western Cape (WC)	
	n	Incidence (95% CI)	n	Incidence (95% CI)	n	Incidence (95% CI)	n	Incidence (95% CI)	n	Incidence (95% CI)	n	Incidence (95% CI)	n	Incidence	n	Incidence	n	Incidence
2004	42 879	724(717-731)	16 767	677(666-687)	49 398	446(442-450)	-	-	10 184	209(205-213)	15 906	436(429-443)	15 854	500(493-508)	11 669	1 128(1 108-1 149)	51 509	980(972-989)
2005	49 511	825(818-832)	19 160	763(752-774)	68 352	609(604-614)	-	-	13 280	269(264-273)	18 691	506(499-513)	24 584	766(756-775)	12 812	1 223(1 201-1 244)	54 465	1 023(1 014-1 031)
2006	51 828	852(845-859)	18 360	721(711-732)	69 189	608(604-613)	-	-	15 825	316(311-321)	20 018	535(527-542)	27 100	833(823-843)	11 582	1 090(1 071-1 110)	55 295	1 024(1 016-1 033)
2007	54 455	883(876-890)	18 594	721(710-731)	59 155	513(509-517)	-	-	18 383	362(357-367)	22 384	590(582-597)	23 370	708(699-718)	10 564	981(962-1 000)	53 501	978(969-986)
2008	64 336	1029(1 021-1 037)	18 870	721(711-731)	61 327	524(520-528)	-	-	21 034	408(403-414)	25 558	664(656-672)	23 355	698(689-707)	10 615	972(953-991)	47 607	858(850-866)
2009	62 421	984(976-992)	17 979	677(667-687)	58 122	490(486-494)	-	-	21 698	415(410-421)	23 485	601(594-609)	22 191	654(645-663)	8 487	766(750-782)	38 084	676(670-683)
2010	68 440	1 063(1 055-1 071)	16 751	622(612-631)	57 364	476(473-480)	-	-	20 775	392(386-397)	22 294	562(555-570)	21 675	629(621-638)	7 129	634(619-649)	37 523	657(650-664)
2011	65 236	998(991-1006)	16 489	603(594-612)	54 722	448(444-452)	101 058	988(982-995)	19 765	367(362-372)	20 447	508(501-515)	19 205	549(542-557)	8 796	771(755-787)	38 242	660(653-666)
2012	63 018	950(942-957)	16 552	596(587-605)	46 490	375(371-378)	90 075	868(862-873)	18 706	342(337-347)	20 192	494(488-501)	17 014	479(472-487)	8 502	734(718-750)	36 890	627(620-633)
2013	65 281	969(961-976)	16 369	581(572-590)	47 376	376(373-379)	79 290	752(747-757)	17 071	308(303-312)	19 413	468(461-475)	17 545	487(480-494)	9 550	812(796-828)	37 193	622(616-628)
2014	60 518	884(877-891)	1 5833	553(544-562)	46 467	363(360-366)	72 743	679(674-684)	15 921	282(278-287)	18 439	438(431-444)	17 790	486(479-493)	9 607	804(788-820)	37 272	614(607-620)
2015	59 205	865(858-872)	14387	502(494-511)	44822	350(347-353)	66512	621(616-626)	14124	251(246-255)	17 271	410(404-416)	17 085	467(460-474)	9 682	810(794-826)	37 967	625(619-631)

♂ Age specific incidence trends – Males



♀ Age specific incidence trends – Females

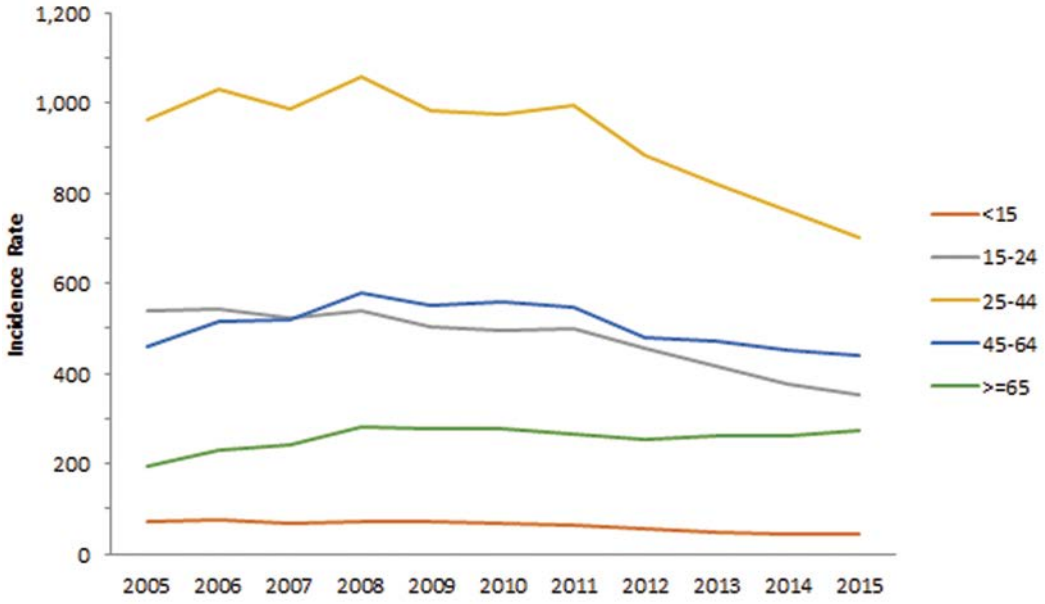


Figure 5: Trends in mPTB incidence rates by age and gender, South Africa: 2004-15

In this report we present national heat maps of mPTB incidence at a sub-district level. The first map shows the burden of TB disease according to geospatial distribution by absolute number of mPTB cases for the year (Figure 6). The second map is adjusted for population size, and shows the mPTB incidence rates per 100 000 people (Figure 7). The maps show vast differences in both burden of disease and incidence rates and highlight an important distinction: The absolute number of cases at a provincial level primarily identifies the four high burden provinces, and when viewed at a sub-district level, the heterogeneity of the findings becomes very apparent. The highest burdened areas are the urban metropolitan regions with the following major cities highlighted: Cape Town, Johannesburg and Buffalo City Metropolitan. The latter city is probably not being given enough attention and carries a very high burden of mPTB. Apart from the other cities and major towns that show a high absolute burden, selected districts in the Eastern Cape and Mpumalanga also account for relatively high burdens requiring attention. These heat maps with absolute burden of mPTB cases provide valuable hotspot information of areas where the highest impact could potentially be made in reducing the burden of TB nationally. This could present a cost-effective approach to address TB in a resource-constrained climate.

The heat map showing the distribution of mPTB incidence rates at a sub-district level (Figure 7) illustrates areas where new cases are occurring at high frequency, adjusted for population size, and for a high burden setting like South Africa it probably reflects ongoing transmission. The western regions of South Africa show the highest incidence rates at a sub-district level and became progressively lower, moving eastwards with the lowest incidence areas in the Limpopo province. Interestingly, the major cities which carry the highest burden of absolute number of mPTB cases and population (Cape Town and Johannesburg) do not have very high incidence rates. However, eThekwini is different, carrying a high absolute case load as well as a relatively high incidence rate. Additional sub-districts with high incidence rates occur predominantly in non-urban settings in the Northern and Western Cape and parts of the Eastern Cape. This may be reflective of patient access to health services and delays in accessing these services. This situation would therefore require a different set of health interventions to those targeting high burden metropolitan areas.

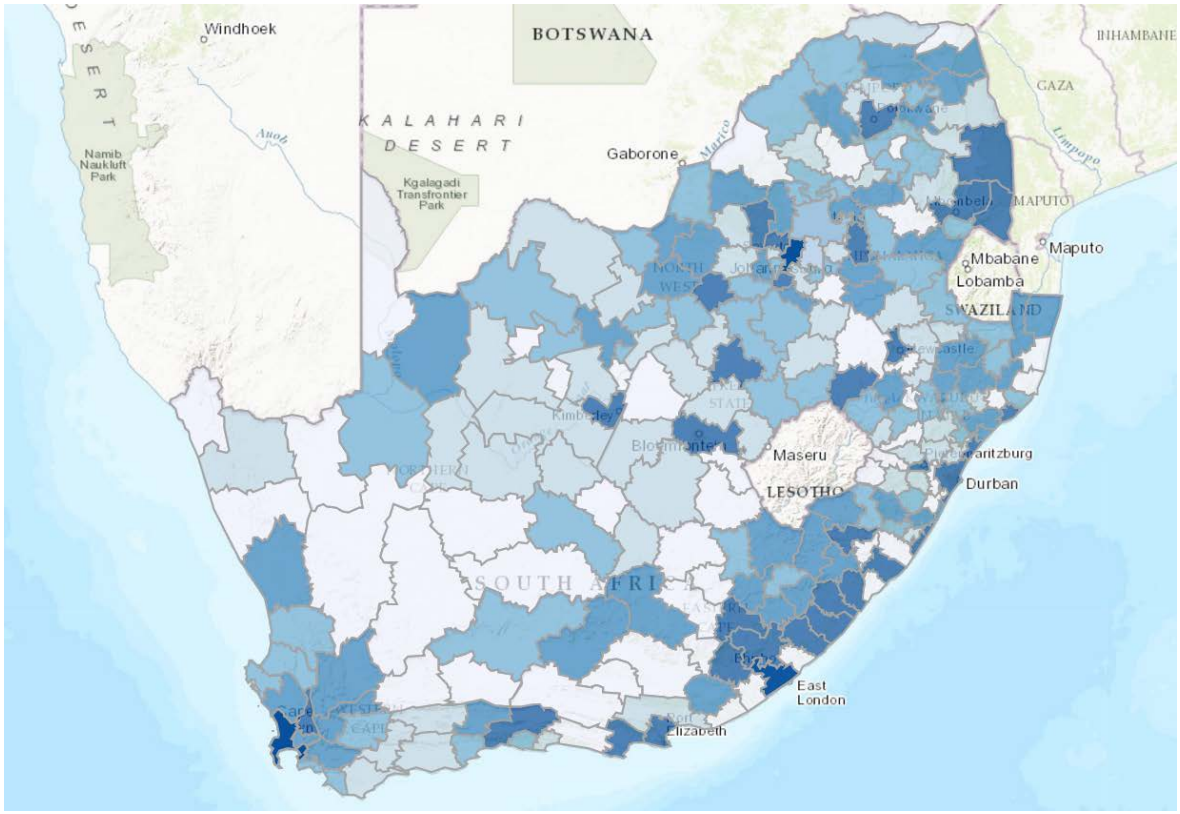


Figure 6: Geospatial distribution of mPTB case burden at a sub-district level, South Africa: 2015

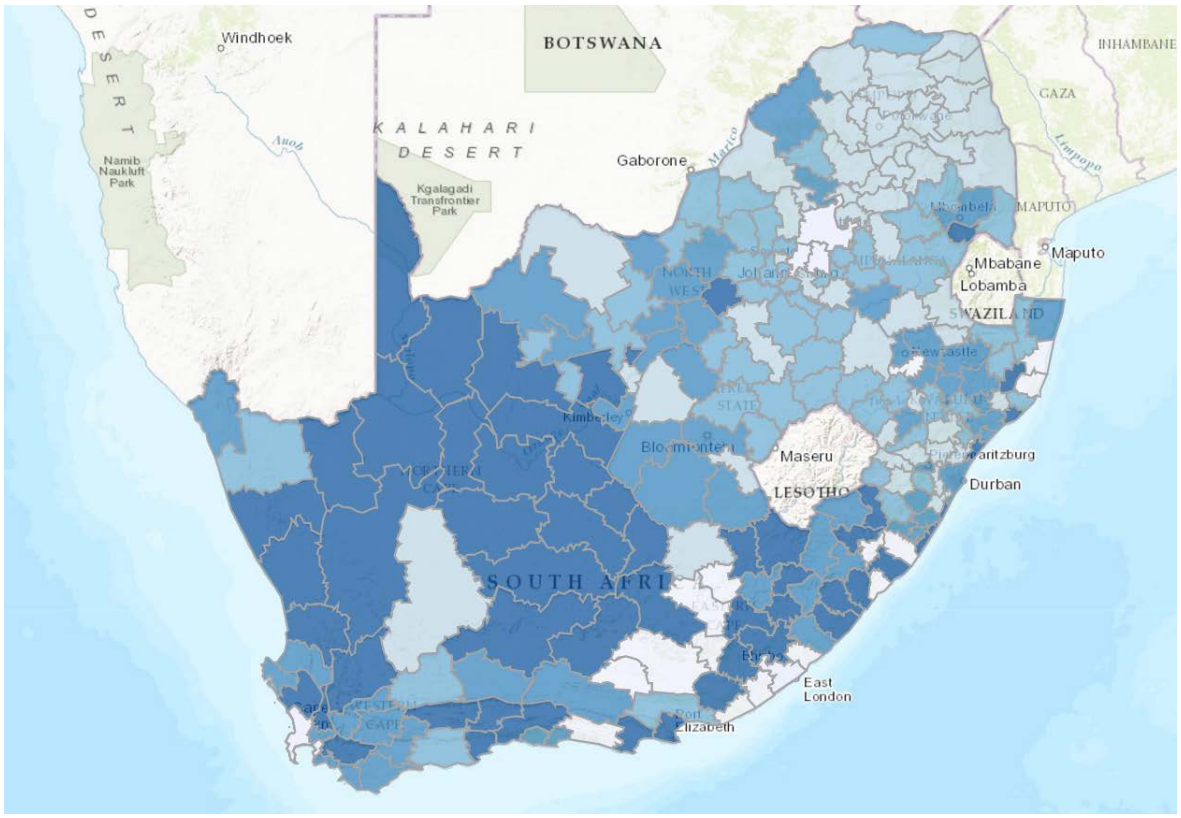


Figure 7: Geospatial distribution of mPTB incidence rates at a sub-district level, South Africa: 2015

Microbiologically confirmed rifampicin resistant tuberculosis

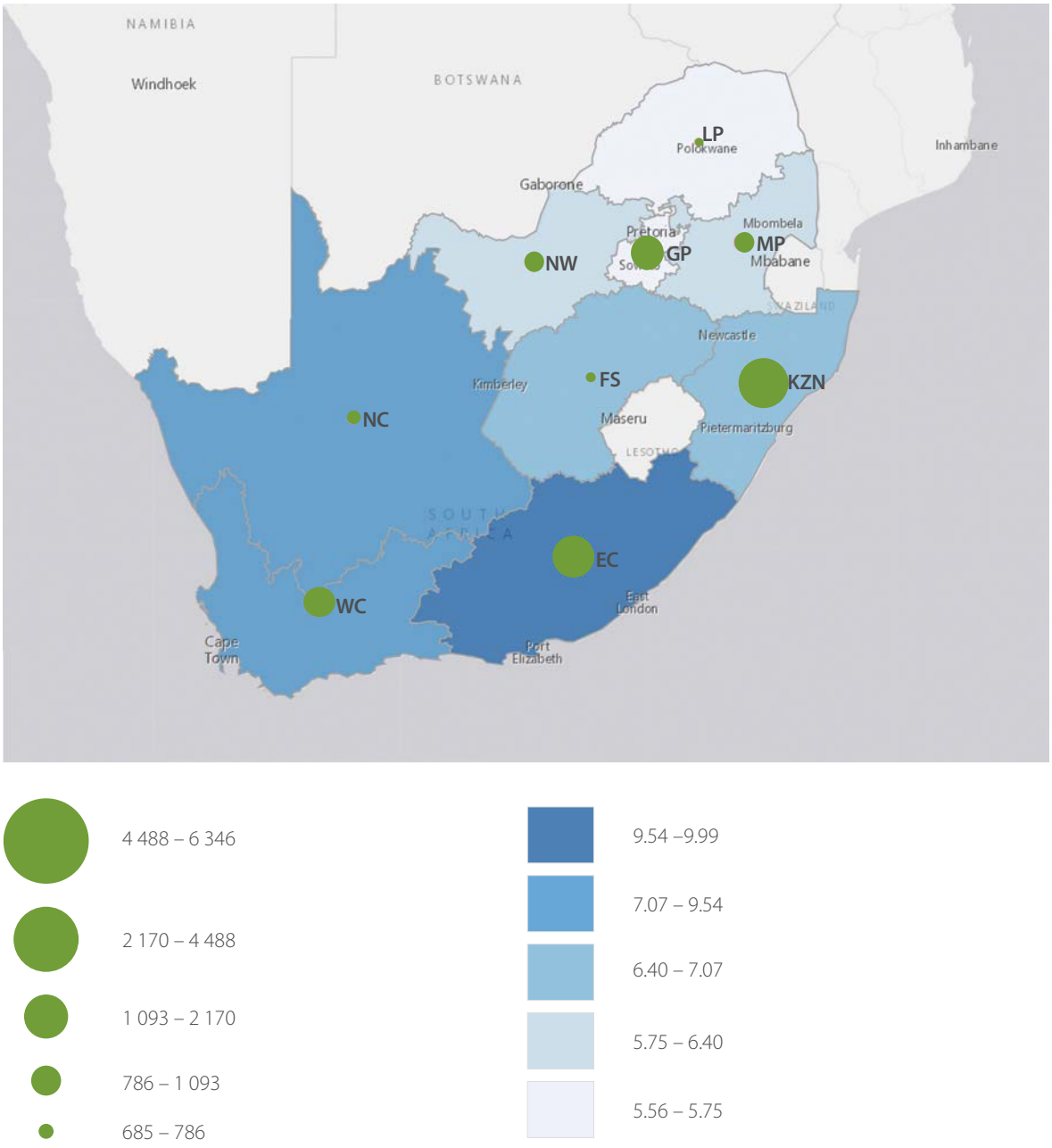


Figure 8: Rifampicin resistant mPTB case burden (circles) and incidence rates (shading), South Africa: spatial distribution, 2015

The geographic distribution of the number of mPTB rifampicin-resistant TB (RR-TB) cases and the incidence rate of RR-TB per 100 mPTB cases is shown in Figure 8 and Table 4. The absolute burden of RR-TB cases is highest in KwaZulu-Natal (6 293), accounting for 29.3% of all cases nationally in 2015. Combined with the second highest (Eastern Cape, 4 511) and third highest (Gauteng, 3 150), these three provinces collectively accounted for most of the drug resistant. TB burden and should be prioritised. Interestingly, Mpumalanga has shown a relatively high absolute burden (1 733) and importantly the highest rate of RR-TB cases per 100 mPTB cases nationally (10; 95% CI: 9.6-10.5). This latter finding is consistent with results from the most recent TB drug resistance survey: 2012-2014 highlighting the high prevalence in this province and providing possible reasons. It should, however, be noted that the incidence rate of RR-TB per 100 mPTB cases is relatively homogenous with most parts of the country ranging from 5.6 to 7.6 and therefore the apparent differences observed are relatively small. It should also be noted that some areas may have a relatively low RR-TB burden but may have a much higher XDR-TB burden and this is not presented in the current report, but will be covered in future reports together with changes that have occurred in South Africa over time.

Table 4: Rifampicin mPTB case burden and incidence rates per 100 mPTB cases by province, South Africa: 2015

Province	Incidence (95% CI)
Eastern Cape	7.6 (7.4-7.8)
Free State	6.5(6.1-6.9)
Gauteng	7 (6.8-7.3)
KwaZulu-Natal	9.5 (9.2-9.7)
Limpopo	5.6 (5.2-6)
Mpumalanga	10 (9.6-10.5)
North West	6.5 (6.1-6.9)
Northern Cape	7.2 (6.7-7.7)
Western Cape	5.9 (5.7-6.2)

Summary

- A total of 3 327 876 mPTB cases occurred between 2004 and 2015.
- Four provinces (KwaZulu-Natal, Eastern Cape, Gauteng and Western Cape) accounted for 74.2% of the absolute burden in South Africa during 2015.
- mPTB incidence rates are on the decline with reductions of -4.1%, -6.0% and -4.8% year-on-year for 2013, 2014 and 2015 respectively which is half of that required by the WHO End TB Strategy.
- Females between the ages of 25-44 have shown the sharpest decline in incidence rates (-33.6%) between 2008 and 2015, reflective of efforts in the HIV programme targeting this age group.
- Change in incidence rates among males has been minimal for the age group 25-44 years over the same period (-13.4%) and shows the highest incidence (2.5 times the national average), requiring initiatives aimed at this population.
- Among provinces, KwaZulu-Natal has shown the sharpest decline in mPTB incidence rates and achieved a reduction of 37.1% over a four year period (2011-2015).
- Antiretroviral therapy expansion, which has probably led to important early successes, has tapered off in several provinces (Gauteng, North West and Western Cape) and other aspects of TB control need to be targeted (pre-treatment loss to follow up, contact tracing etc.).
- Rifampicin resistant TB is concentrated in KwaZulu-Natal, accounting for 29.3% of the national burden, while Mpumalanga has the highest incidence rate at 10 (95%CI: 9.6-10.5) among provinces.

EASTERN CAPE

Between the period 2004 and 2015, a total of 707 128 microbiologically confirmed cases of pulmonary TB (mPTB) were diagnosed in Eastern Cape (Table 5). The peak number of mPTB cases was 68 440, occurring in 2010 and in the most recent year (2015) the number of cases was 59 205. The highest burden of mPTB cases occurred in the following three districts (Figure 9 and Table 6): Nelson Mandela Bay Metro (12 275), OR Tambo (11 881) and Buffalo City Metro (7 881). Together they account for 54.1% of the total burden in 2015. This pattern has remained unchanged when compared with 2004, though lower absolute numbers of cases have been observed in the Nelson Mandela Metro when comparing 2015 to the 2004 data.

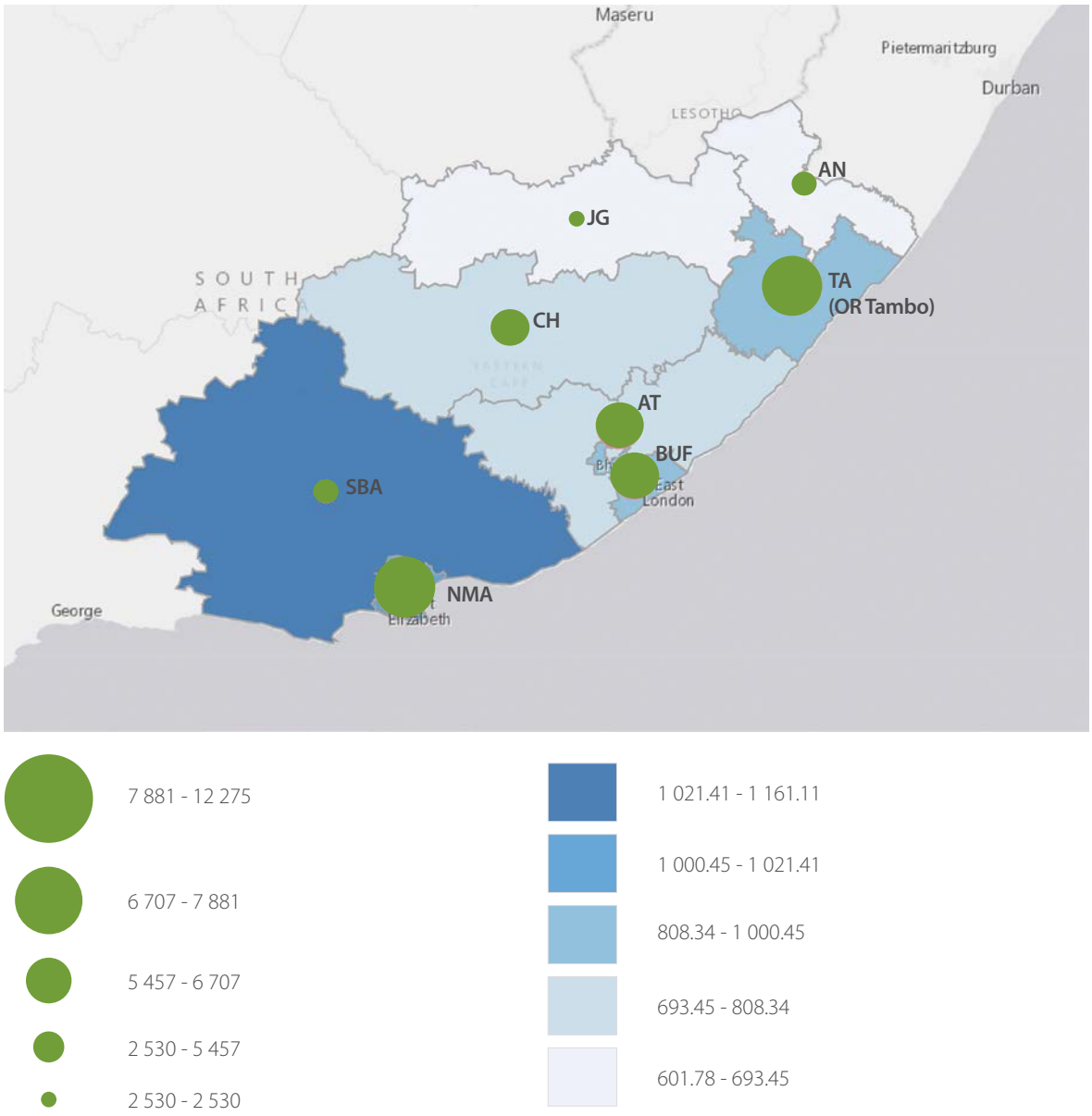


Figure 9: mPTB case burden (circles) and incidence rates (shading), Eastern Cape: spatial distribution, 2015

The overall trend in TB over the period showed an increasing incidence rate peaking in 2010 at 1 063 (95% CI: 1 055-1 071) mPTB cases per 100 000 people and subsequently showing consistent declines to 865 (95% CI: 858-872) in 2015 (Table 5). The cumulative number of cases of TB averted between 2010 and 2015 were 9 235. This downward trend is consistent with what was previously reported[3]. The annual change has been +2.0%, -8.8% and -2.1% for the last three years as compared to the 10% required for the WHO End TB Strategy.

Table 5: mPTB case burden and incidence rates by year, Eastern Cape: 2004-2015

Year	n	Incidence*/100000 (95% CI)	Annual change in cases (n)	Annual change in incidence (%)
2004	42 879	724(717-731)	-	-
2005	49 511	825(818-832)	6 632	14.0
2006	51 828	852(845-859)	2 317	3.3
2007	54 455	883(876-890)	2 627	3.6
2008	64 336	1 029(1 021-1 037)	9 881	16.5
2009	62 421	984(976-992)	-1 915	-4.4
2010	68 440	1 063(1 055-1 071)	6 019	8.0
2011	65 236	998(991-1 006)	-3 204	-6.1
2012	63 018	950(942-957)	-2 218	-4.8
2013	65 281	969(961-976)	2 263	2.0
2014	60 518	884(877-891)	-4 763	-8.8
2015	59 205	865(858-872)	-1 313	-2.1

Incidence trends by district have been mixed in this province (Figure 10). The Nelson Mandela Metro region had the highest incidence rate in 2004, at 1 637 (95% CI:1 613-1 662) mPTB cases per 100 000 people and has declined to 1 021 (95% CI:1 003-1 040) in 2015 (Table 6). The Sarah Baartman District had the second highest incidence rate in 2004 at 1 250 (95% CI: 1 216-1 285) and is now the district with the highest incidence rate in 2015 at 1 161 (95%CI: 1 131-1 192) (reasons for this situation should be investigated). The most striking trend was encountered in the Alfred Nzo District, showing sharp changes in mPTB incidence trends, peaking in 2010 at 1 442 (95%CI: 1 415-1 468) per 100 000 people, followed by sharp declines with an incidence rate of 602 (95%CI: 585-619) in 2015.

The increase in incidence rate is unlikely to have been driven by improved diagnostics as it pre-dated the introduction of the GeneXpert (GXP) assay, while the declines occurred when GXP became widely used. The declines are certainly encouraging and understanding the reason(s) for these shifts will be valuable for future planning. Fluctuating allocation of resources at sub-district level in this province may have led to such shifts; however, these would not impact greatly on the incidence as both the numerator and denominator of the allocation figures would have shifted. Secondly, if a shift in allocation at sub-district level had occurred, this would have impacted on adjacent district(s) and such major shifts in other districts have not been observed.

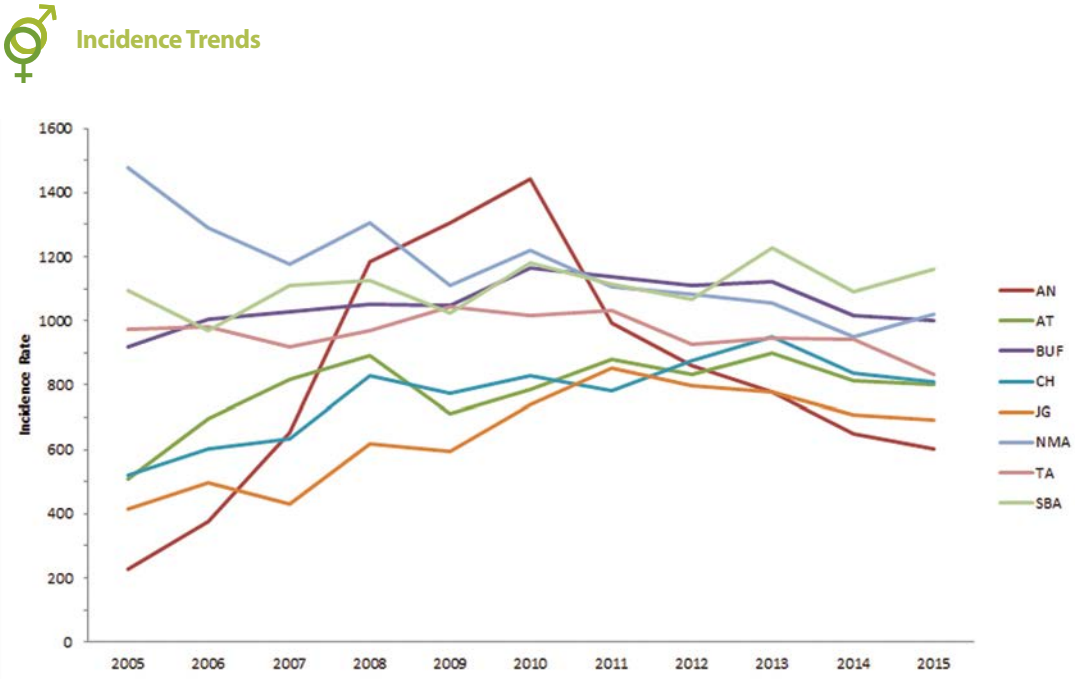


Figure 10: Trends in mPTB incidence rates by district, Eastern Cape: 2004-15

Table 6: mPTB case burden and r incidece ates by year, Eastern Cape: 2004-2015

Year	Alfred Nzo (AZ)		Amathole (AT)		Buffalo City Metro (BUF)		Chris Hani (CH)		Joe Gqabi (JG)		Nelson Mandela Bay Metro (NMA)		O R Tambo (TA)		Sarah Baartman (SBA)	
	n	Incidence (95% CI)	n	Incidence (95% CI)	n	Incidence (95% CI)	n	Incidence (95% CI)	n	Incidence (95% CI)	n	Incidence (95% CI)	n	Incidence (95% CI)	n	Incidence (95% CI)
2004	35	5 (3-7)	2496	310 (298-322)	5876	862 (840-884)	3151	439 (424-454)	738	234 (217-251)	17027	1637 (1613-1662)	8472	688 (673-702)	5084	1250 (1216-1285)
2005	1663	227 (216-238)	4145	508 (492-523)	6344	918 (896-941)	3796	522 (505-539)	1330	416 (394-439)	15564	1477 (1454-1500)	12152	973 (956-991)	4517	1096 (1064-1129)
2006	2776	374 (360-388)	5746	694 (677-713)	7038	1005 (982-1029)	4431	601 (583-619)	1609	496 (472-521)	13778	1290 (1269-1312)	12401	980 (963-997)	4049	969 (940-1000)
2007	4928	654 (636-673)	6866	818 (799-838)	7307	1029 (1006-1053)	4740	634 (616-652)	1416	431 (409-454)	12742	1177 (1156-1197)	11758	917 (900-933)	4698	1109 (1078-1142)
2008	9052	1185 (1161-1210)	7576	890 (870-911)	7578	1053 (1029-1077)	6279	828 (808-849)	2059	618 (591-645)	14334	1305 (1284-1327)	12624	970 (953-987)	4834	1126 (1094-1158)
2009	10107	1304 (1279-1330)	6157	713 (696-731)	7642	1047 (1023-1070)	5942	773 (753-792)	2013	595 (570-622)	12355	1109 (1090-1129)	13746	1042 (1024-1059)	4459	1024 (994-1054)
2010	11334	1442 (1415-1468)	6874	785 (766-804)	8619	1163 (1139-1188)	6477	830 (810-850)	2540	740 (712-770)	13775	1219 (1198-1239)	13598	1015 (998-1033)	5223	1181 (1150-1214)
2011	7935	994 (973-1016)	7830	881 (861-901)	8563	1139 (1115-1163)	6201	783 (763-803)	2970	853 (822-884)	12705	1107 (1088-1127)	14041	1033 (1016-1050)	4991	1112 (1082-1143)
2012	6956	859 (839-879)	7525	834 (815-853)	8474	1110 (1086-1134)	7028	874 (854-895)	2814	796 (767-826)	12589	1081 (1062-1100)	12766	925 (909-941)	4866	1068 (1038-1099)
2013	6397	777 (759-797)	8257	901 (882-921)	8688	1120 (1097-1144)	7755	949 (928-971)	2788	776 (748-806)	12479	1055 (1036-1074)	13242	945 (929-961)	5675	1227 (1195-1259)
2014	5433	650 (633-668)	7564	812 (794-831)	8015	1017 (995-1040)	6955	838 (819-858)	2588	709 (682-737)	11410	949 (932-967)	13424	943 (927-959)	5129	1091 (1062-1122)
2015	5030	602 (585-619)	7444	800 (781-818)	7881	1000 (978-1023)	6707	808 (789-828)	2530	693 (667-721)	12275	1021 (1003-1040)	11881	834 (820-850)	5457	1161 (1131-1192)

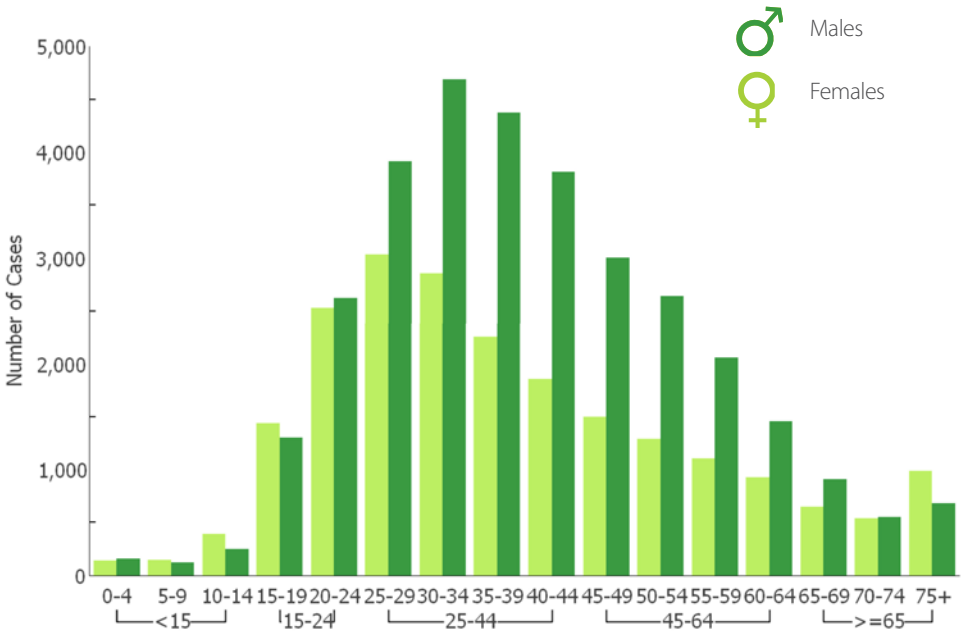
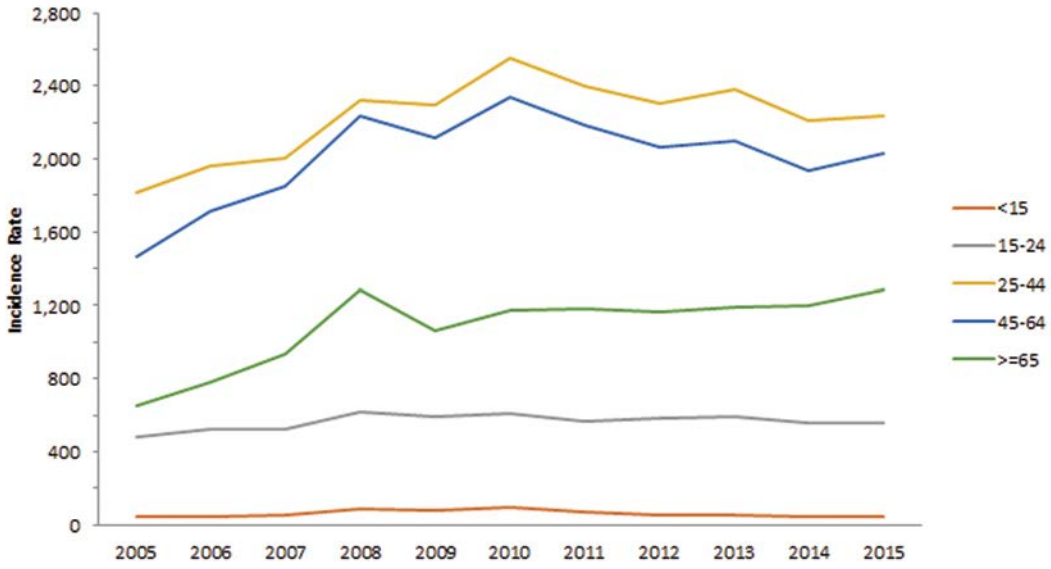


Figure 11: Age and gender population pyramid of mPTB cases, Eastern Cape: 2015

The most affected age groups with mPTB coincide with those in the economically active age categories (25-44), with a clear male dominance overall in 2015 (Figure 11). Among males, the peak in absolute number of mPTB cases occurred in the 30-34 year age group and in females in the 25-29 year age group. The age and gender profile of cases in earlier years showed the classic pattern of more cases in females (25-44 years) which has reduced over time. An encouraging finding is that this group also experienced a sharp decline in mPTB incidence rates of 1 753 (95% CI: 1 725-1 781) in 2010 to 1 134 (95% CI:1 112-1 157) (Figure 12); a reduction of 35.3% and is the principal group driving the provincial declines.

♂ Age specific incidence trends – Males



Age specific incidence trends – Females

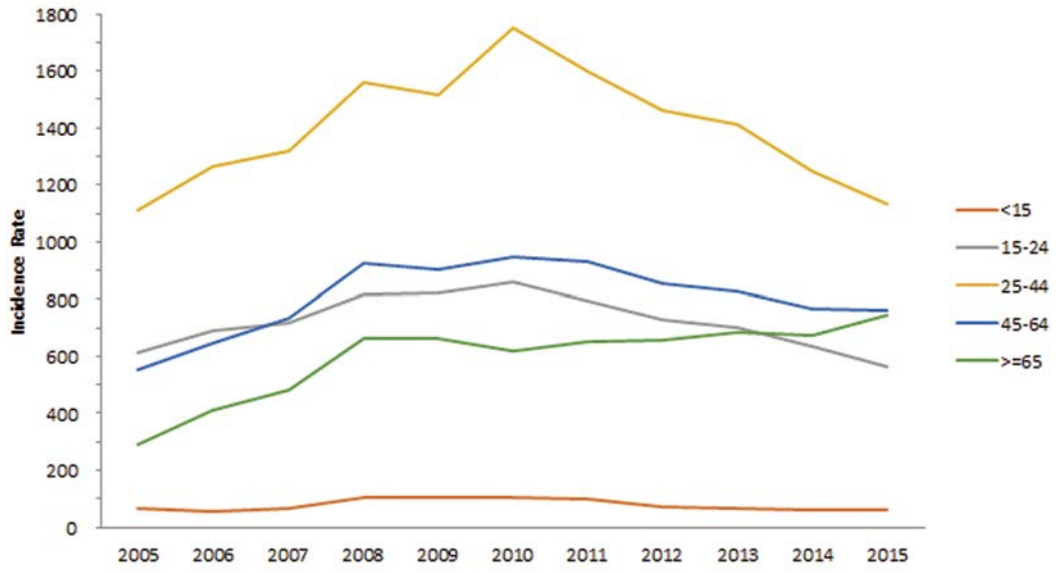


Figure 12: Trends in mPTB incidence rates by age and gender, Eastern Cape: 2004-15

Similar to the national picture, the highest burdened age groups among males have shown slow declines in incidence rates and this is concerning. Additionally, the mPTB incidence rates in males aged 25-44 years was exceedingly high at the peak in 2010 at 2 550 (95%CI:2 513-2 587) per 100 000 people. This rate is similar to those reported for mine workers, though this is at a community level rather than in a congregate setting. Age specific mPTB incidence rates in this province are generally higher than for other provinces with all individuals 15 years and older, among both males and females, having an incidence rate > 500 per 100 000 people. Similar to national trends, among individuals aged >65 years of age, there is an upward trend with very high rates of above 1 200 cases per 100 000 people among males. This may be reflective of a high transmission rate with individuals experiencing their disease later in life; particularly for HIV negative individuals or patients with HIV that are re sponsive to long-term ART.

Microbiologically confirmed rifampicin resistant tuberculosis

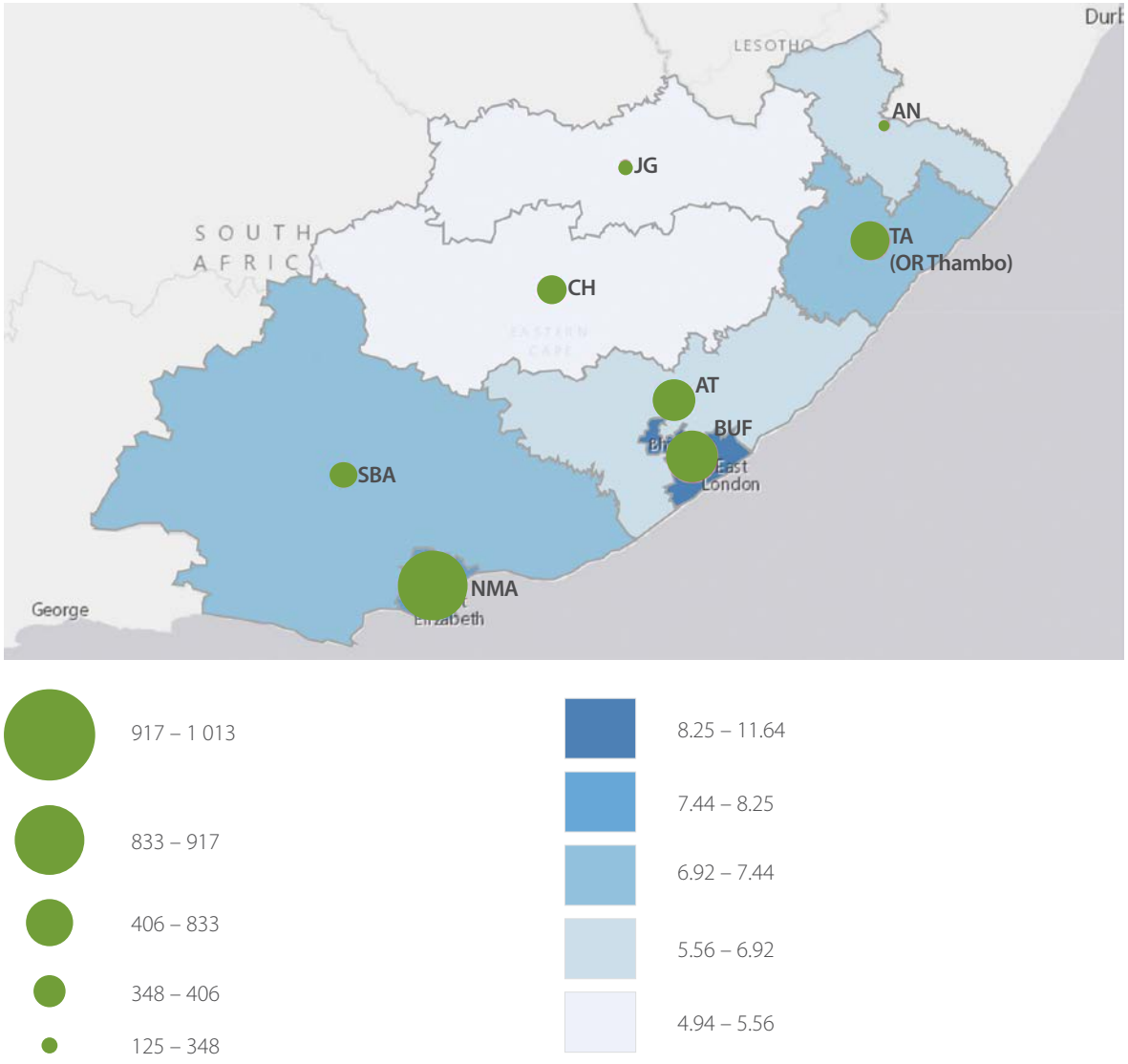


Figure 13: Rifampicin resistant mPTB case burden (circles) and incidence rates (shading), Eastern Cape: spatial distribution, 2015

The geographic distribution of the number of mPTB RR-TB cases and the incidence rate of RR-TB per 100 mPTB cases are shown in Figure 13 and Table 7. The absolute burden of RR-TB cases is highest in Nelson Mandela Bay Metro (1 038), Buffalo City Metro (907) and OR Tambo district (838) and together they account for 61.7% of the RR-TB burden in the province for 2015 and should be key priority areas. Buffalo City Metro had the highest incidence (11.5; 95%CI: 10.8-12.3) for the province and is also among the highest nationally. This implies a high force of transmission and reasons for this should be investigated, including delays in accessing care and treatment, adherence issues and lack of contact tracing. The second highest was Nelson Mandela Metro which also carries a high absolute burden and will similarly need further attention. It should also be noted that some areas may have a relatively low RR-TB burden but may have a much higher XDR-TB burden; this is not presented in the current report, but will be covered in future reports as well as in a forthcoming trend analysis for drug resistant TB.

Table 7: Rifampicin mPTB case burden and incidence rates among mPTB cases by district, Eastern Cape: 2015

District	Incidence (95% CI)
Alfred Nzo	7 (6.3-7.8)
Amathole	6.3 (5.8-6.9)
Buffalo City Metro	11.5 (10.8-12.3)
Chris Hani	5.5 (5-6.1)
Joe Gqabi	5.1 (4.3-6.1)
Nelson Mandela Bay Metro	8.5 (7.9-9)
O R Tambo	7.1 (6.6-7.5)
Sarah Baartman	7.4 (6.7-8.1)

Summary

- 707 128 mPTB cases occurred between 2004 and 2015.
- The three highest burden districts are: Nelson Mandela Bay Metro, OR Tambo and Buffalo City Metro and account for 54.1% of the absolute mPTB burden.
- Change in mPTB incidence rates across the province was +2.0%, -8.8% and -2.1% year-on-year for 2013, 2014 and 2015 respectively.
- Females between 25-44 years of age have shown the sharpest decline in incidence between 2010 and 2015 (-35.3%).
- Incidence rates among males are exceptionally high in the economically active age groups (>2000/100 000 people) and should be targeted for greatest impact.
- High and increasing rates are observed for people >65 years of age for both genders and may reflect increase in reactivation disease among HIV negative patients or those on ART who have an increased life expectancy.
- Buffalo City Metro had the highest RR-TB incidence rate for the province and was among the highest nationally.

FREE STATE

Between the period 2004 and 2015, a total of 206 111 microbiologically confirmed cases of pulmonary TB (mPTB) were diagnosed in the Free State (Table 8). The peak number of mPTB cases was 19 160, occurring in 2005; and in 2015 the number of cases was down to 14 387. The highest burden of mPTB cases occurred in the following three districts (Figure 14 and Table 9) in order of burden: Manguang (4 419), Thabo Mofutsanyana (3519) and Lejweleputswa (3290). Together they account for 78.0% of the total burden in 2015. This pattern has changed since 2004/05 when Lejweleputswa district had the highest case burden of mPTB incidence in the province. The change may reflect urbanisation over the period influencing the increase in Mangaung, though other reasons may also contribute.

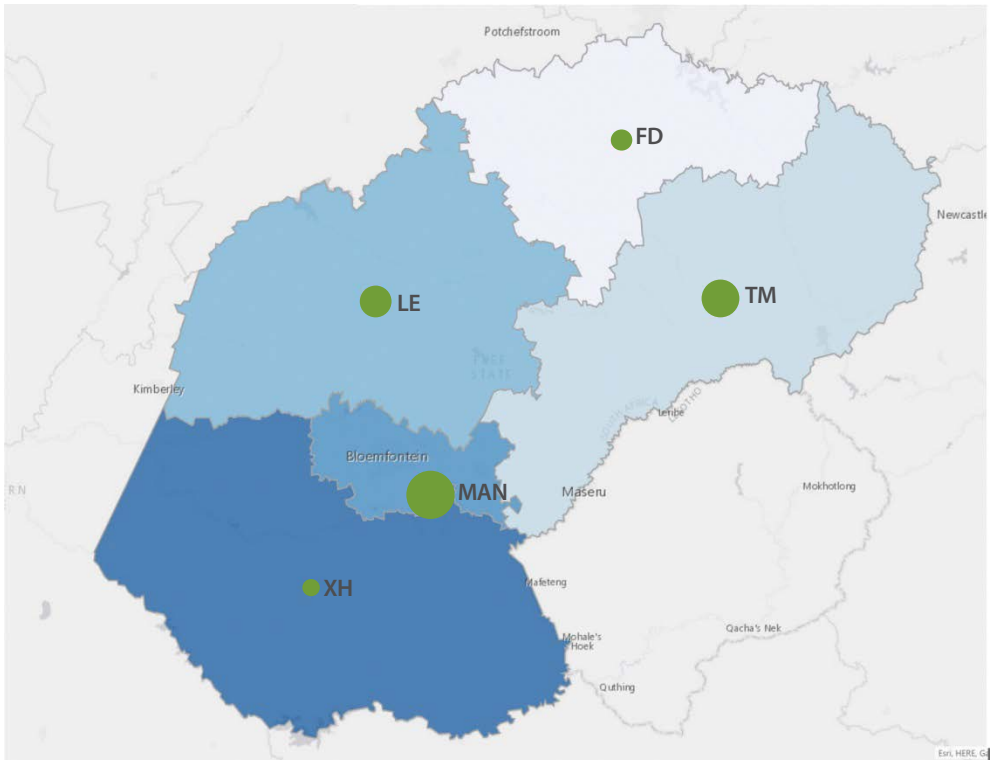


Figure 14: mPTB case burden (circles) and incidence rates (shading), Free State: spatial distribution, 2015

The overall trend in TB over the period showed a consistent year-on-year decline in rates, peaking in 2005 at 763 (95% CI:752-774) mPTB cases per 100 000 people; with subsequent consistent declines occurring down to 502(95% CI:494-511) in 2015. The cumulative total of cases of TB averted between 2005 and 2015 was 4 773. This decline is consistent with what was previously reported[3], and the downward trend beyond 2012 has continued, with annual changes of -2.5%, -4.8% and -9.2%, for the last three years, as compared to the 10% required for the WHO End TB Strategy.

Table 8: mPTB case burden and incidence rates by year, Free State: 2004-2015

Year	n	Incidence/100000 (95% CI)	Annual change in cases (n)	Annual change in incidence (%)
2004	16 767	677(666-687)	-	-
2005	19 160	763(752-774)	2 393	12.7
2006	18 360	721(711-732)	-800	-5.5
2007	18 594	721(710-731)	234	0.0
2008	18 870	721(711-731)	276	0.0
2009	17 979	677(667-687)	-891	-6.1
2010	16 751	622(612-631)	-1 228	-8.1
2011	16 489	603(594-612)	-262	-3.1
2012	16 552	596(587-605)	63	-1.2
2013	16 369	581(572-590)	-183	-2.5
2014	15 833	553(544-562)	-536	-4.8
2015	14 387	502(494-511)	-1 446	-9.2

With the exception of Manguang, the incidence trends appear to be homogeneous in this province with the remaining districts appearing to show declines in incidence rates from 2005 to 2015 (Table 9 and Figure 15). In 2005 Xhariep and Lejweleputswa had peak incidence rates of 1026 (95% CI:973-1 082) and 977 (95% CI:952-1 003), but have since shown appreciable declines down to 572 (95% CI:534-611) and 503 (95% CI:486-520) respectively. Manguang district had the lowest incidence rate in 2004 (456; 95% CI:440-472) and in 2015 had the second highest incidence rate (567; 95% CI:550-584). Efforts to understand the reason behind this district's high absolute burden will be important to inform attempts at control.

Incidence Trends

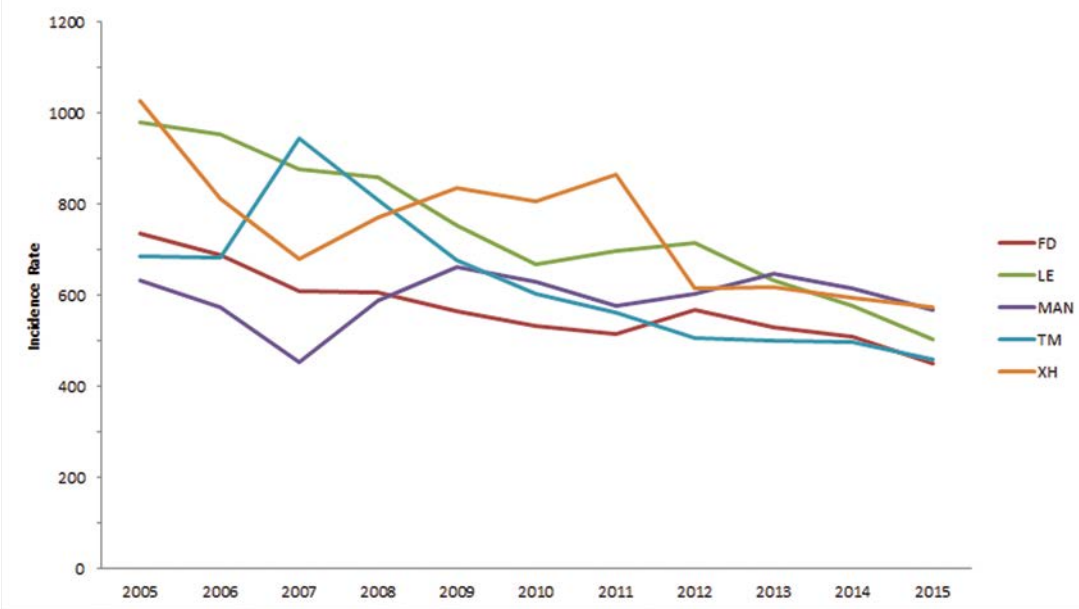


Figure 15: Trends in mPTB incidence rates by district, Free State: 2004-15

Table 9: mPTB case burden and incidence rates by district, Free State: 2004-2015

Year	Fezile Dabi (FD)		Lejweleputswa (LE)		Mangaung Metro (MAN)		Thabo Mofutsanya-na (TM)		Xhariep (XH)	
	n	Incidence (95% CI)	n	Incidence (95% CI)	n	Incidence (95% CI)	n	Incidence (95% CI)	n	Incidence (95% CI)
2004	2 897	658 (634-682)	5 466	965 (939-991)	3 073	456 (440-472)	4 532	682 (662-702)	799	605 (564-649)
2005	3 271	733 (708-758)	5 610	977 (952-1003)	4 304	630 (611-649)	4 602	683 (664-703)	1 373	1026 (973-1082)
2006	3 104	686 (662-711)	5 538	952 (927-977)	3 966	572 (555-590)	4 652	682 (662-701)	1 100	811 (764-861)
2007	2 791	608 (586-631)	5 166	876 (852-900)	3 173	452 (436-468)	6 534	944 (921-967)	930	677 (634-721)
2008	2 817	606 (583-628)	5 130	858 (834-881)	4 185	587 (570-606)	5 667	808 (787-829)	1 071	768 (723-816)
2009	2 664	565 (543-586)	4 561	752 (730-774)	4 769	660 (641-679)	4 807	675 (656-695)	1 178	833 (786-882)
2010	2 548	532 (512-553)	4 104	666 (646-687)	4 597	627 (609-645)	4 347	602 (584-620)	1 155	805 (759-853)
2011	2 497	514 (494-534)	4 348	696 (675-717)	4 275	574 (557-592)	4 110	561 (544-578)	1 259	864 (817-913)
2012	2 797	567 (546-588)	4 521	713 (692-734)	4 560	603 (586-621)	3 765	506 (490-522)	909	615 (576-656)
2013	2 644	528 (508-548)	4 071	632 (612-651)	4 955	646 (628-664)	3 774	499 (483-515)	925	616 (577-657)
2014	2 584	508 (488-528)	3 760	574 (556-593)	4 779	613 (596-631)	3 806	496 (480-512)	904	593 (555-633)
2015	2 287	449 (431-468)	3 290	503 (486-520)	4 419	567 (550-584)	3 519	458 (443-474)	872	572 (534-611)

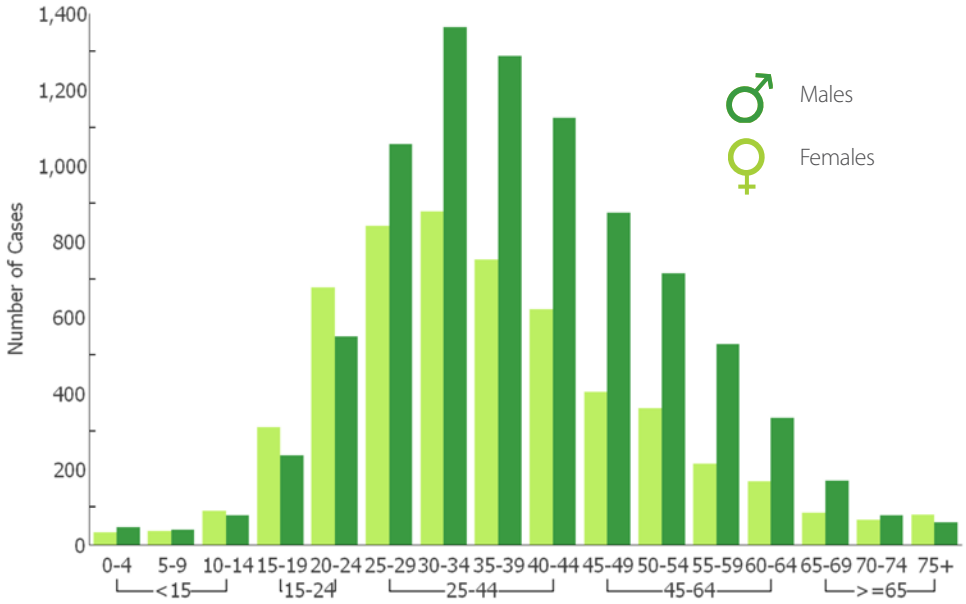
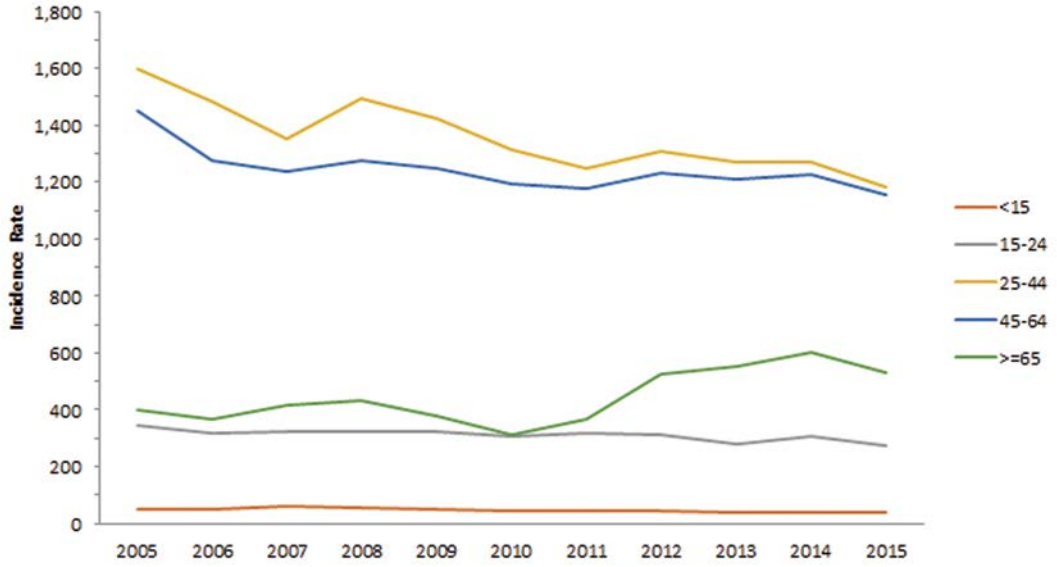


Figure 16: Age and gender population pyramid of mPTB cases, Free State: 2015

The population pyramid (Figure 16) is very similar to the national picture for 2015, highlighting the high burden among males. The absolute number of incidence cases was notably higher among females in the age group 20-24 and lower for age group 30-34 compared to males (Figure 16). The impact of the ART programme on the 25-44 year age group, in particular among females, can be seen by the very large declines observed for this group starting in 2005 when the mPTB incidence rate was over 1 372 95%CI:1 335-1 410) per 100 000 people (Figure 17); declining to 732 (95%CI:707-758) in 2015, a reduction of 46.6%. Similar to patterns observed in other provinces and nationally; among males particularly ages 25-64, a very slow year-on-year decline in incidence rate was seen. The incidence rate is notably higher than other age groups, being four times higher than males 15-24 years and twice as high compared with females 45-64 years for 2015.

♂ Age specific incidence trends – Males



♀ Age specific incidence trends – Females

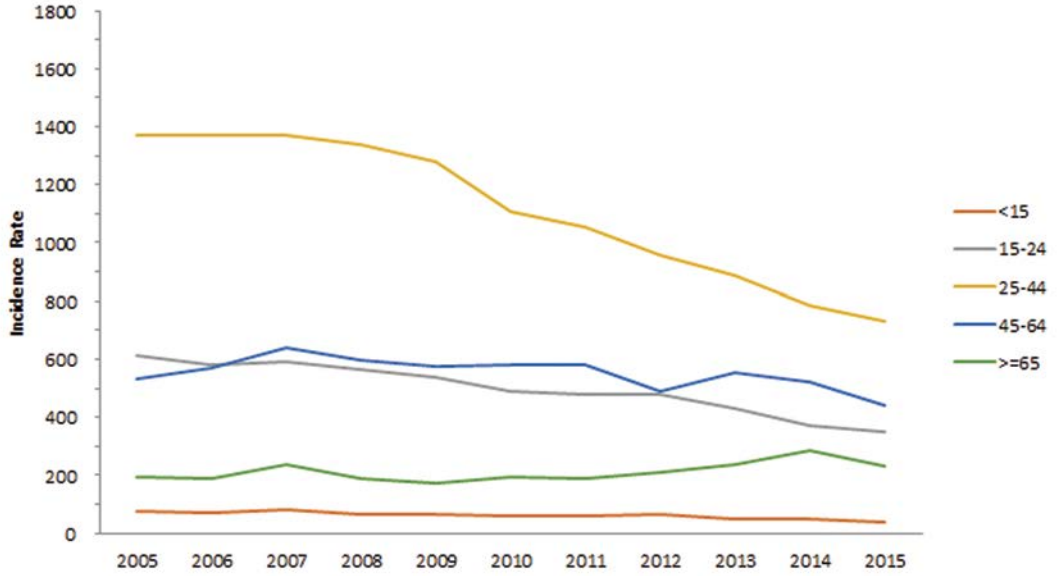


Figure 17: Trends in mPTB incidence rates by age and gender, Free State: 2004-15

Microbiologically confirmed rifampicin resistant tuberculosis

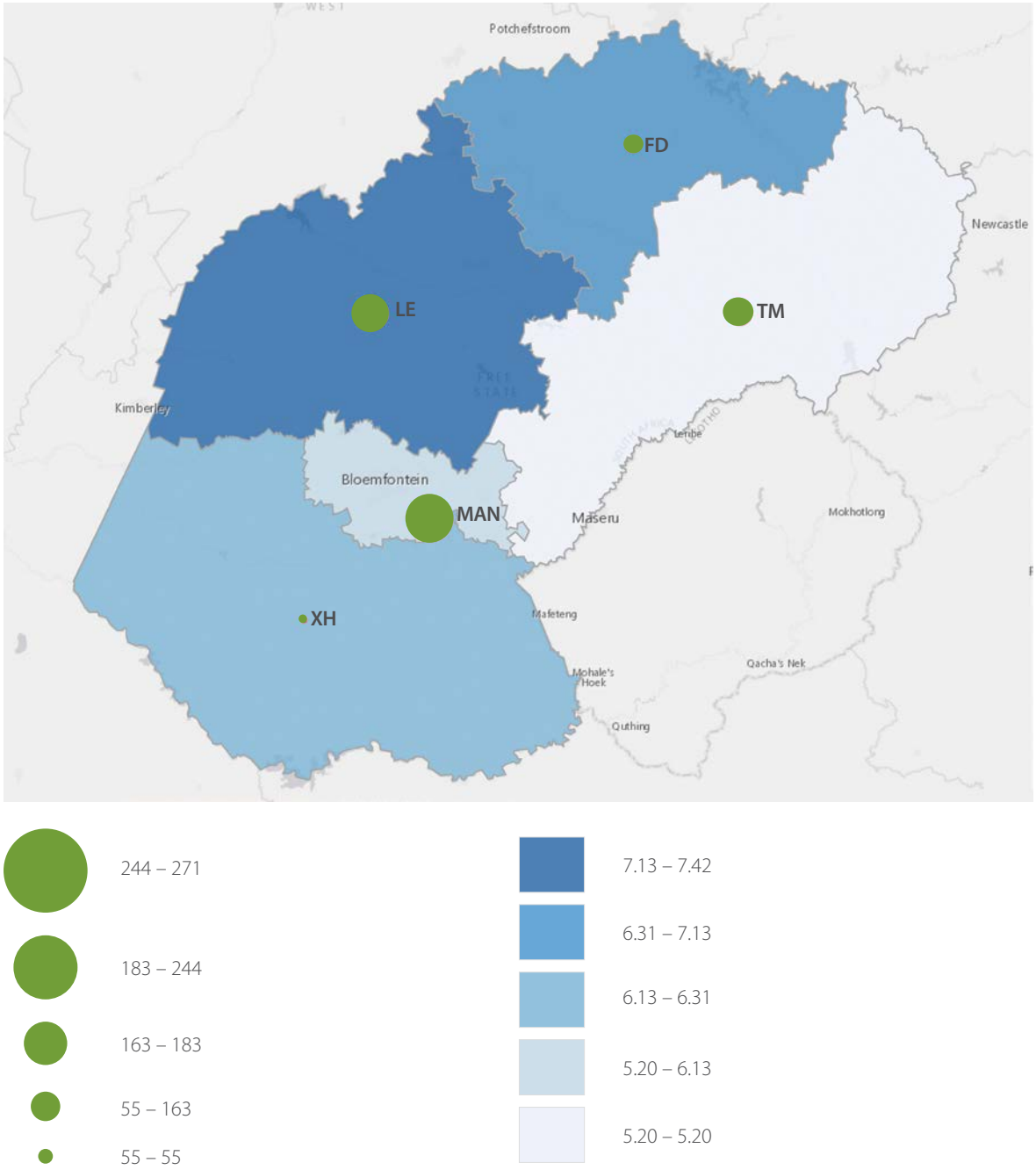


Figure 18: Rifampicin resistant mPTB case burden (circles) and incidence rates (shading), Free State: spatial distribution, 2015

The geographic distribution of the mPTB RR-TB cases and incidence rate of RR-TB per 100 mPTB cases is shown in Figure 18 and Table 10. The absolute burden of RR-TB cases is highest in Mangaung Metro (268) and Lejweleputswa (248) and together they account for 55.3% of the RR-TB burden in the province for 2015. The RR-TB incidence rate is relatively homogenous in the province, ranging between 5.5 and 7.5 per 100 mPTB cases which is slightly lower than the national average of 7.6 (95% CI 7.5-7.7).

Table 10: Rifampicin mPTB case burden and incidence rates among mPTB cases by district, Free State: 2015

District	Incidence (95% CI)
Fezile Dabi	7.3 (6.2-8.5)
Lejweleputswa	7.5 (6.6-8.5)
Mangaung Metro	6.1 (5.4-6.8)
Thabo Mofutsanyana	5.5 (4.7-6.3)
Xhariep	6.7 (5.1-8.6)

Summary

- 206 111 mPTB cases occurred between 2004 and 2015.
- The three highest burden districts are Manguang, Thabo Mofutsanyana and Lejweleputswa and together they account for 78.0% of the total mPTB burden in 2015.
- mPTB incidence rates are declining with a reduction of -2.5%, -4.8% and -9.2% year-on-year for 2013, 2014 and 2015 respectively.
- mPTB incidence rates among females between 25-44 years of age have reduced by almost 50% over the past decade.
- mPTB incidence rates are homogenous between the districts and clustered between 449-572 per 100 000 people in 2015.
- Mangaung Metro and Lejweleputswa district together account for 55.3% of the total provincial burden of RR-TB cases for 2015.

GAUTENG

Gauteng had the second highest incidence of mPTB cases in 2015 and between the period 2004 and 2015 a total of 662 784 microbiologically confirmed cases of pulmonary TB (mPTB) were diagnosed (Table 11). The peak number of mPTB cases was 69 189 in 2006 and in the most recent year (2015) the number of cases was 44 822. The highest burden of mPTB cases occurs in the following two districts: City of Johannesburg (17 361) and Ekurhuleni (11 234); together they account for 63.8% of the total burden in 2015 for the province (Figure 19 and Table 12). This pattern has remained unchanged when compared with 2005.

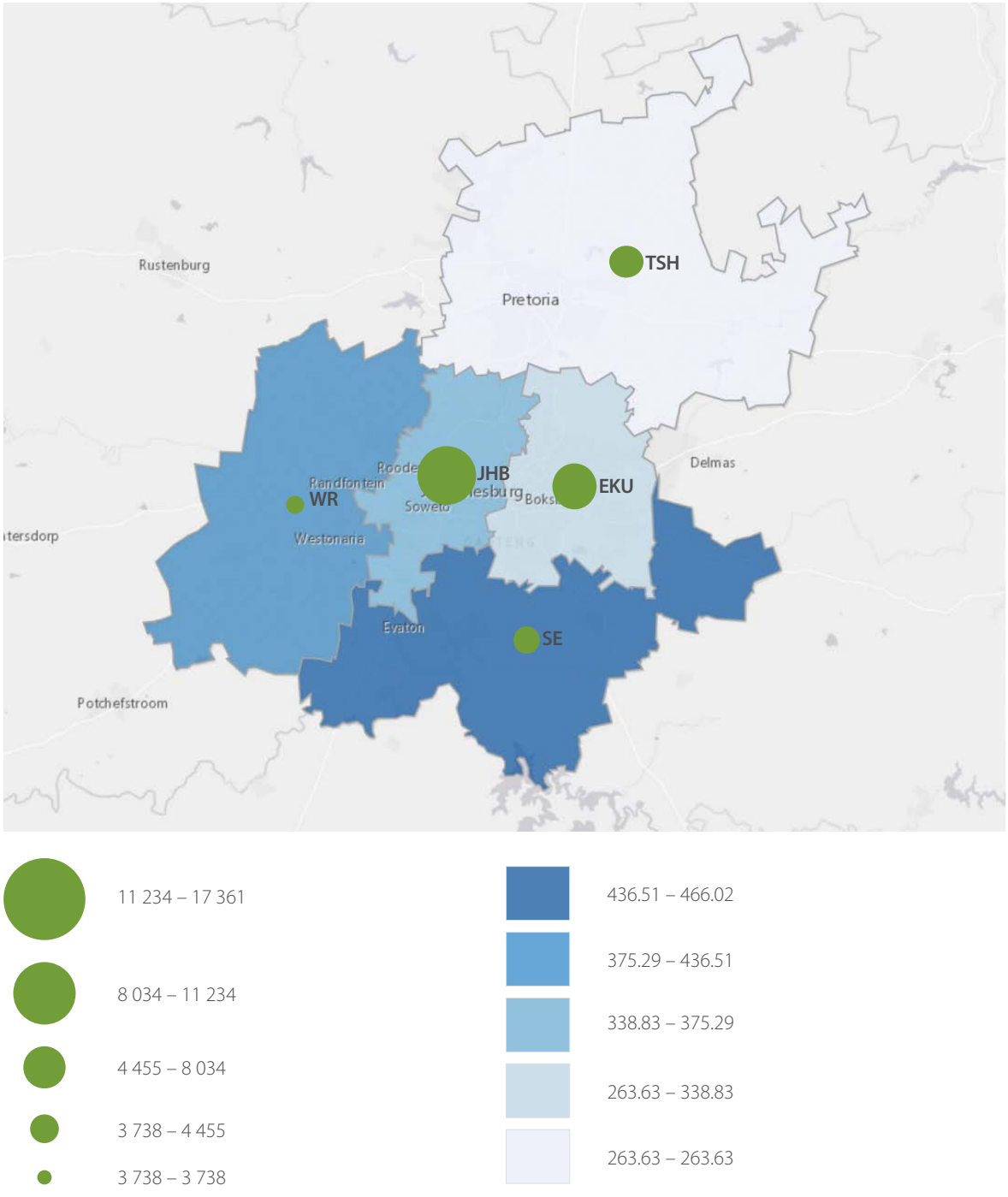


Figure 19: mPTB case burden (circles) and incidence rates (shading), Gauteng: spatial distribution, 2015

The peak incidence rate was observed in 2005 at 609 (95%CI: 604-614) mPTB cases per 100 000 people and showed consistent declines to 350 (95%CI: 347-353) in 2015 (Table 11). The cumulative total of cases of TB averted between 2005 and 2015 was 23 530. The trend in incidence rate is consistent with what was previously reported[3], with a slow but substantive decline since. The annual change has been +0.3,-3.5 and -3.6% for the last three years of the reporting period. The declines are below the required 10% target set for the WHO End TB Strategy but above the global average. Large decreases were achieved in earlier years and highlight the potential for this province to meet the targets set.

Table 11: mPTB case burden and incidence rates by year, Gauteng: 2004-2015

Year	n	Incidence/100000 (95% CI)	Annual change in cases (n)	Annual change in incidence (%)
2004	49 398	446(442-450)	-	-
2005	68 352	609(604-614)	18 954	36.5
2006	69 189	608(604-613)	837	-0.2
2007	59 155	513(509-517)	-10 034	-15.6
2008	61 327	524(520-528)	2172	2.1
2009	58 122	490(486-494)	-3 205	-6.5
2010	57 364	476(473-480)	-758	-2.9
2011	54 722	448(444-452)	-2 642	-5.9
2012	46 490	375(371-378)	-8 232	-16.3
2013	47 376	376(373-379)	886	0.3
2014	46 467	363(360-366)	-909	-3.5
2015	44 822	350(347-353)	-1 645	-3.6

The incidence trend by district has been relatively consistent with declines seen in all districts though more pronounced in some than others (Table 12 and Figure 20). The West Rand had the highest incidence rate in 2005, peaking at 1 023 (95%CI: 1 001-1 047) per 100 000 people and has since more than halved its incidence rate (437; 95%CI: 423-451) by 2015. Tshwane district consistently had the lowest incidence rate and half the national average, highlighting the highly variable incidence across this densely populated province. Incidence rates in all districts for Gauteng in 2015 were lower than the national average of 520 mPTB cases per 100 000 people.

Incidence Trends

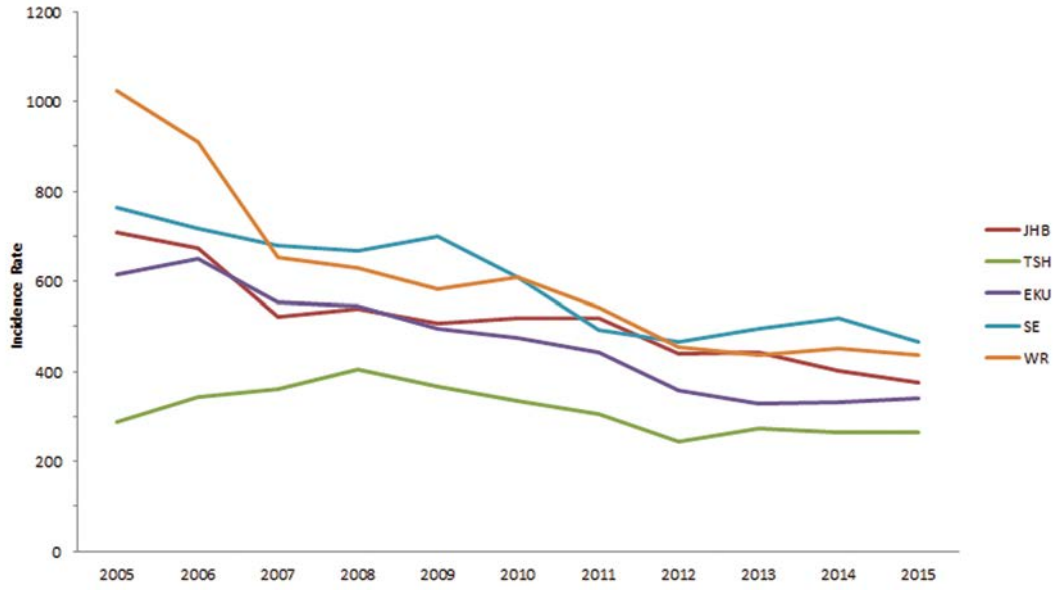


Figure 20: Trends in mPTB incidence rates by district, Gauteng: 2004-15

Table 12: mPTB case burden and incidence rates by district, Gauteng: 2004-2015

Year	City of Johannesburg Metro (JHB)		City of Tshwane Metro (TSH)		Ekurhuleni Metro (EKU)		Sedibeng (SE)		West Rand (WR)	
	n	Incidence (95% CI)	n	Incidence (95% CI)	n	Incidence (95% CI)	n	Incidence (95% CI)	n	Incidence (95% CI)
2004	20 070	501 (494-508)	3 928	149 (144-154)	14 975	522 (514-530)	4 986	603 (586-620)	5 439	734 (715-754)
2005	28 716	708 (700-716)	7 684	288 (281-294)	17 873	615 (606-624)	6 394	763 (744-782	7 685	1023 (1001-1047)
2006	27 679	673 (665-681)	9 312	344 (337-351)	19 188	651 (642-661)	6 090	717 (699-735	6 920	909 (888-931)
2007	21 749	522 (515-529)	9 944	362 (355-369)	16 566	555 (546-563)	5 856	680 (663-697	5 040	653 (635-671)
2008	22 736	538 (531-545)	11 297	406 (398-413)	16 546	546 (538-555)	5 823	667 (650-684	4 925	629 (612-647)
2009	21 713	506 (500-513)	10 368	367 (360-374)	15 224	495 (488-503)	6 193	699 (682-717	4 624	583 (566-600)
2010	22 525	518 (511-525)	9 613	335 (329-342)	14 839	476 (468-484)	5 479	609 (593-626	4 908	609 (592-627)
2011	22 972	520 (513-527)	8 839	304 (298-310)	13 988	442 (435-449)	4 496	493 (478-507	4 427	541 (526-558)
2012	19 729	440 (434-446)	7 213	244 (239-250)	11 468	357 (350-363)	4 310	465 (451-479	3 770	454 (440-469)
2013	20 132	442 (436-448)	8 162	272 (266-278)	10 742	329 (323-335)	4 645	494 (480-508	3 695	438 (424-453)
2014	18 573	401 (396-407)	8 048	264 (258-270)	11 010	332 (326-338)	4 962	519 (505-534	3 874	452 (438-467)
2015	17 361	375 (370-381)	8 034	264 (258-269)	11 234	339 (333-345)	4 455	466 (452-480	3 738	437 (423-451)

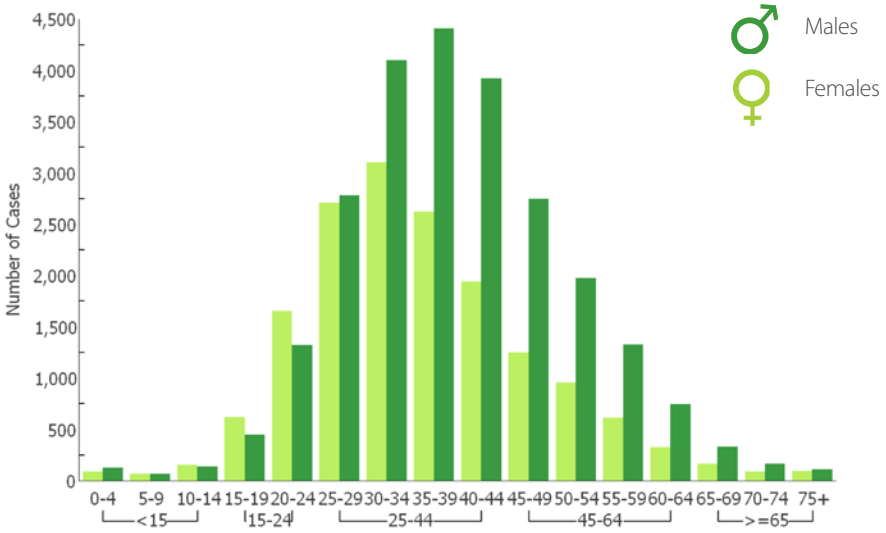
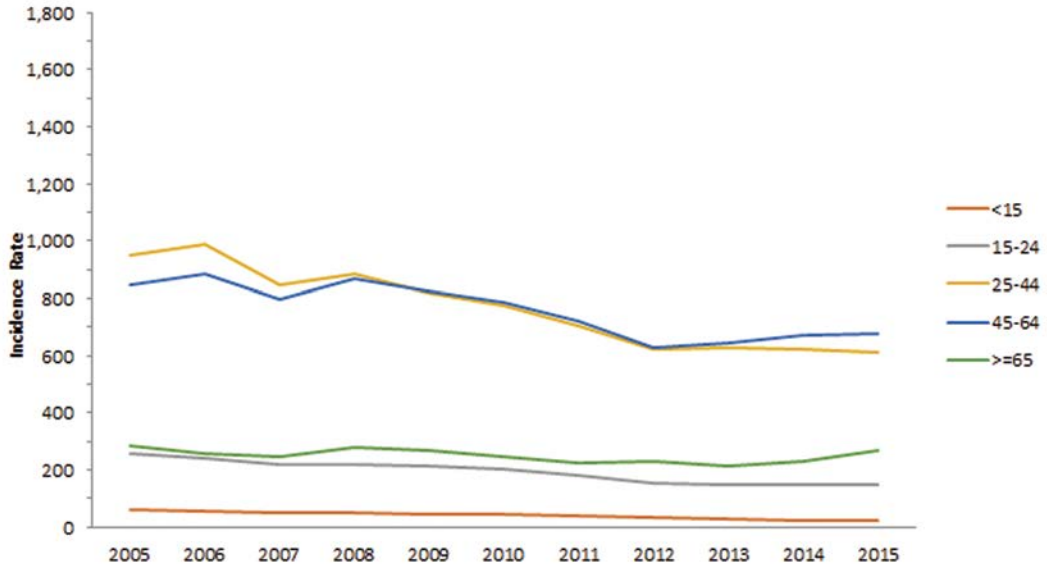


Figure 21: Age and gender population pyramid of mPTB cases, Gauteng: 2015

The most affected with mPTB are those in the economically active age groups (25-44 and 45-64) with a clear male dominance overall in 2015 (Figure 21). There were twice as many mPTB cases among males than females in those aged 35 years and older, while the numbers were similar in those below 35 years (Figure 22). Unlike the national picture, the highest burdened age groups among males have shown notable reductions in incidence rates, even though this is slower than observed among females. This provides an encouraging indication that more males are coming forward to be tested and treated. It is a significant one as the mPTB incidence rates among males aged between 25-44 years and 45-64 years are generally higher than observed in females (Figure 22) highlighting an important population in which to accelerate declines for the province to meet the END TB targets. It should be noted that in most recent years the decline in incidence rates among males has stagnated and further campaigns will be required to change the pattern being observed. Similar to the trends nationally among individuals aged >65 years of age, there is a marginal upward shift in 2015 in this age group which needs to be monitored. The increase in this older age group may be reflective of the high incidence rates in the early 1990s and 2000s with exposed individuals experiencing their disease later in life; particularly for HIV negative individuals or patients with HIV responsive to long-term ART therapy. This would however require further research.

♂ Age specific incidence trends – Males



♀ Age specific incidence trends – Females

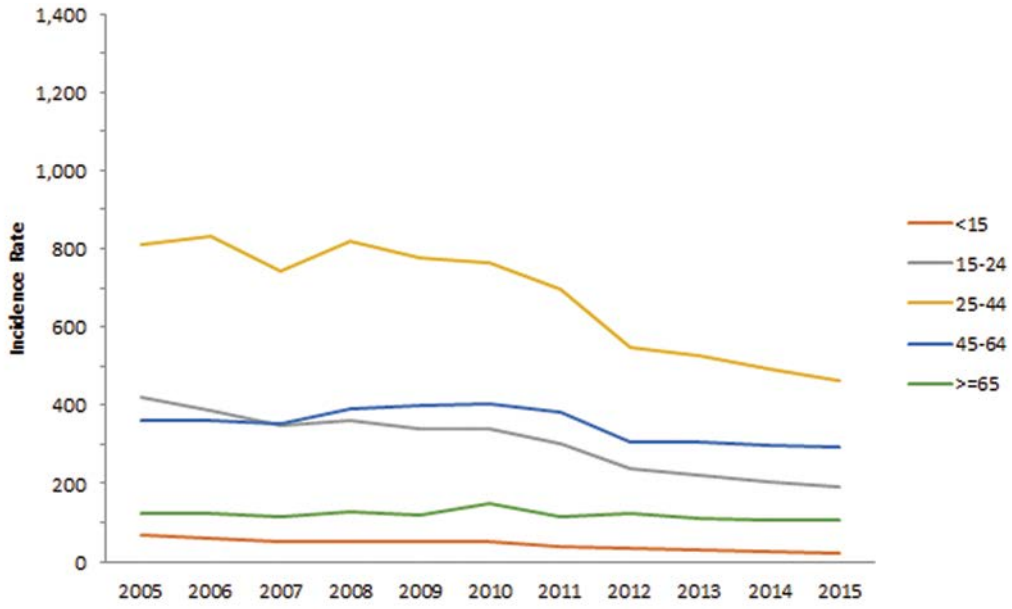


Figure 22: Trends in mPTB incidence rates by age and gender, Gauteng: 2004-15

Microbiologically confirmed rifampicin resistant tuberculosis

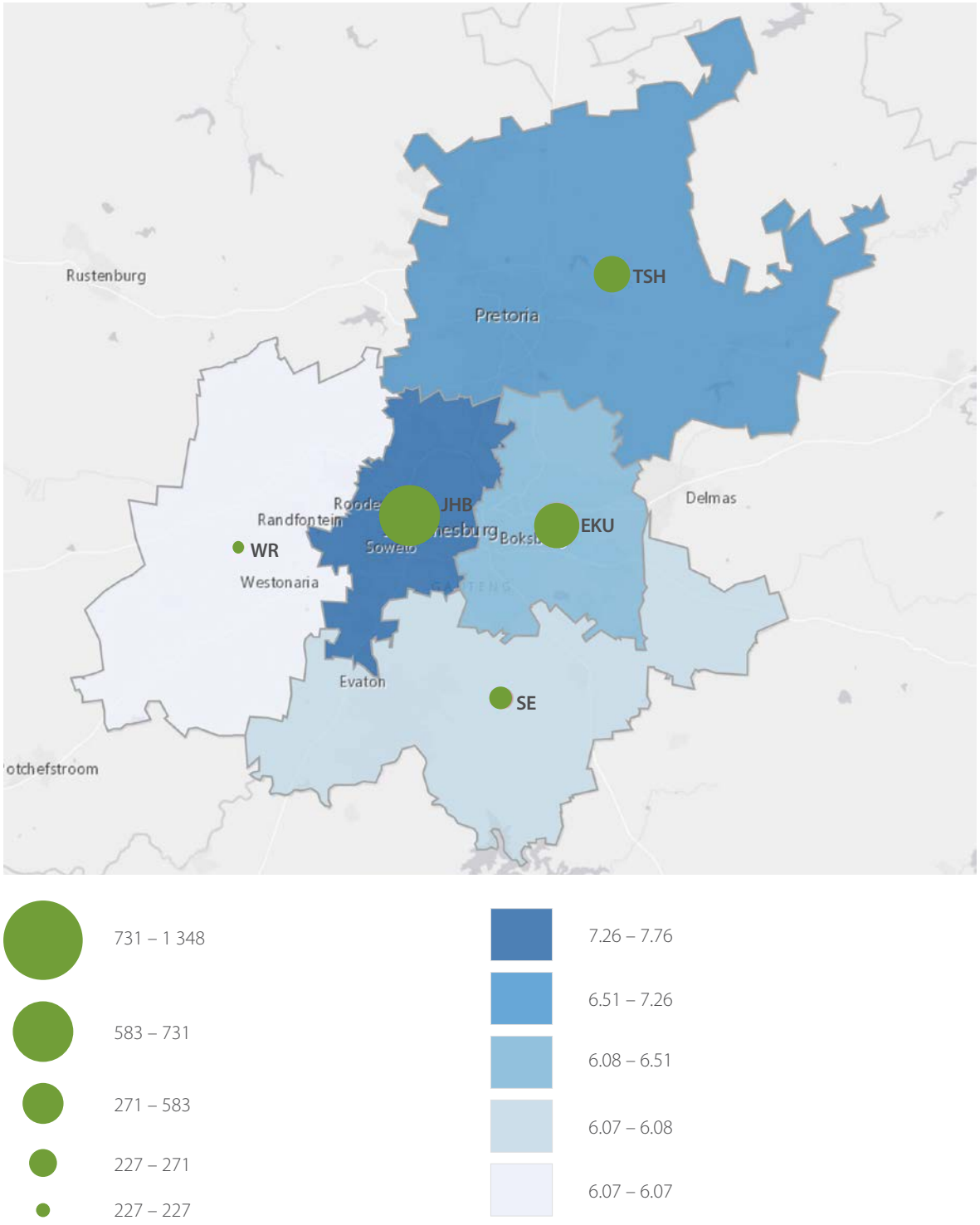


Figure 23: Rifampicin resistant mPTB case burden (circles) and incidence rates (shading), Gauteng: spatial distribution, 2015

The geographic distribution of the number of mPTB RR-TB cases and incidence rate of RR-TB per 100 mPTB cases is shown in Figure 23 and Table 13. The absolute burden of RR-TB cases is highest in the City of Johannesburg (1 334) and has a similar burden to the combined absolute burden for the second and third highest districts, Ekhuruleni (734) and City of Tshwane (587) metros respectively. The incidence rates are relatively homogenous and range between 6.0 and 7.7 RR-TB cases per 100 mPTB cases in Sedibeng and the City of Johannesburg respectively. The higher rate in the City of Johannesburg is concerning due to the population density of this part of the country and partly reflects the transmission potential in this type of environment.

Table 13: Rifampicin mPTB case burden and incidence rates among mPTB cases by district, Gauteng: 2015

District	Incidence (95% CI)
City of Johannesburg Metro	7.7 (7.3-8.1)
City of Tshwane Metro	7.3 (6.7-7.9)
Ekurhuleni Metro	6.5 (6.1-7)
Sedibeng	6 (5.3-6.7)
West Rand	6.1 (5.4-7)

Summary

- 662 784 mPTB cases occurred between 2004 and 2015.
- The two highest burden districts are: the City of Johannesburg and Ekurhuleni which together account for 63.8% of the absolute mPTB burden.
- The annual change in mPTB incidence rates is +0.3,-3.5 and -3.6% year-on-year for 2013, 2014 and 2015 respectively.
- Females between the ages of 25-44 years have shown the sharpest decline in incidence rates, reflective of efforts in the HIV programme targeting this age group.
- Incidence rates among males have also shown early declines which is different to the national picture, but has slowed in recent years and campaigns targeting this group will be important to accelerate decline in incidence.
- The City of Johannesburg has the highest absolute burden of RR-TB cases in the province – equivalent to Ekhuruleni Metro and Tshwane Metro combined.

KwaZulu-Natal

Due to previously mentioned constraints, data were only available for the period between 2011 and 2015 for KwaZulu-Natal. During this period, 409 678 microbiologically confirmed cases of pulmonary TB (mPTB) were diagnosed in KwaZulu-Natal (Table 14). The peak number of mPTB cases was 101 058, occurring in 2011 and in 2015 the number of cases was 66 512. The district with the highest absolute burden of mPTB cases is in the eThekwini Metro and it alone accounts for 40.9% of the total burden of the province in 2015 (Table 15 and Figure 24). This pattern has remained unchanged when compared with 2011.

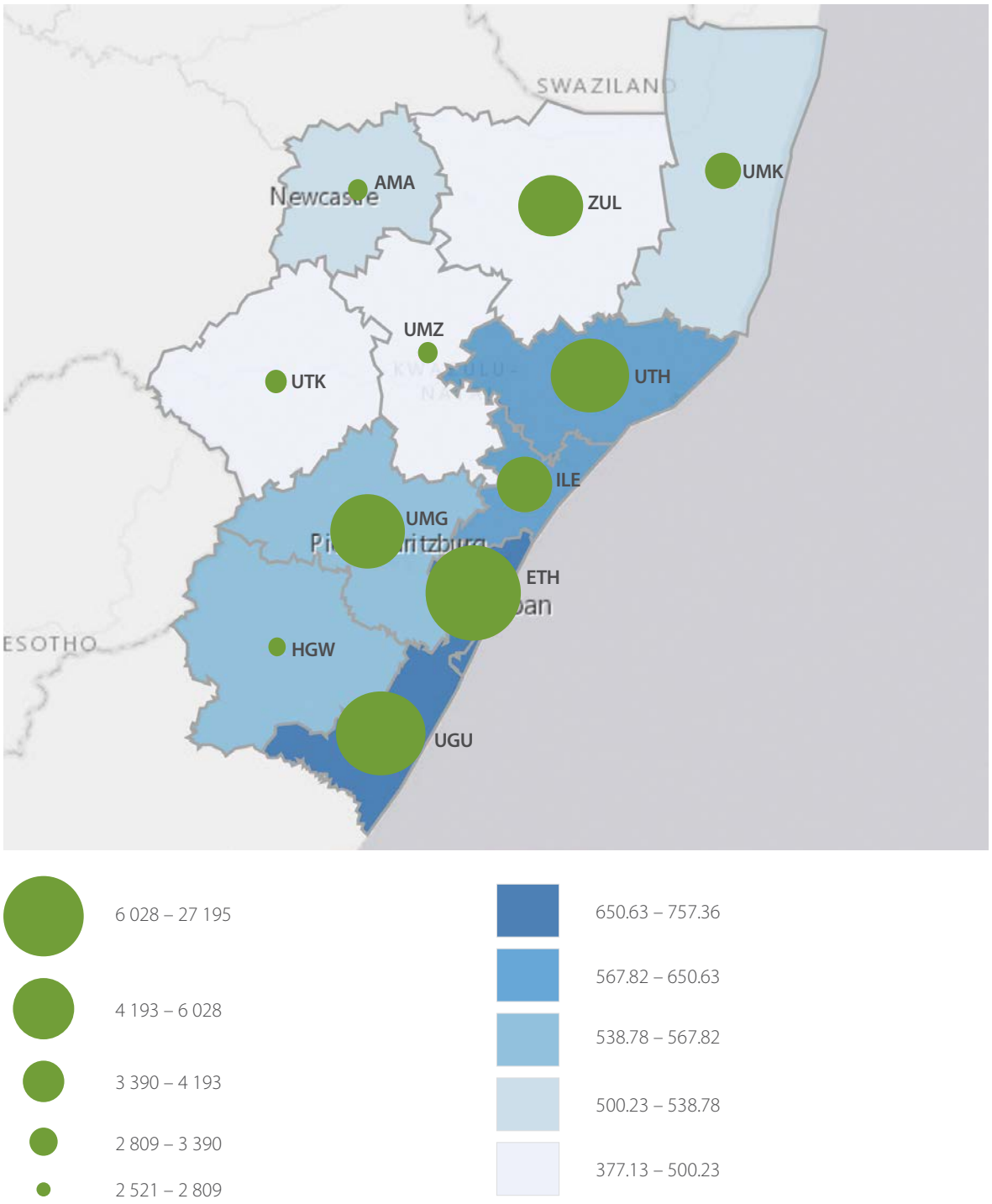


Figure 24: mPTB case burden (circles) and incidence rates (shading), KwaZulu-Natal: spatial distribution, 2015

Previous data were modelled to estimate the mPTB incidence and showed peak incidence in 2011 with evidence of a decline in 2012[3]. The current report provides updated information for subsequent years and confirms that the decline persisted year-on-year. In this update we report a peak incidence rate in 2011 of 988 (95%CI: 982-995) mPTB cases per 100 000 people and subsequent consistent declines to 621 (95%CI: 616-626) in 2015 (Table 14). The cumulative total number of cases of TB averted between 2011 and 2015 was 34 546. The annual change has been -13.4%, -9.7% and -8.5% for the last three years, and is closely comparable to the 10% required by the WHO End TB Strategy. As one of the highest burdened provinces in the country, these statistics are very encouraging and a likely contributor to the declines in the national picture. The ART programme probably plays a significant role in this province, which also has one of the highest HIV prevalence rates nationally.

Table 14: mPTB case burden and incidence rates by year, KwaZulu-Natal: 2004-2015

Year	n	Incidence/100000 (95% CI)	Annual change in cases (n)	Annual change in incidence (%)
2004	-	-	-	-
2005	-	-	-	-
2006	-	-	-	-
2007	-	-	-	-
2008	-	-	-	-
2009	-	-	-	-
2010	-	-	-	-
2011	101 058	988(982-995)	-	-
2012	90 075	868(862-873)	-10 983	-12.1
2013	79 290	752(747-757)	-10 785	-13.4
2014	72 743	679(674-684)	-6 547	-9.7
2015	66 512	621(616-626)	-6 231	-8.5

Incidence rates by district were highly variable in 2011, ranging between 506 and 1 309 per 100 000 people and down to between 377 and 757 per 100 000 people in 2015, with declines observed in all districts (Figure 25 and Table 15). eThekwini Metro, Ugu and uThungulu districts had the highest incidence rate in 2011 and have shown very impressive declines in mPTB incidence rates by 2015: 1309 (95%CI: 1 297-1 321) to 757 (95%CI: 748-766), 1 308 (95%CI: 1 282-1 335) to 699 (95%CI: 681-719) and 1 086 (95%CI: 1 065-1 108) to 599 (95%CI: 584-615) respectively. Understanding the reasons for these successes would be important and should be replicated in districts with a poorer annual decline in incidence rates (e.g. uMgungundlovu).

Incidence Trends

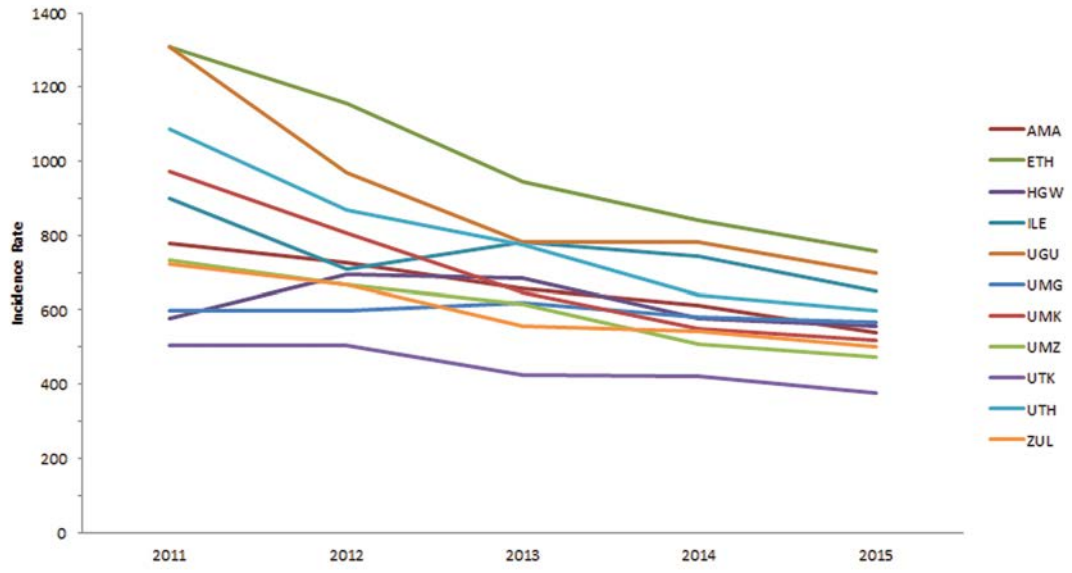


Figure 25: Trends in mPTB incidence rates by district, KwaZulu-Natal: 2004-15

Table 15: mPTB case burden and incidence rates by district, KwaZulu-Natal: 2004-2015

Year	Amajuba (AMA)		eThekwini Metro (ETH)		Harry Gwala (HGW)		iLembe (ILE)		Ugu (UGU)		uMgungundlovu (UMG)		uMkhanyakude (UMK)		Umzinyathi (UMZ)		uThukela (UTK)		uThungulu (UTH)		Zululand (ZUL)	
	n	Incidence (95% CI)	n	Incidence (95% CI)	n	Incidence (95% CI)	n	Incidence (95% CI)	n	Incidence (95% CI)	n	Incidence (95% CI)	n	Incidence (95% CI)	n	Incidence (95% CI)	n	Incidence (95% CI)	n	Incidence (95% CI)	n	Incidence (95% CI)
2011	3 881	780 (755-805)	44 878	1309 (1297-1321)	2 651	577 (555-599)	5 440	900 (877-925)	9 413	1308 (1282-1335)	6 054	597 (582-613)	6 055	972 (947-996)	3 722	732 (708-756)	3 372	506 (489-524)	9 816	1086 (1065-1108)	5 776	722 (703-741)
2012	3 668	726 (703-750)	40 212	1155 (1144-1167)	3 246	696 (672-720)	4 342	708 (687-729)	7 084	970 (947-993)	6 148	597 (583-613)	5 098	806 (784-828)	3 449	668 (646-691)	3 410	504 (488-522)	7 983	870 (851-889)	5 435	669 (651-687)
2013	3 366	656 (634-678)	33 432	946 (936-956)	3 241	684 (661-708)	4 874	782 (760-805)	5 797	781 (761-802)	6 453	618 (603-633)	4 144	645 (625-665)	3 236	617 (596-639)	2 916	425 (409-440)	7 225	775 (758-793)	4 606	558 (542-575)
2014	3 185	611 (590-632)	30 152	840 (830-849)	2 780	578 (556-600)	4 718	745 (724-767)	5 903	783 (763-804)	6 161	580 (566-595)	3 592	550 (532-569)	2 703	507 (488-527)	2 947	422 (407-438)	6 064	641 (625-657)	4 538	541 (526-557)
2015	2 809	539 (519-559)	27 195	757 (748-766)	2 685	558 (537-579)	4 118	651 (631-671)	5 271	699 (681-719)	6 028	568 (554-582)	3 390	519 (502-537)	2 521	473 (455-492)	2 631	377 (363-392)	5 671	599 (584-615)	4 193	500 (485-516)

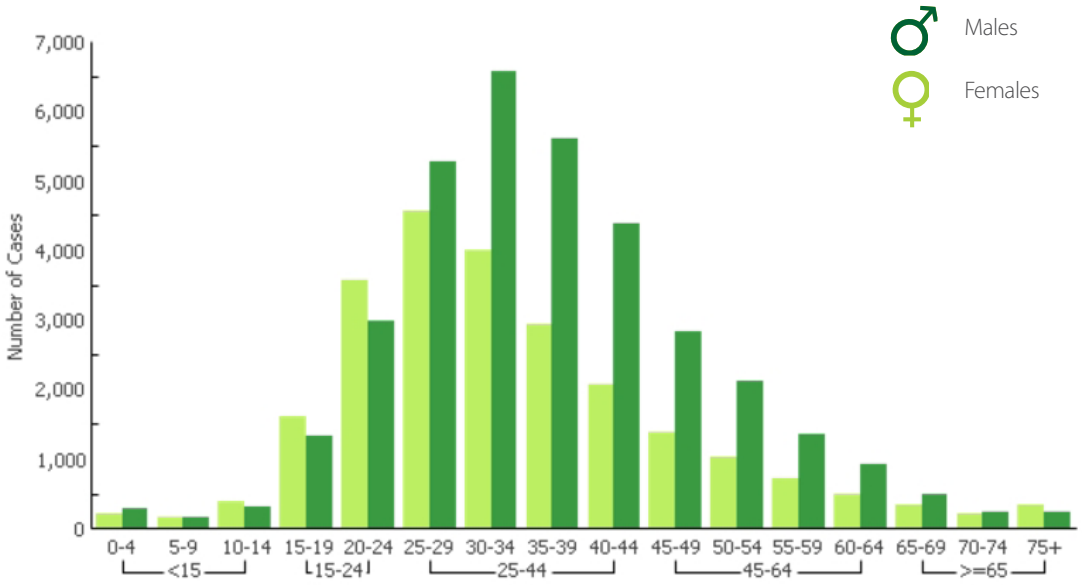
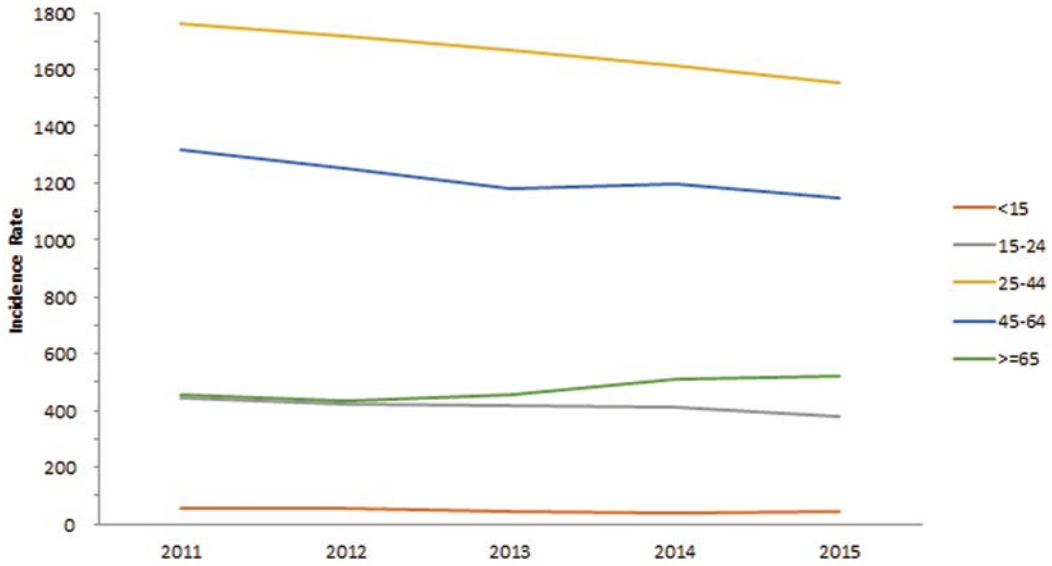


Figure 26: Age and gender population pyramid of mPTB cases, KwaZulu-Natal: 2015

The peak number of mPTB cases was in the 30-34 year age group for males and the 25-29 year age group for females (Figure 26). There were twice as many male cases aged 30 years and older compared to females, while in those aged below 30 it was similar. Declines in incidence rates among females 25-44 years were observed, similar to the national trend.

Also similar to the national picture, the highest burdened age groups among males have shown disconcertingly slow declines in incidence rates (Figure 27). Additionally, the mPTB incidence rates in males aged between 25-44 years and 45-64 years were the highest for the province and notably higher in the younger age group. Interestingly, from 2012 patients >65 years had higher rates than the 15-24 age group suggesting that reactivation disease may also be important in this province.

♂ Age specific incidence trends – Males



♀ Age specific incidence trends – Females

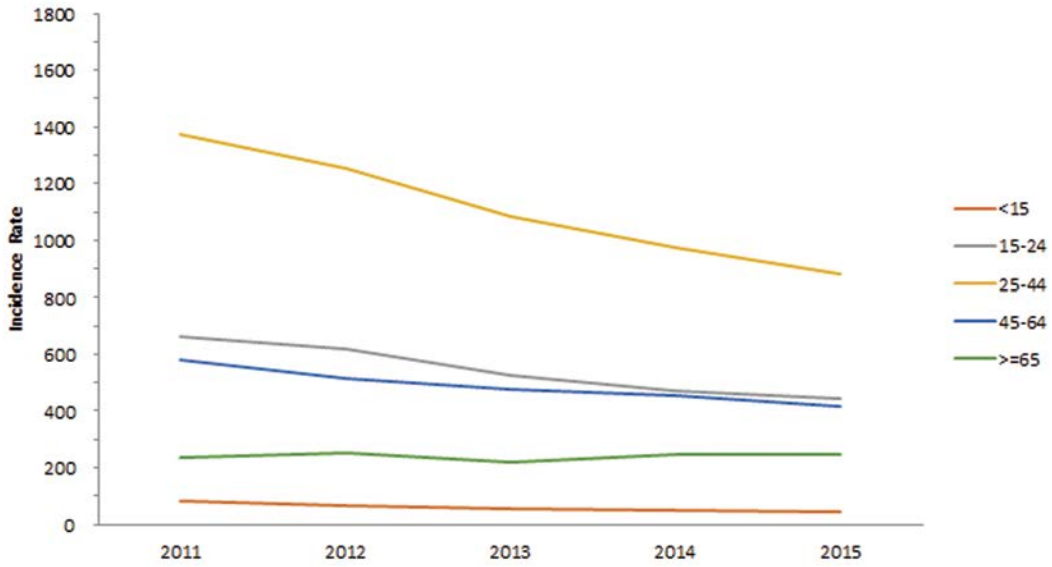


Figure 27: Trends in mPTB incidence rates by age and gender, KwaZulu-Natal: 2004-15

Microbiologically confirmed rifampicin resistant tuberculosis

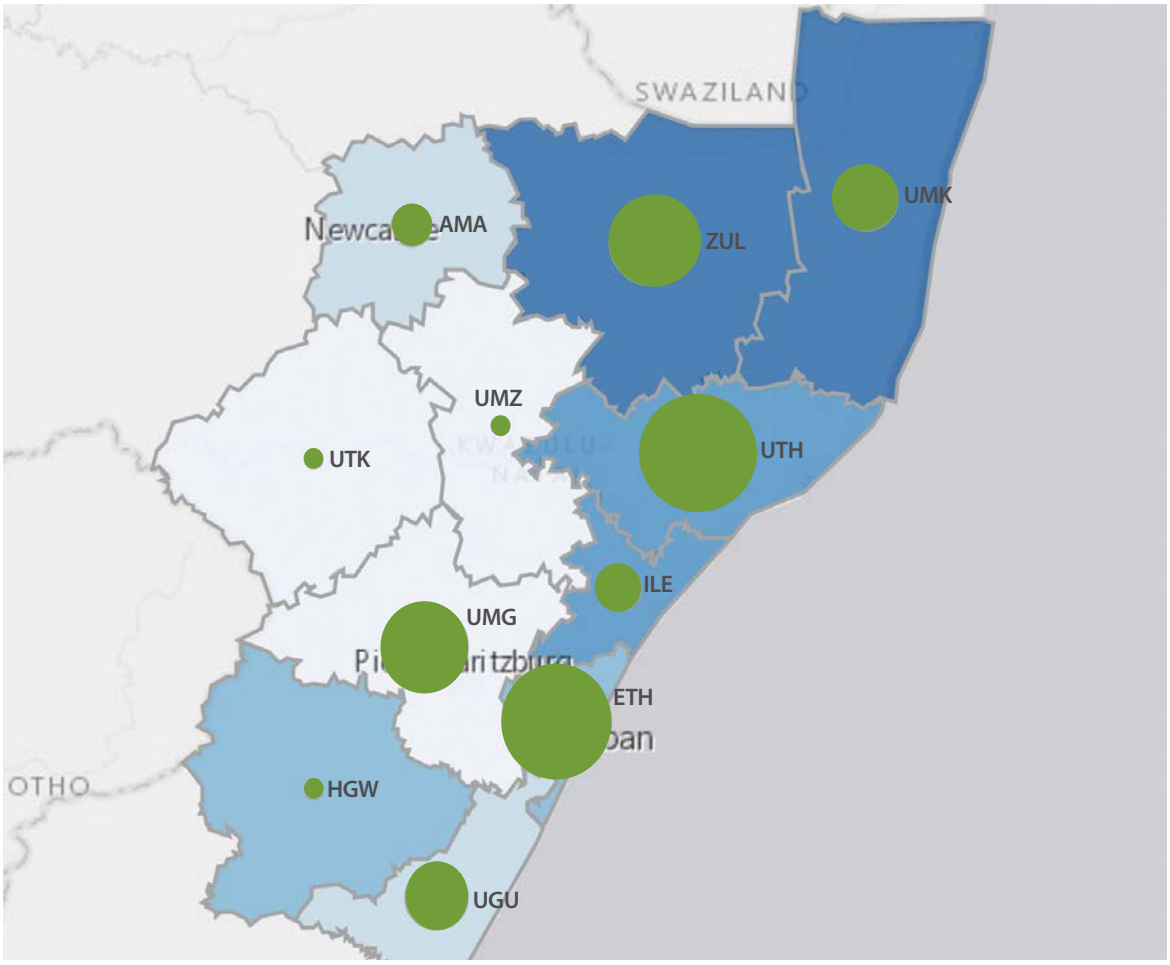


Figure 28: Rifampicin resistant mPTB case burden (circles) and incidence rates (shading), KwaZulu-Natal: spatial distribution, 2015

The geographic distribution of the number of mPTB RR-TB cases and incidence rate of RR-TB per 100 mPTB cases is shown in Figure 28 and Table 16. The absolute burden of RR-TB cases is highest in eThekwini Metro (2 436) – higher than the number of cases for the entire Western Cape for the same period (2 252). It carries 38.7% of the provincial burden alone and is thus a key area requiring specific attention to reduce the burden in the province. Overcrowding and poverty are likely underlying factors that would take a long time to address, but attempts at early diagnosis and treatment will be essential to contain the burden. The incidence rates across all districts are higher than the national average and highest in uMkhanyakude at 13.3 (98% CI:12.1-14.6). Districts close to the borders of both Mozambique and Swaziland, countries with high drug resistance rates, show the highest incidence rates for the province and efforts aimed at improving cross-border co-operation will be key to contain the burden in these districts.

Table 16: Rifampicin mPTB case burden and incidence rates among mPTB cases by district, KwaZulu-Natal: 2015

District	Incidence (95% CI)
Amajuba	8.9 (7.9-10.1)
eThekwini Metro	9 (8.6-9.3)
Harry Gwala	8.9 (7.8-10.1)
iLembe	10.3 (9.3-11.3)
Ugu	8.6 (7.8-9.4)
uMgungundlovu	8 (7.3-8.7)
uMkhanyakude	13.3 (12.1-14.6)
Umzinyathi	7.9 (6.8-9)
uThukela	8.3 (7.2-9.5)
uThungulu	11.5 (10.6-12.4)
Zululand	11.7 (10.7-12.8)

Summary

- 409 678 mPTB cases occurred between 2011 and 2015.
- eThekwini Metro alone accounted for 40.9% of the absolute mPTB burden.
- mPTB incidence rates are on the decline with reductions of -13.4%, -9.7% and -8.5% year-on-year for 2013, 2014 and 2015 respectively; closely matching the END TB targets.
- The mPTB incidence among males aged 25-44 years of age remains above 1 500 per 100 000 people and is exceptionally high.
- Higher rates are observed for people aged >65 compared with 15-24 age group, suggesting that reactivation disease, especially in a high HIV endemic area like KwaZulu-Natal, is a contributory factor.
- eThekwini Metro has the highest burden of RR-TB in the province and has a higher absolute burden than the entire Western Cape for the same period, while carrying 38.7% of the KwaZulu-Natal burden.
- Neighboring countries Mozambique and Swaziland have the highest incidence rates for RR-TB.

LIMPOPO

A total of 206 766 microbiologically confirmed cases of pulmonary TB (mPTB) were diagnosed in Limpopo between 2004 and 2015 (Table 17). The peak number of mPTB cases occurred in 2009 (21 698) and in the most recent year reported (2015), the number of cases was 14 124. The two highest burdened districts of mPTB cases was Capricorn (3 419) and Mopani (3 164) (Figure 29 and Table 18), together accounting for 46.6% of the total burden in 2015. There has been a general increase in the absolute number of mPTB cases for all districts compared with 2004.

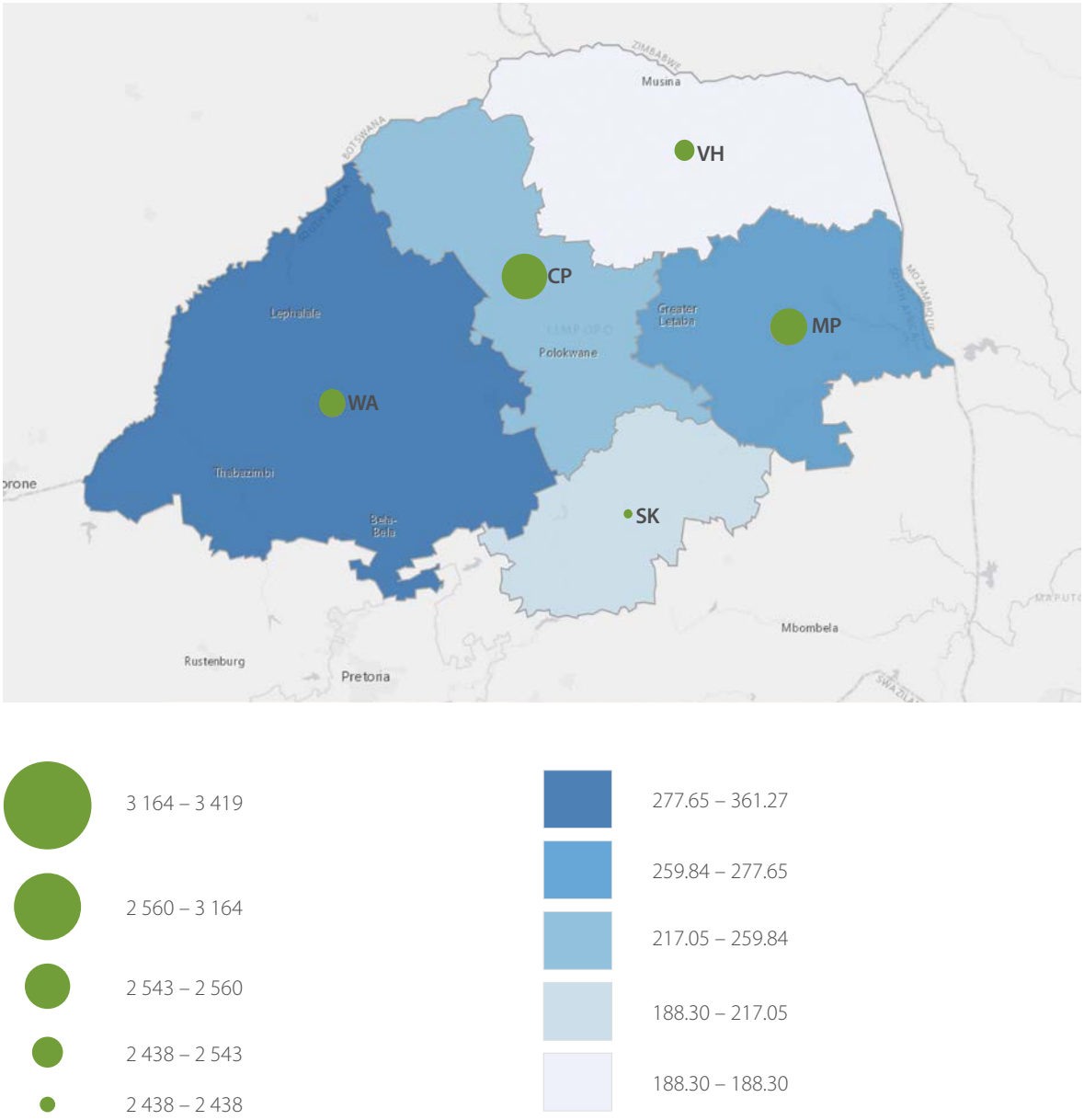


Figure 29: mPTB case burden (circles) and incidence rates (shading), Limpopo: spatial distribution, 2015

The overall trend in mPTB incidence rates over the period showed a rapid increase from a low starting level. From 2004 the mPTB incidece rate per 100 000 people was 209 (95%CI: 205-213), peaking in 2009 at 415 (95%CI: 410-421) and subsequently showing consistent declines to 251 (95%CI: 246-255) in 2015 (Table 17). It should be noted that although declines have been seen in the most recent years – relative to 2005 – baseline incidence rates are notably higher in 2015 than 2004. This pattern is different to that observed in other provinces. The cumulative total of mPTB cases averted between the peak in 2009 and in 2015 was 7 574. This decline is consistent with what was previously reported[3] and has continued beyond 2012. The annual change was -9.9%, -8.4%, and -11.0% for the last three years; closely comparable to the 10% required for the WHO End TB Strategy.

Table 17 mPTB case burden and incidence rates by year, Limpopo: 2004-2015

Year	n	Incidence/100000 (95% CI)	Annual change in cases (n)	Annual change in incidence (%)
2004	10 184	209(205-213)	-	-
2005	13 280	269(264-273)	3 096	28.7
2006	15 825	316(311-321)	2 545	17.5
2007	18 383	362(357-367)	2 558	14.6
2008	21 034	408(403-414)	2 651	12.7
2009	21 698	415(410-421)	664	1.7
2010	20 775	392(386-397)	-923	-5.5
2011	19 765	367(362-372)	-1 010	-6.4
2012	18 706	342(337-347)	-1 059	-6.8
2013	17 071	308(303-312)	-1 635	-9.9
2014	15 921	282(278-287)	-1 150	-8.4
2015	14 124	251(246-255)	-1 797	-11.0

The trend in mPTB incidence rates by district has been similar to the provincial picture (Table 18). Waterberg showed the highest mPTB incidence per 100 000 people in 2004 (285; 95%CI: 272-299) and remains the district with the highest incidence rate in 2015 (361; 95%CI: 347-376). The incidence rates in Waterberg are almost twice as high compared to Vhembe, while the remaining districts share a very similar incidence rate clustered around 250 per 100 000 people (Figure 30). By 2015 the overall incidence has been reduced by approximately 30% (between the peak incidence in the districts in 2008 and 2009).

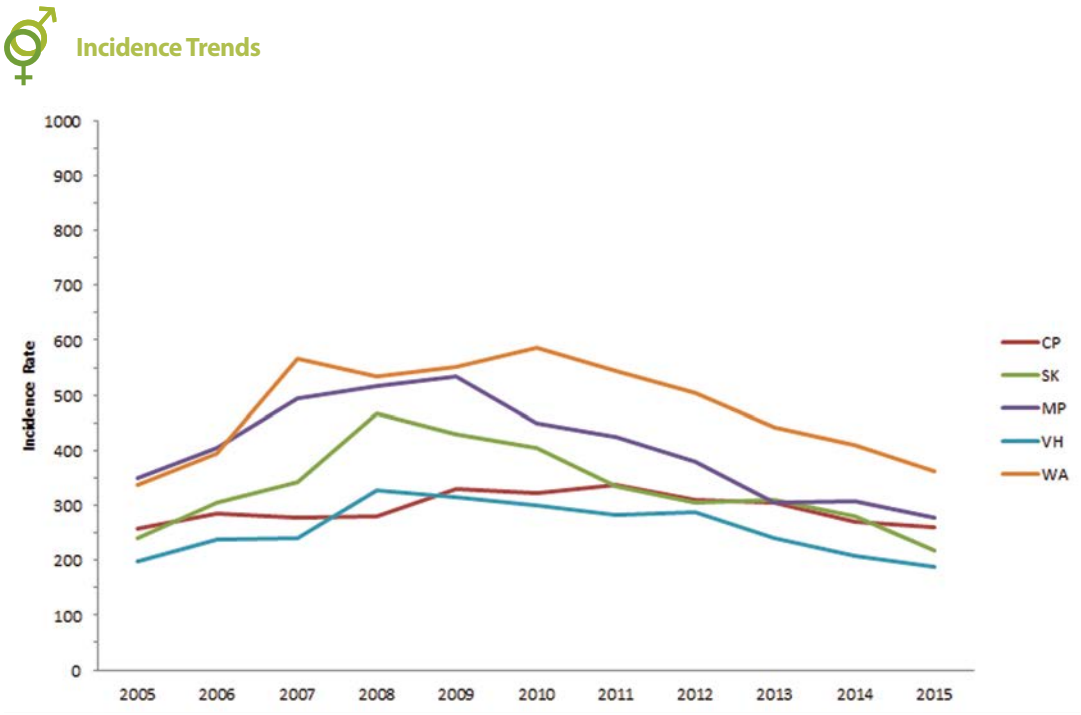


Figure 30: Trends in mPTB incidence rates by district, Limpopo: 2004-15

Table 18: mPTB case burden and incidence rates by district, Limpopo: 2004-2015

Year	Capricorn (CP)		Greater Sekhukhune (SK)		Mopani (MP)		Vhembe (VH)		Waterberg (WA)	
Year	n	Incidence (95%CI)	n	Incidence (95%CI)	n	Incidence (95%CI)	n	Incidence (95%CI)	n	Incidence (95%CI)
2004	2 869	252 (243-261)	1 955	201 (192-210)	2 364	240(230-250)	1 249	107 (101-113)	1 747	285 (272-299)
2005	2 961	257 (247-266)	2 366	240 (231-250)	3 504	351(339-362)	2 348	198 (190-206)	2 101	338 (324-353)
2006	3 341	286 (276-296)	3 039	304 (294-315)	4 086	403(391-416)	2 871	239 (231-248)	2 488	395 (380-411)
2007	3 281	277 (267-286)	3 463	342 (331-354)	5 084	495(482-509)	2 937	241 (233-250)	3 618	567 (548-585)
2008	3 367	280 (271-290)	4 792	467 (454-480)	5 380	517(503-531)	4 046	328 (318-338)	3 449	533 (515-551)
2009	4 025	330 (320-340)	4 471	429 (417-442)	5 627	533(519-547)	3 951	316 (306-326)	3 624	552 (534-570)
2010	3 987	322 (312-332)	4 270	404 (392-416)	4 808	449(436-461)	3 801	299 (290-309)	3 909	586 (568-605)
2011	4 244	338 (328-348)	3 600	336 (325-347)	4 615	424(412-437)	3 631	282 (273-291)	3 675	543 (526-561)
2012	3 972	311 (302-321)	3 321	305 (295-316)	4 187	379(368-391)	3 758	287 (278-296)	3 468	505 (488-522)
2013	3 963	306 (297-316)	3 420	309 (299-320)	3 418	305(295-315)	3 185	240 (231-248)	3 085	442 (427-458)
2014	3 562	271 (262-280)	3 137	279 (270-289)	3 504	307(297-318)	2 810	208 (200-216)	2 908	410 (396-426)
2015	3 419	260 (251-269)	2 438	217 (209-226)	3 164	278(268-287)	2543	188 (181-196)	25 60	361 (347-376)

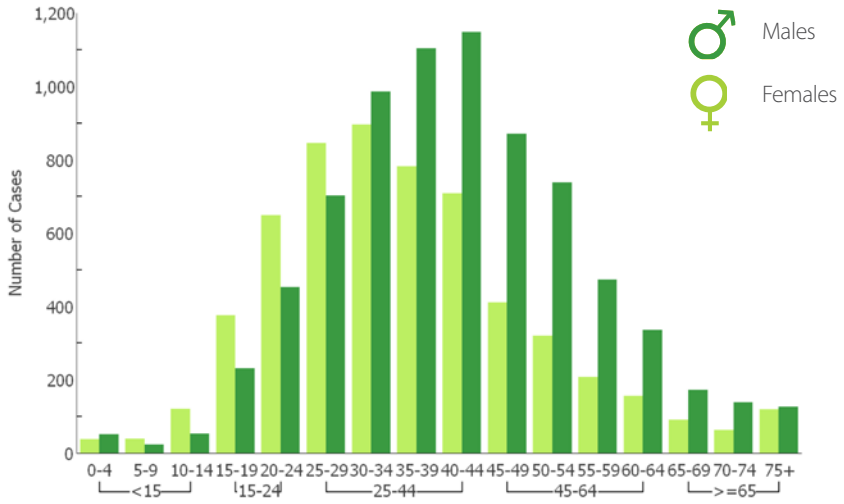
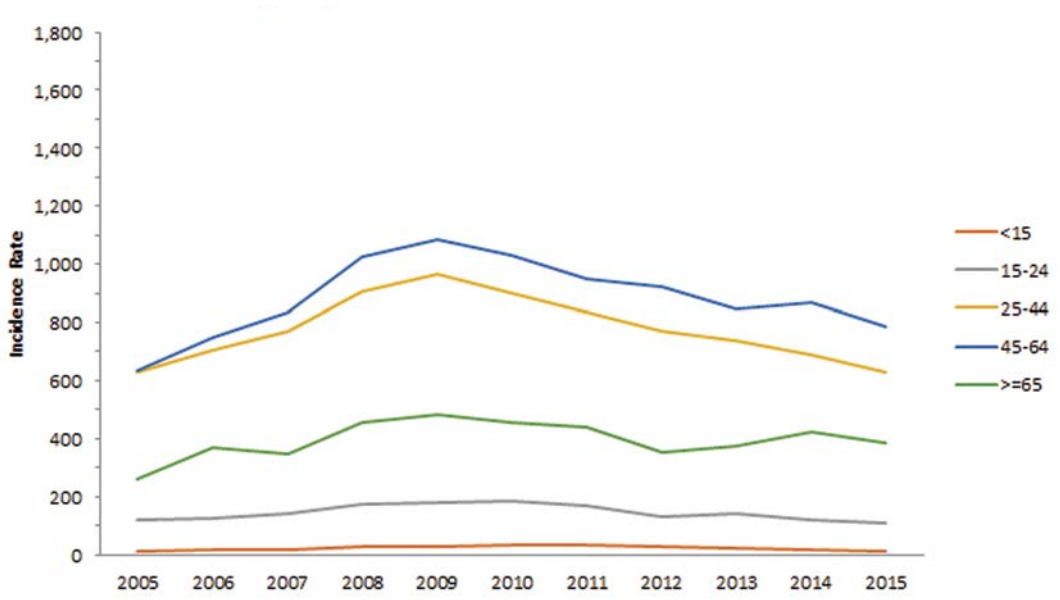


Figure 31: Age and gender population pyramid of mPTB cases, Limpopo: 2015

The most affected age group with mPTB are those in the economically active age groups (25-64) with a clear male dominance overall in 2015 (Figure 31). The declining trend for females (25-44 years) was also observed for this province. However it followed an initial sharp incline as shown in (Figure 32) starting in 2005 at 431 (95%CI:415-447) mPTB cases per 100 000 people, peaking in 2009 at 762 (95%CI:742-782) showing a 76.8% increase. This was followed by a sharp decline from the peak to 418 (95%CI:404-433) in 2015, a 45.1% decrease. Peculiar to this province is the higher mPTB incidence rate among 45-64 year old males compared with the male 25-44 year age group which is not seen in other provinces (Figure 32). This is possibly due the high migration of the younger 25-44 male age group, from this province for economic reasons. It would be important to assess loss to follow up rates for this age group and assess the need for strengthening the transfer of patients between provinces.

♂ Age specific incidence trends – Males



♀ Age specific incidence trends – Females

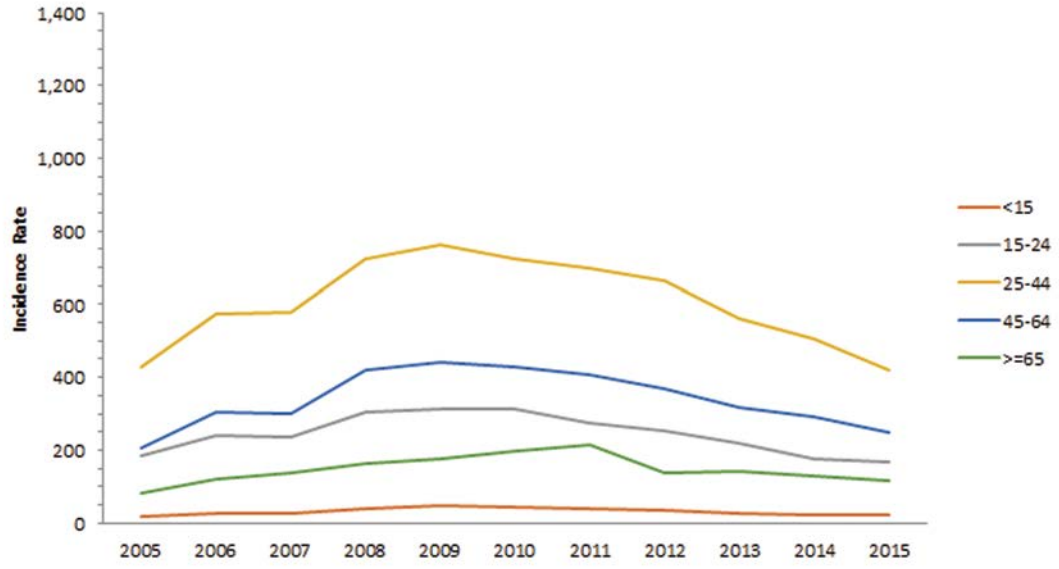


Figure 32: Trends in mPTB incidence rates by age and gender, Limpopo: 2004-15

Microbiologically confirmed rifampicin resistant tuberculosis

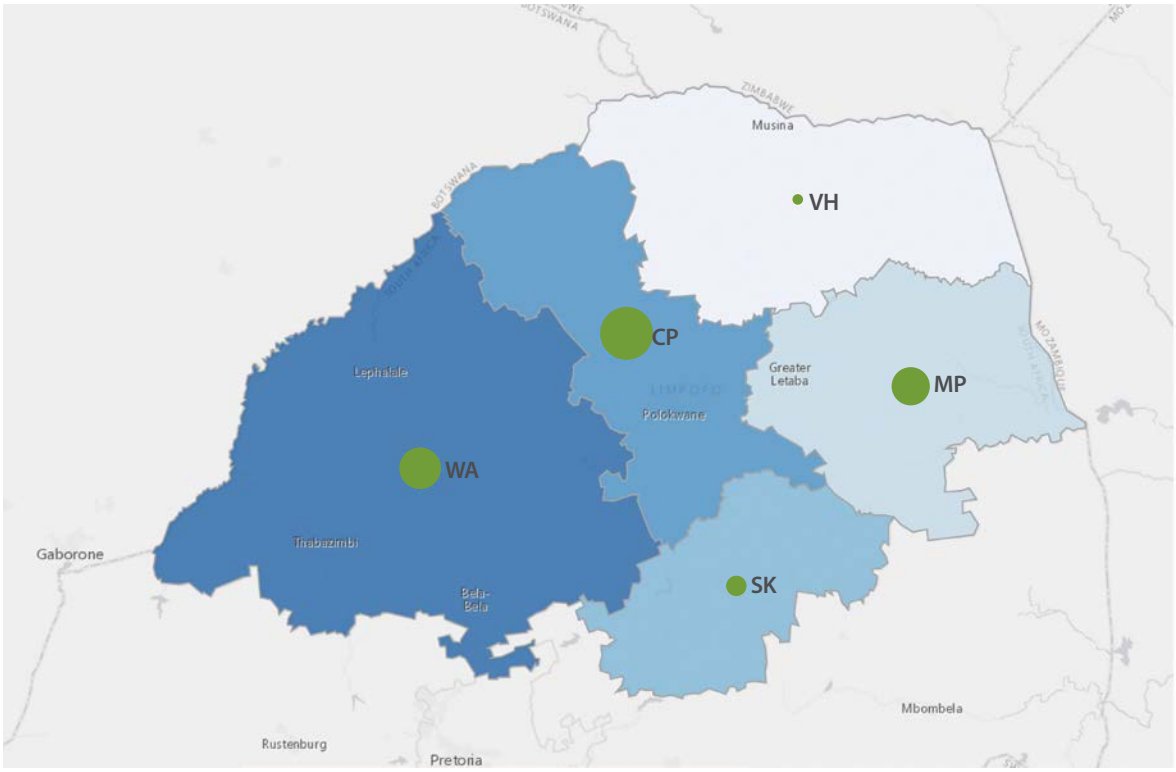


Figure 33: Rifampicin resistant mPTB case burden (circles) and incidence rates (shading), Limpopo: spatial distribution, 2015

The geographic distribution of the number of mPTB RR-TB cases and incidence rate of RR-TB per 100 mPTB cases is shown in Figure 33 and Table 19. The absolute burden of RR-TB cases in Limpopo is among the lowest in the country and fairly homogenous across the districts, with between 100 and 200 cases per year per district. The highest incidence rate is in Waterberg (7.1; 95%CI: 6.1-8.2) and reasons for this should be investigated.

Table 19: Rifampicin mPTB case burden and incidence rates among mPTB cases by district, Limpopo: 2015

District	Incidence (95% CI)
Capricorn	5.8 (5-6.7)
Greater Sekhukhune	5.5 (4.6-6.5)
Mopani	5.2 (4.4-6)
Vhembe	4.2 (3.5-5.1)
Waterberg	7.1 (6.1-8.2)

Summary

- 206 766 mPTB cases occurred between 2004 and 2015.
- The two highest burden districts are Capricorn and Mopani accounting for 46.6% of the absolute mPTB burden.
- mPTB incidence rates are on the decline with -9.9%, -8.4%, -11.0% year-on-year for 2013, 2014 and 2015 respectively and closely match the 10% required for the END TB targets.
- Among males, mPTB incidence rates were higher within the 45-64 age group than the 25-44 age group and this is different compared to other provinces.
- RR-TB absolute burden is low with between 100-200 cases per district per year.

MPUMALANGA

A total of 244 098 microbiologically confirmed cases of pulmonary TB (mPTB) were diagnosed in Mpumalanga between 2004 and 2015 (Table 20). The peak number of mPTB cases was 25 558 and occurred in 2008 and in the year 2015 the number of cases was 17 271. The district with the highest burden of mPTB cases was Ehlanzeni (8 283) and accounted for 48% of the total burden in 2015 (Table 21 and Figure 34). This pattern has remained unchanged when compared with 2004, with Gert Sibande and Nkangala reporting the second and third highest absolute number of mPTB cases.

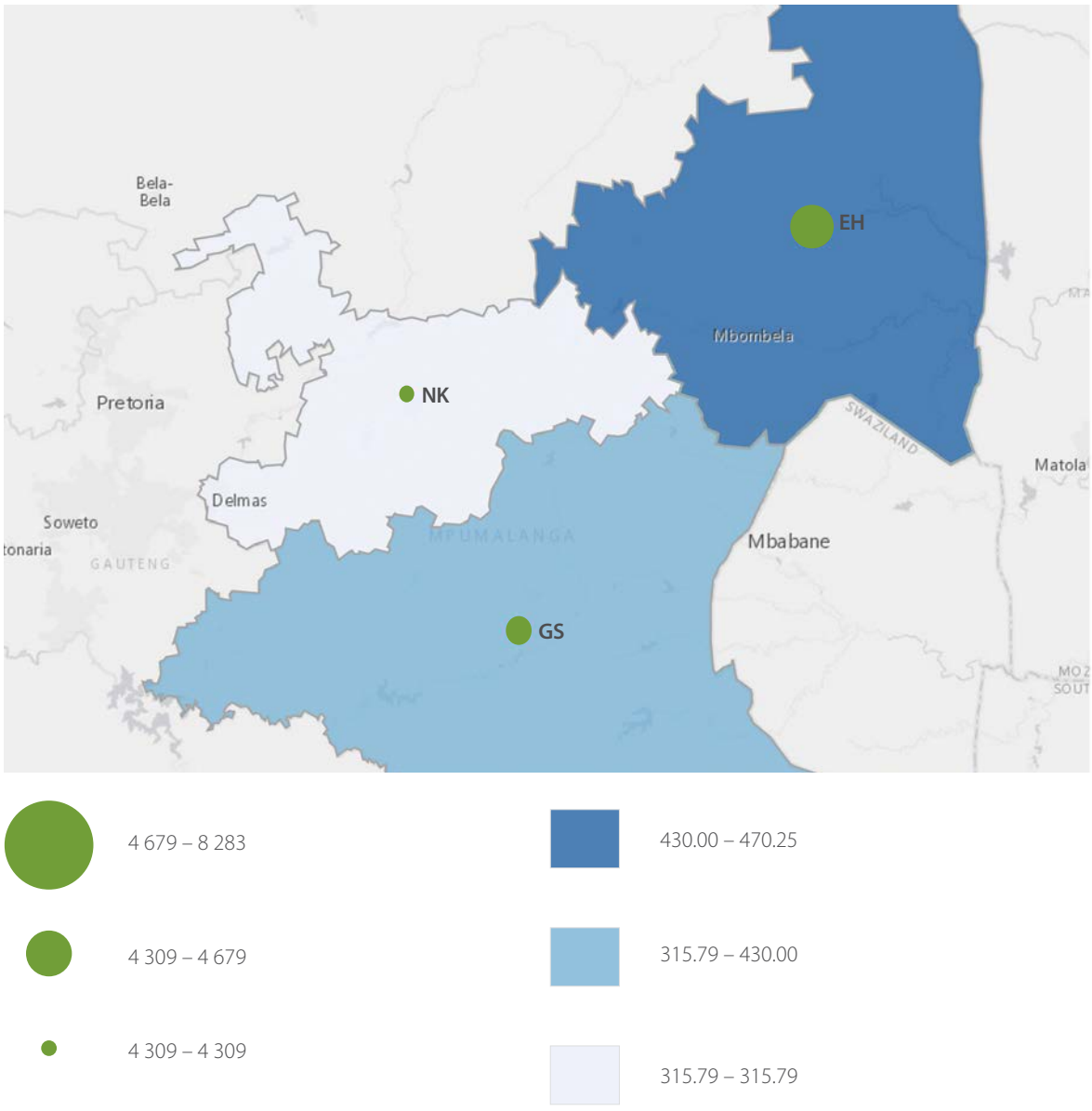


Figure 34: mPTB case burden (circles) and incidence rates (shading), Mpumalanga: spatial distribution, 2015

The overall trend in TB over the period showed increases in mPTB incidence rates peaking in 2008 at 664 (95%CI: 656-672) per 100 000 people and subsequently consistent declines to 410 (95%CI: 404-416) in 2015 (Table 20). The cumulative total of cases of TB averted between 2008 and 2015 was 8 287. This declining trend is consistent with what was previously reported[3], and has continued beyond 2012. The annual change has been -5.3%, -6.4% and -6.4% for the last three years as compared to the 10% required for the WHO End TB Strategy.

Table 20: mPTB case burden and incidence rates by year, Mpumalanga: 2004-2015

Year	n	Incidence/100 000 (95% CI)	Annual change in cases (n)	Annual change in incidence (%)
2004	15 906	436(429-443)	-	-
2005	18 691	506(499-513)	2 785	16.1
2006	20 018	535(527-542)	1 327	5.7
2007	22 384	590(582-597)	2 366	10.3
2008	25 558	664(656-672)	3 174	12.5
2009	23 485	601(594-609)	-2 073	-9.5
2010	22 294	562(555-570)	-1 191	-6.5
2011	20 447	508(501-515)	-1 847	-9.6
2012	20 192	494(488-501)	-255	-2.8
2013	19 413	468(461-475)	-779	-5.3
2014	18 439	438(431-444)	-974	-6.4
2015	17 271	410(404-416)	-1 168	-6.4

The incidence trend has been similar between districts and mirrors the provincial picture (Figure 35). Nkangala started at a low base and in 2004 had an incidence rate of half of that in Ehlanzeni; however, in 2015 the incidence in all three districts is closer and ranges between 316 and 470 per 100 000 people (Table 21). The distribution of mPTB incidence across the districts in Mpumalanga appears homogenous, although at a sub-district level, those neighbouring Mozambique and Swaziland show higher incidence rates.

Incidence Trends

Figure 35: Trends in mPTB incidence rates by district, Mpumalanga: 2004-15

Table 21: mPTB incident case burden and rates by district, Mpumalanga: 2004-2015

Year	Ehlanzeni (EH)		Gert Sibande (GS)		Nkangala (NK)	
	n	Incidence (95%CI)	n	Incidence (95%CI)	n	Incidence (95%CI)
2004	9 017	592 (579-604)	3 867	411 (398-424)	3 022	256 (247-265)
2005	9 822	636 (623-649)	5 054	530 (515-545)	3 815	319 (309-329)
2006	10 384	663 (651-676)	5 333	551 (537-566)	4 301	355 (344-365)
2007	10 901	687 (674-700)	6 302	643 (627-659)	5 181	421 (410-433)
2008	12 643	786 (772-799)	6 346	638 (623-654)	6 569	527 (514-540)
2009	10 593	649 (637-661)	5 866	582 (567-597)	7 026	555 (543-569)
2010	9 920	599 (587-611)	5 771	564 (549-579)	6 603	514 (502-527)
2011	8 693	517 (506-528)	5 684	547 (533-562)	6 070	466 (454-478)
2012	9 115	534 (523-545)	5 371	509 (496-523)	5 706	431 (420-443)
2013	8 976	518 (507-529)	5 049	471 (458-485)	5 388	401 (391-412)
2014	9 004	511 (501-522)	4 759	437 (425-450)	4 676	343 (333-353)
2015	8 283	470 (460-480)	4 679	430 (418-443)	4 309	316 (306-325)

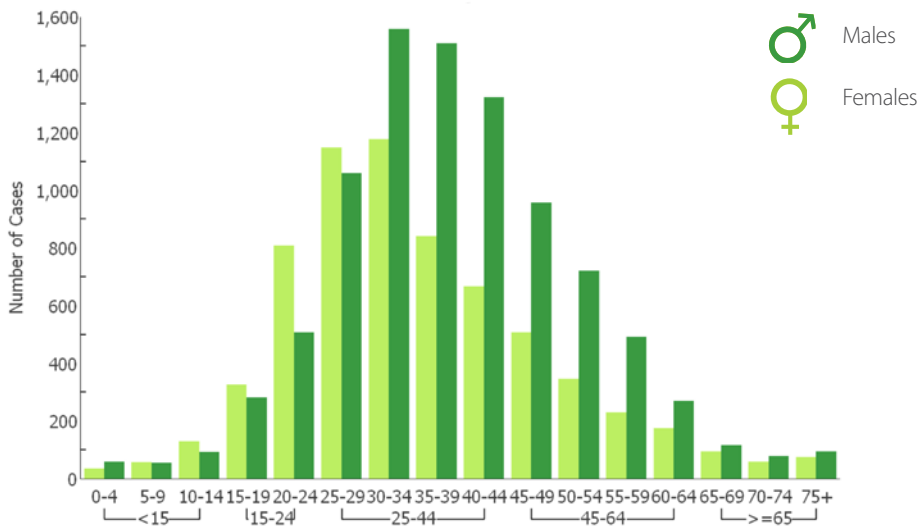
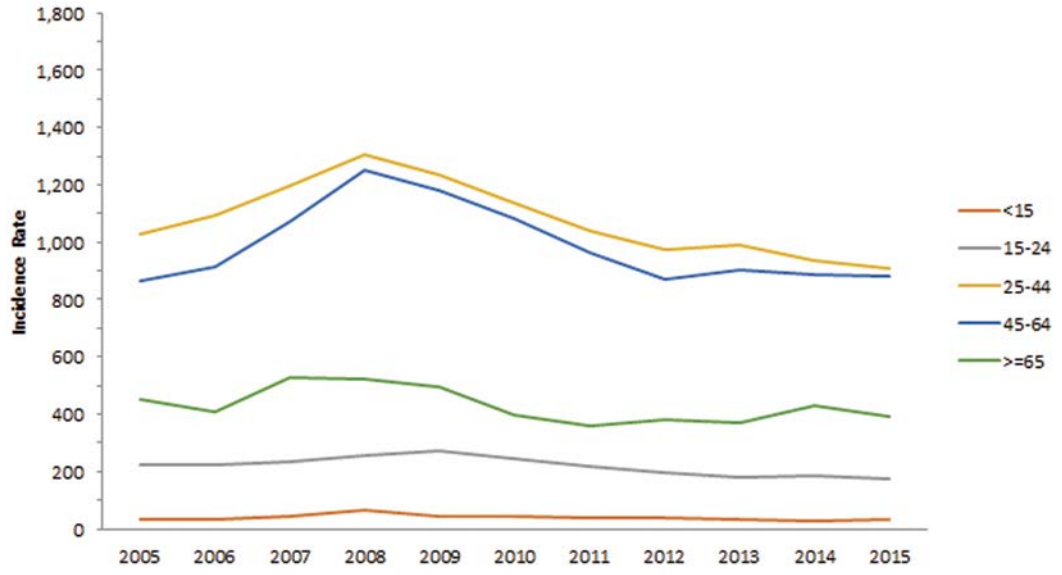


Figure 36: Age and gender population pyramid of mPTB incidence cases, Mpumalanga: 2015

The most affected with mPTB are the economically active age groups (25-44 years) with a clear male dominance overall in 2015 (Figure 36). The incidence trend showed the sharpest declines in women (25-44 years), which is consistent with national observations (Figure 37). Importantly, similar declines were observed for males, which is different from the national picture and very encouraging. However, overall declines have been minimal since 2012, and need to be investigated.

♂ Age specific incidence trends – Males



♀ Age specific incidence trends – Females

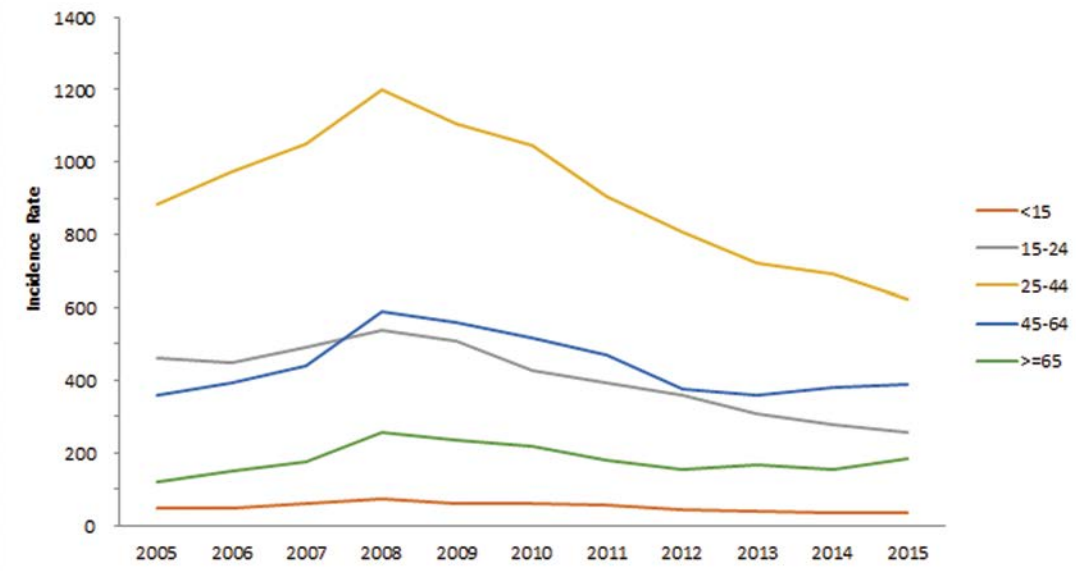


Figure 37: Trends in mPTB incidence rates by age and gender, Mpumalanga: 2004-15

Microbiologically confirmed rifampicin resistant tuberculosis

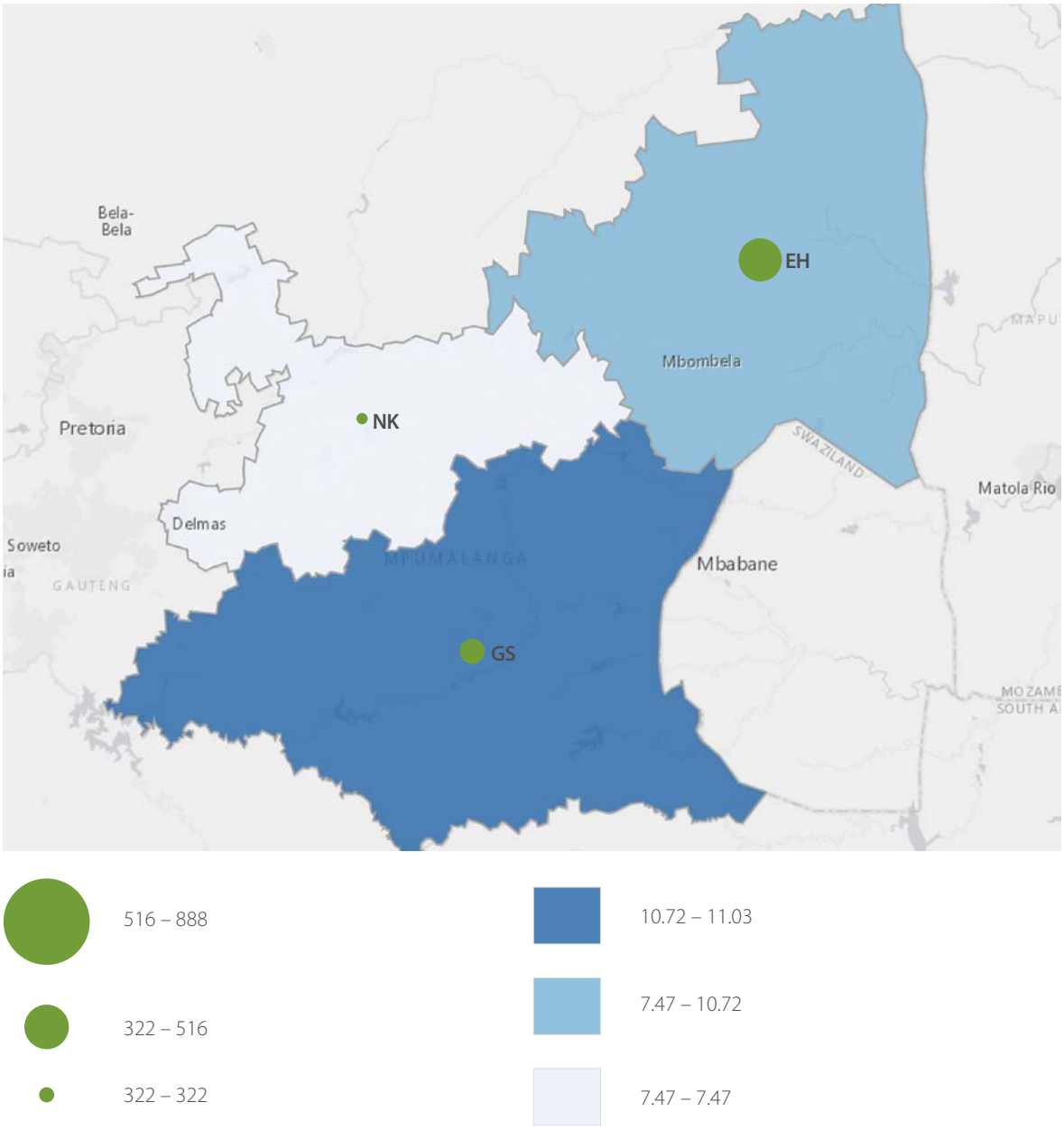


Figure 38: Rifampicin resistant mPTB case burden (circles) and incidence rates (shading), Mpumalanga: spatial distribution, 2015

The geographic distribution of the number of mPTB RR-TB cases and incidence rate of RR-TB per 100 mPTB cases is shown in Figure 38 and Table 22. The absolute burden of RR-TB cases is highest in the Ehlanzeni district (900) and equivalent to the combined total of the other two districts. It is important to note that the incidence rate in Ehlanzeni and Gert Sibande are among the highest nationally at 10.9 for both districts. This is concerning and has been previously noted in the SA TB DRS 2012-14 Report, showing this province has the highest rate of MDR-TB nationally. Several factors are contributory, including emergent mining activity, high poverty levels and HIV, economic cross-border migration and health systems challenges. Addressing these issues would be essential to control efforts.

Table 22: Rifampicin mPTB case burden and incidence rates among mPTB cases by district, Mpumalanga: 2015

District	Incidence (95% CI)
Ehlanzeni	10.9 (10.2-11.6)
Gert Sibande	10.9 (10-11.9)
Nkangala	7.5 (6.7-8.3)

Summary

- 244 098 mPTB cases occurred between 2004 and 2015.
- The highest burden district is Ehlanzeni and accounts for 48% of the absolute mPTB burden.
- mPTB incidence rates are on the decline with reductions of -5.3%, -6.4% and -6.4% for 2013, 2014 and 2015 respectively.
- Unlike several other provinces, declines in mPTB incidence rates have been observed in both males and females in the 25-44 age group.
- RR-TB incidence rates for Ehlanzeni and Gert Sibande districts are among the highest nationally.

NORTH WEST

A total of 246 768 microbiologically confirmed cases of pulmonary TB (mPTB) were diagnosed in North West between 2004 and 2015 (Table 23). The peak number of mPTB cases occurred in 2006 with a total of 27 100 and in the most recent reported year, 2015, the number of cases was 17 085. The burden of mPTB cases was almost equally distributed with a difference of only approximately 100 mPTB cases in three of the four districts (Figure 39 and Table 24). These districts account for 85.4% of the total burden in 2015, in order: Bojanala Platinum, Ngaka Modiri Molema and Dr Kenneth Kaunda. This pattern has changed since 2004 when Dr Kenneth Kaunda district had the highest number of mPTB cases – almost twice as high as any of the other districts.

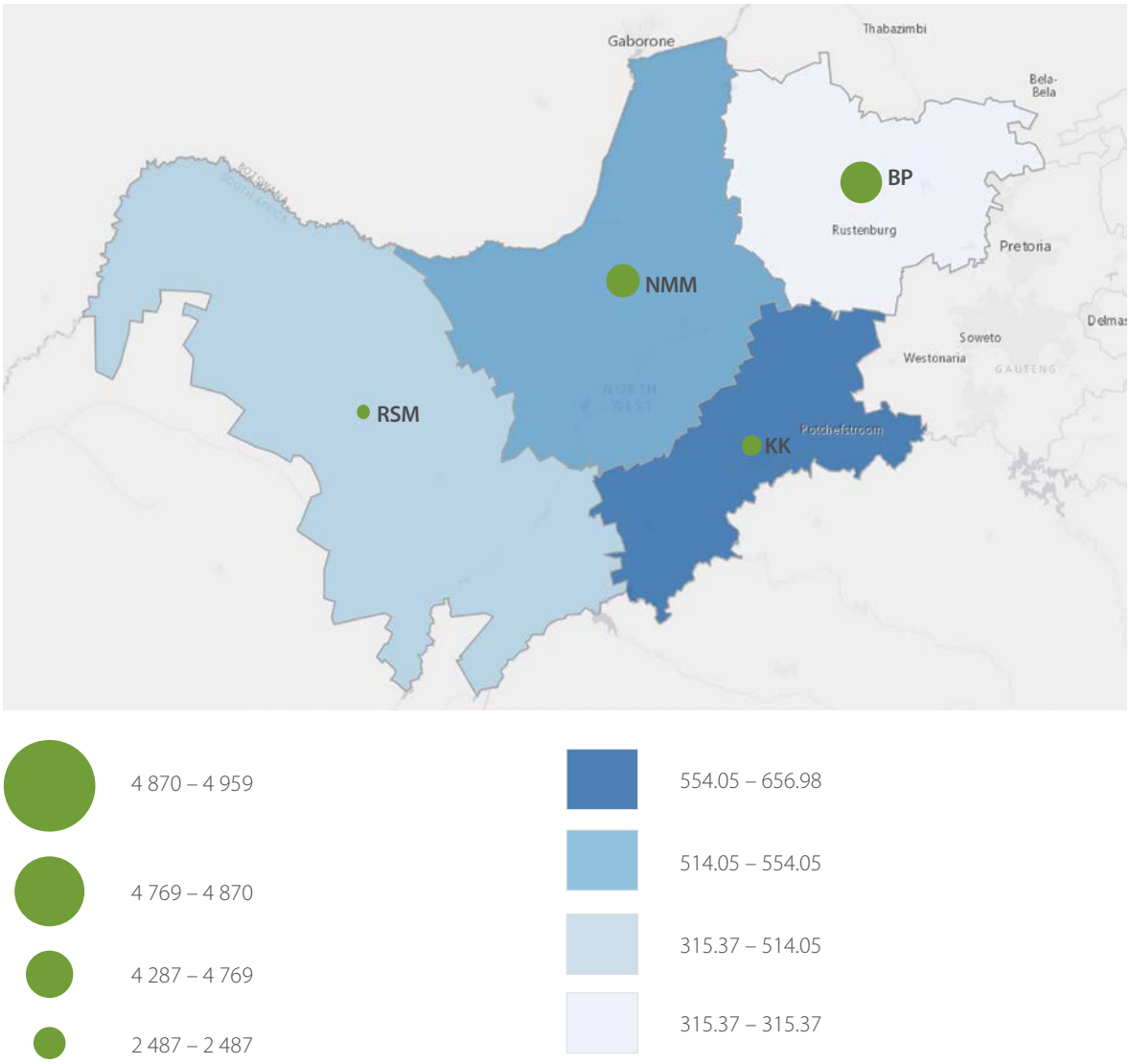


Figure 39: mPTB case burden (circles) and incidence rates (shading), North West: spatial distribution, 2015

The overall trend in TB over the period showed increases in mPTB incidence rates peaking as early as 2006 at 833 (95%CI: 823-843) per 100 000 people, with a relatively consistent decline to 467 (95%CI: 460-474) in 2015 (Table 23). The cumulative total cases of TB averted between 2006 and 2015 was 10 015. This decline is consistent with what was previously reported[3], however the trend beyond 2012 is relatively flat. Compared to the sharp declines between 2006 and 2012 which saw mPTB incidence rates nearly halve, the annual change has been +1.7%, -0.2% and -3.9 % for the last three years. This poses a major challenge in light of the targeted 10% set for the END TB strategy. In part this may be due to better case detection due to wider use of the GXP, as well as greater numbers of screening activities in the province's peri-mining communities, which may be masking the decline. If this is the case, it would serve to achieve long term benefits, though this will need to be investigated and additional interventions instituted to improve the annual decline in TB incidence required.

Table 23: mPTB case burden and incidence rates by year, North West: 2004-2015

Year	n	Incidence/100 000 (95% CI)	Annual change in cases (n)	Annual change in incidence (%)
2004	15 854	500(493-508)	-	-
2005	24 584	766(756-775)	8 730	53.2
2006	27 100	833(823-843)	2 516	8.7
2007	23 370	708(699-718)	-3 730	-15.0
2008	23 355	698(689-707)	-15	-1.4
2009	22 191	654(645-663)	-1 164	-6.3
2010	21 675	629(621-638)	-516	-3.8
2011	19 205	549(542-557)	-2 470	-12.7
2012	17 014	479(472-487)	-2 191	-12.8
2013	17 545	487(480-494)	531	1.7
2014	17 790	486(479-493)	245	-0.2
2015	17 085	467(460-474)	-705	-3.9

A striking observation when comparing districts is the large decline in Dr Kenneth Kaunda district which is the likely reason driving the successes in this province (Figure 40). This district has seen exceptionally high mPTB incidence rates of 1 754 (95% CI: 1722-1787) per 100 000 in 2006 drop by more than 50% in 2015 to an incidence rate of 657 (95%CI: 638-676). Several changes may explain this, including initial large mining activities in this region with generally high incidence rates and the subsequent shutting down of many mines. Additionally, over the years mining houses have taken on a greater responsibility for the health and wellbeing of mine workers and their families. Lastly, the upscaling of ART services over the period in this district has been successful and the current findings may be a reflection of the positive impact of these efforts. Compared to the trends observed for Dr Kenneth Kaunda, the other districts appear lackluster with minimal changes, except for Dr Segomotsi Mompati which demonstrates similarly good progress (Table 24). As targeted efforts will be important in this relatively sparsely populated province, a review of the current status in districts with a lower rate of change will be helpful, as well as a review at the sub-district level.

Incidence Trends

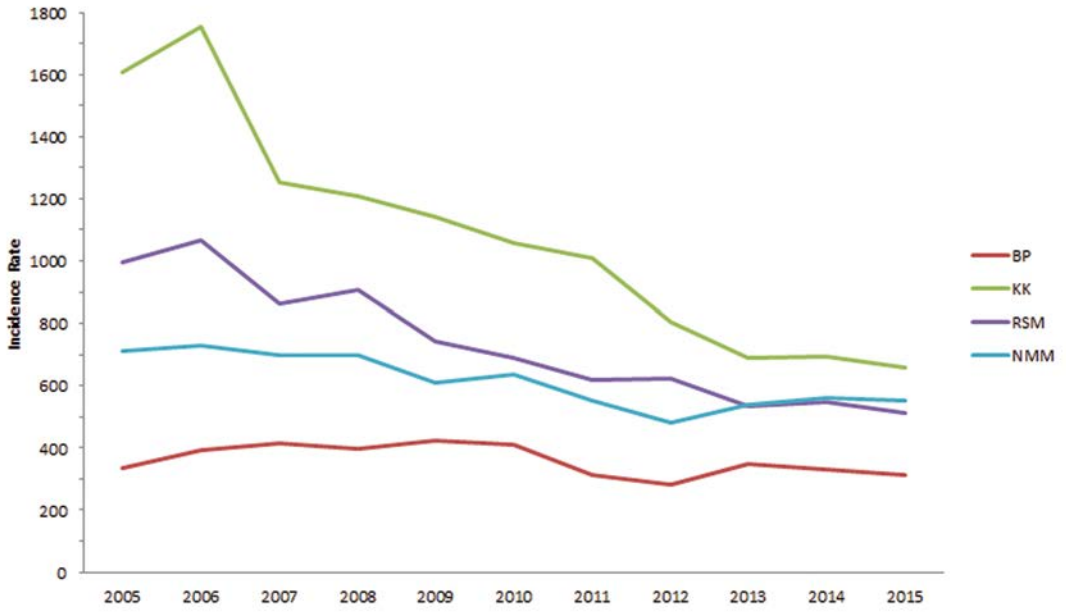


Figure 40: Trends in mPTB incidence rates by district, North West: 2004-15

Table 24: mPTB case burden and incidence rates by district, North West: 2004-2015

Year	Bojanala Platinum (BP)		Dr Kenneth Kaunda (KK)		Dr Ruth Segomotsi Mompati (RSM)		Ngaka Modiri Molema (NMM)	
	n	Incidence (95% CI)	n	Incidence (95% CI)	n	Incidence (95% CI)	n	Incidence (95% CI)
2004	3 639	267 (259-276)	6 619	1054 (1029-1079)	2 569	614 (590-638)	3 027	398 (384-412)
2005	4 633	336 (326-346)	10 243	1609 (1578-1641)	4 217	994 (964-1025)	5 491	712 (694-732)
2006	5 505	394 (384-404)	11 315	1754 (1722-1787)	4 588	1067 (1036-1098)	5 692	729 (710-748)
2007	5 877	415 (404-426)	8 201	1254 (1227-1281)	3 767	864 (837-892)	5 525	698 (679-716)
2008	5 712	398 (387-408)	8 016	1209 (1182-1235)	4 015	908 (880-937)	5 612	699 (681-717)
2009	6 207	426 (415-437)	7 679	1141 (1116-1167)	3 325	741 (716-767)	4 980	611 (594-628)
2010	6 058	410 (399-420)	7 211	1056 (1032-1081)	3 137	689 (665-714)	5 269	637 (620-655)
2011	4 712	314 (305-323)	7 005	1011 (987-1035)	2 860	619 (597-642)	4 628	552 (536-568)
2012	4 325	284 (275-292)	5 676	807 (786-828)	2 922	623 (601-646)	4 091	480 (466-495)
2013	5 411	350 (340-359)	4 939	691 (672-711)	2 542	534 (513-555)	4 653	538 (522-553)
2014	5 185	330 (321-339)	5 035	694 (675-713)	2 640	546 (525-567)	4 930	561 (545-577)
2015	4 959	315 (307-324)	4 769	657 (638-676)	2 487	514 (494-535)	4 870	554 (539-570)

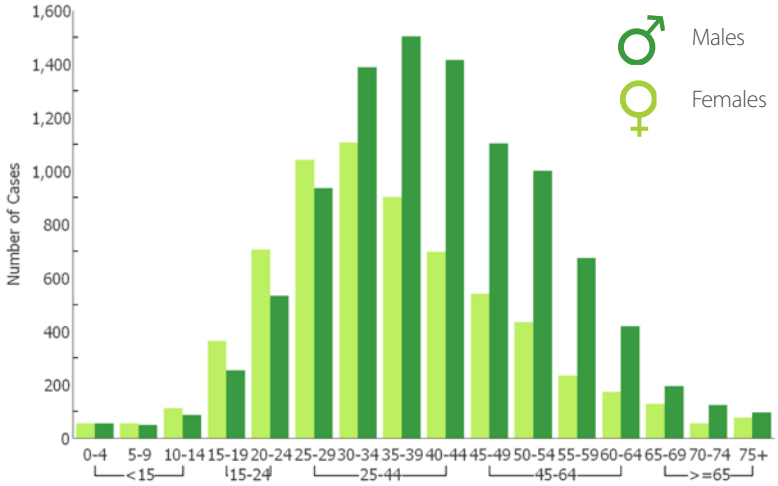
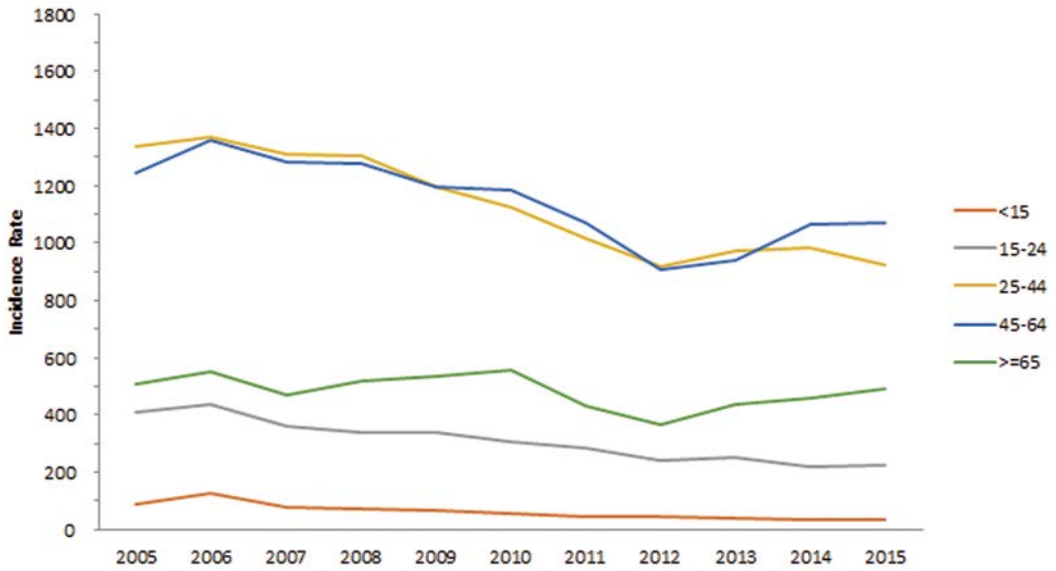


Figure 41: Age and gender population pyramid of mPTB cases, North West: 2015

The age groups most affected with mPTB are males between 25-64 years and females between 20-40 years (Figure 41). In line with the national pattern, incidence trends showed the sharpest declines among women (25-44), but was also observed among men (Figure 42). The notable difference is the increase observed in men aged 45-64 years with an incidence rate of 905 (95%CI: 871-940) in 2012 increasing to 1 069 (95%CI: 1032-1107) in 2015. This increase is consistent with efforts in mining and peri-mining communities in recent years and indicates that improvement in case detection has materialised in these communities, which will hopefully provide lasting benefits.

♂ Age specific incidence trends – Males



♀ Age specific incidence trends – Females

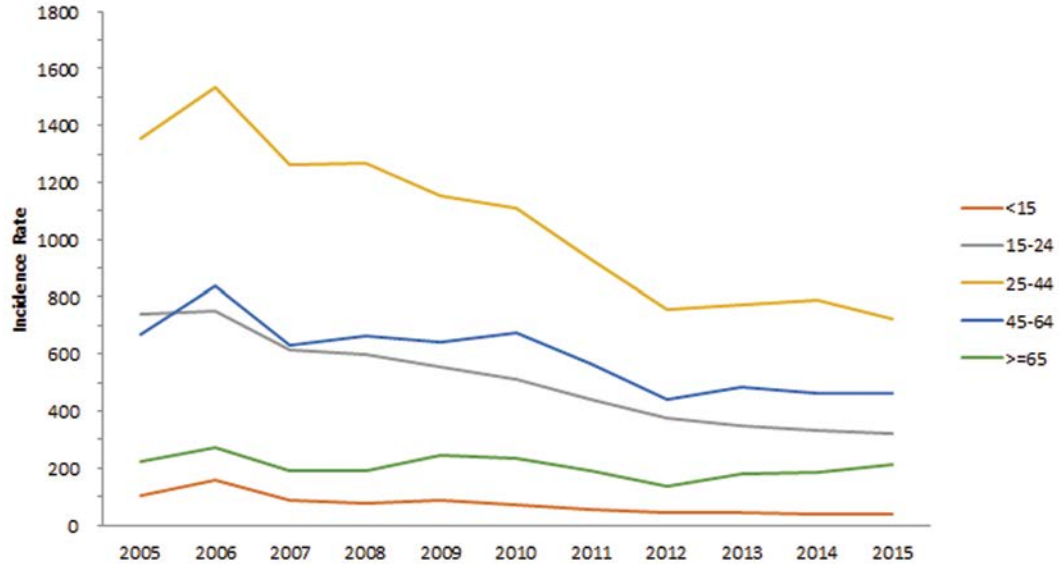


Figure 42: Trends in mPTB incidence rates by age and gender, North West: 2004-15

Microbiologically confirmed rifampicin resistant tuberculosis

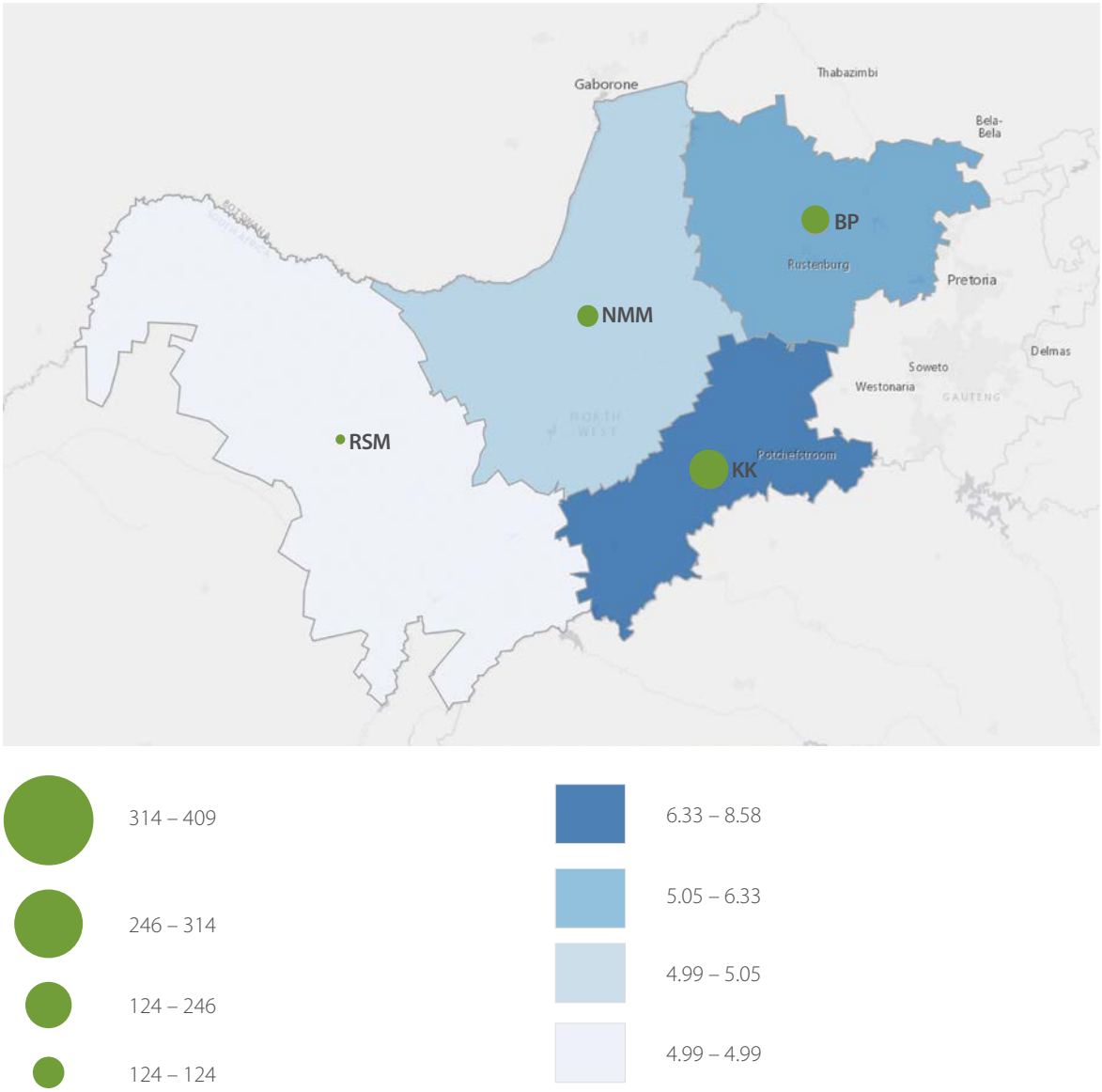


Figure 43: Rifampicin resistant mPTB case burden (circles) and incidence rates (shading), North West: spatial distribution, 2015

The geographic distribution of the number of mPTB RR-TB cases and incidence rate of RR-TB per 100 mPTB cases is shown in Figure 43 and Table 25. The absolute burden of RR-TB cases is highest in Dr Kenneth Kaunda district (420) which, together with Bojanala Platinum (313), accounts for 66.3% of the total RR-TB burden in the province. Importantly, the Dr Kenneth Kaunda district has a notably higher incidence rate of 8.8 (95%CI: 8-9.7) per 100 mPTB TB cases. This indicates a higher rate of transmission in this district and further investigations are required. The possible role of mines and congregate settings should be investigated for this area, and interventions aimed at improving case detection, including household contact tracing.

Table 25: Rifampicin mPTB case burden and incidence rates among mPTB cases by district, North West: 2015

District	Incidence (95% CI)
Bojanala Platinum	6.3 (5.6-7.1)
Dr Kenneth Kaunda	8.8 (8-9.7)
Dr Ruth Segomotsi Mompati	5 (4.2-6)
Ngaka Modiri Molema	5.1 (4.5-5.7)

Summary

- 246 768 mPTB cases occurred between 2004 and 2015.
- Bojanala Platinum, Ngaka Modiri Molema and Dr Kenneth Kaunda districts together account for 85.4% of the total mPTB burden for 2015.
- The mPTB incidence rate has been on the decline since 2006; however this has flat-lined in the last three years at +1.7%, -0.2% and -3.9 % for 2013, 2014 and 2015 respectively.
- The mPTB incidence rates has more than halved in the Dr Kenneth Kaunda district and is likely the main driver of the provincial decline in incidence rates observed).
- Declining mPTB incidence rates have shown an encouragingly similar trend for both males and females in the 25-44 age group.
- The rise in incidence rate in males aged 45-64 years is concerning.
- RR-TB burden is relatively low in this province, however incidence rates in Dr Kenneth Kaunda district are notably higher and require further investigation.

NORTHERN CAPE

Between 2004 and 2015, a total of 118 995 microbiologically confirmed cases of pulmonary TB (mPTB) were diagnosed in Northern Cape (Table 26). The peak number of mPTB cases identified for the reporting period was 12 812 and occurred in 2005, while in 2015 the number of cases was 9 682. The two highest burden districts by absolute number of mPTB cases were Frances Baard (3 066) and ZF Mgcawu (2 397); together accounting for 56.4% of the total burden in 2015 (Figure 44 and Table 27). This pattern has remained unchanged over the period comparing 2004 and 2015.

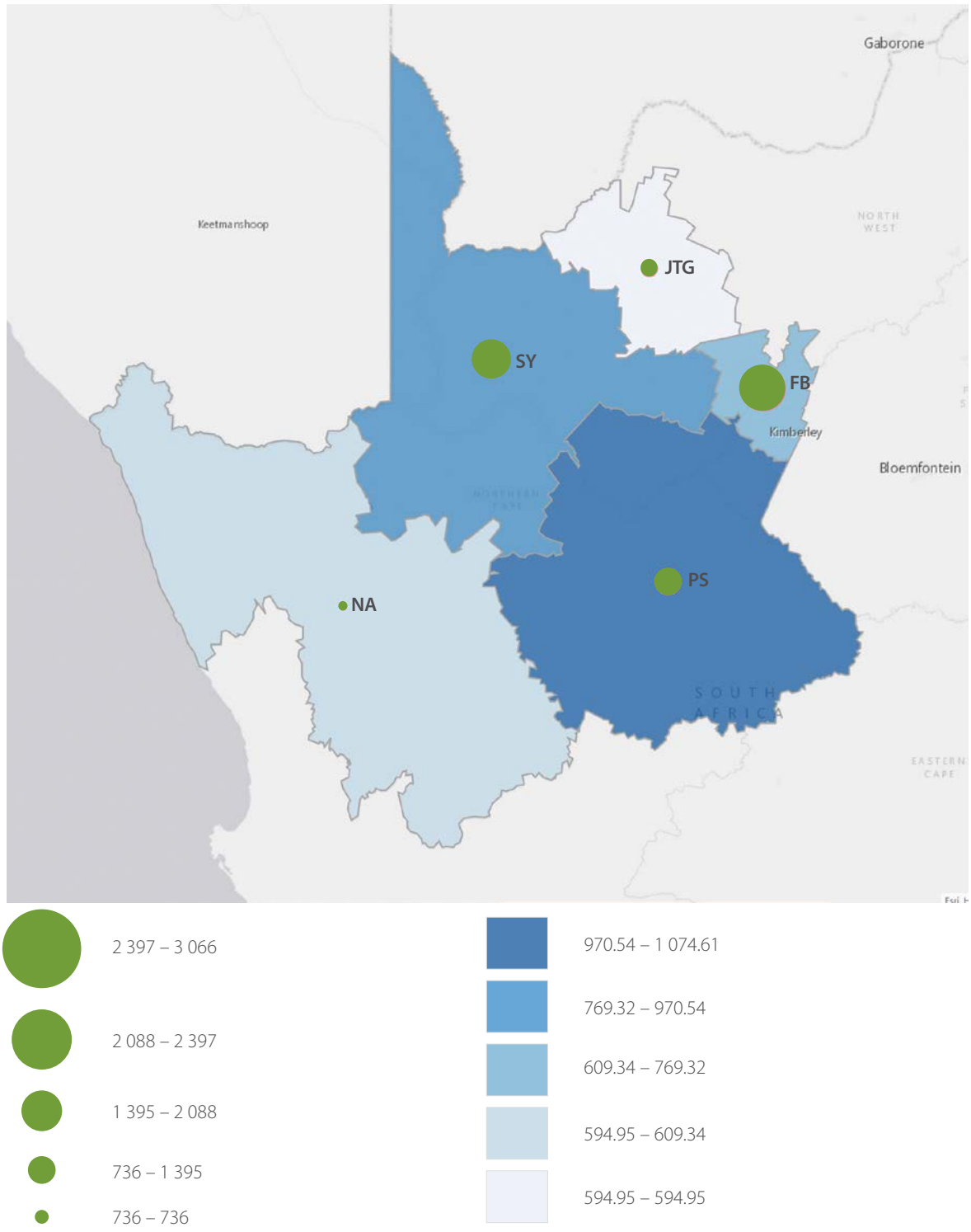


Figure 44: mPTB case burden (circles) and incidence rates (shading), Northern Cape: spatial distribution, 2015

The overall trend over the period showed declines in mPTB incidence rates starting at 1 223 (95% CI: 1201-1244) per 100 000 people in 2005 and declining to 634 (95%CI: 619-649) in 2010 (Table 26). Unlike other provinces with a downward trajectory, consistent inclines in mPTB incidence have been observed in this province to 810 (95%CI: 794-826) per 100 000 in 2015. It is possible that the increase is driven by improvement of quality diagnostics (e.g. GXP) in difficult to access communities typical of this province. However the GXP was introduced in 2011, and by 2015 we would expect the impact to diminish and declines to occur. Further investigations will be needed to determine reasons for these changes. The annual change has been +10.6%, -1.0% , +0.7% for the last three years and poses a major challenge in light of the targeted 10% set for the WHO End TB Strategy. In terms of absolute numbers, the Northern Cape's contribution to the target at a national level is likely to be small but remains a concern at the local level.

Table 26: mPTB case burden and incidencs rates by year, Northern Cape: 2004-2015

Year	n	Incidence/100 000 (95% CI)	Annual change in cases (n)	Annual change in incidence (%)
2004	11 669	1128(1108-1149)	-	-
2005	12 812	1223(1201-1244)	1143	8.4
2006	11 582	1090(1071-1110)	-1230	-10.9
2007	10 564	981(962-1000)	-1018	-10.0
2008	10 615	972(953-991)	51	-0.9
2009	8 487	766(750-782)	-2128	-21.2
2010	7 129	634(619-649)	-1358	-17.2
2011	8 796	771(755-787)	1667	21.6
2012	8 502	734(718-750)	-294	-4.8
2013	9 550	812(796-828)	1048	10.6
2014	9 607	804(788-820)	57	-1.0
2015	9 682	810(794-826)	75	0.7

Incidence rates by district have been generally high across the province and showed declines in the earlier years; however two districts (Frances Baard and ZF Mgcawu) have shown a marked upward trend since 2010 and may also be responsible for the provincial changes noted (Figure 45). Further investigations are required to determine reasons for this change in trend. The district with the highest incidence in 2015 was Pixley Ka Seme (Table 27) at above 1 000 per 100 000 people. This incidence will also need to be reviewed further.

Incidence Trends

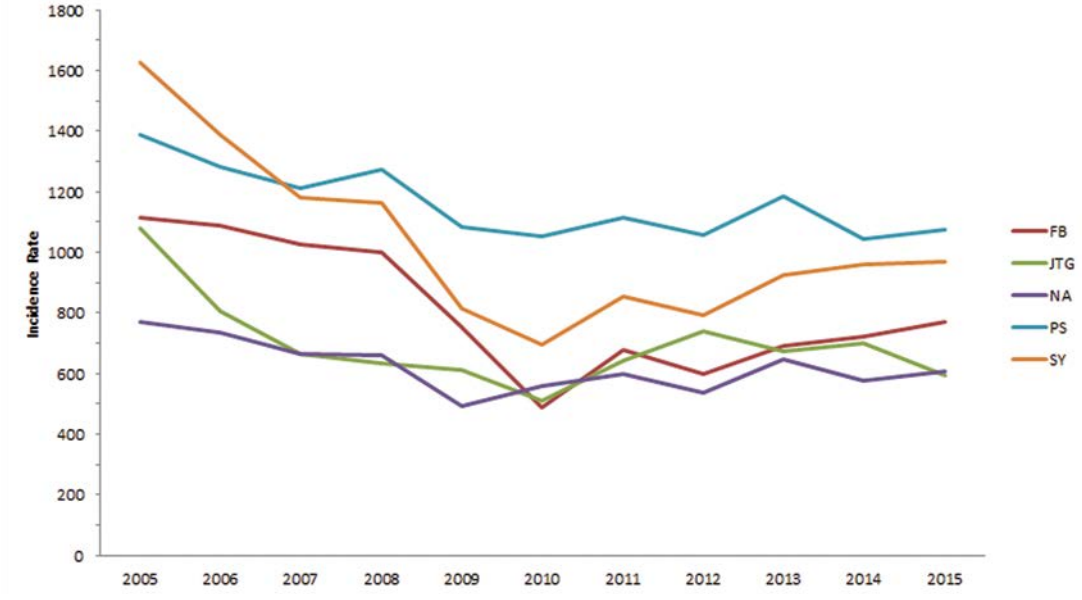


Figure 45: Trends in mPTB incidence rates by district, Northern Cape: 2004-15

Table 27: mPTB case burden and incidence rates by district, Northern Cape: 2004-2015

Year	Frances Baard (FB)		John Taolo Gaetsewe (JTG)		Namakwa (NA)		Pixley Ka Seme (PS)		ZF Mgcawu (SY)	
	n	Incidence (95% CI)	n	Incidence (95% CI)	n	Incidence (95% CI)	n	Incidence (95% CI)	n	Incidence (95% CI)
2004	4 072	1 181 (1 145-1 218)	1 222	602 (569-637)	901	862 (807-920)	2 144	1 275 (1 221-1 330)	3 330	1 558 (1 505-1 612)
2005	3 898	1 115 (1 081-1 151)	2 220	1 080 (1 035-1 126)	815	769 (717-824)	2 362	1 386 (1 331-1 443)	3 517	1 624 (1 571-1 678)
2006	3 858	1 089 (1 055-1 124)	1 677	805 (767-844)	788	734 (684-787)	2 217	1 283 (1 231-1 338)	3 042	1 386 (1 337-1 436)
2007	3 688	1 027 (994-1061)	1 402	664 (629-699)	722	663 (616-713)	2 125	1 213 (1 162-1 266)	2 627	1 180 (1 136-1 226)
2008	3 641	1 000 (968-1033)	1 356	633 (600-667)	730	661 (614-711)	2 263	1 274 (1 222-1 328)	2 625	1 163 (1 119-1 208)
2009	2 782	753 (725-782)	1 333	613 (581-647)	553	494 (453-537)	1 953	1 084 (1 036-1 133)	1 866	815 (778-853)
2010	1 829	488 (466-511)	1 129	512 (482-543)	636	560 (517-605)	1 922	1 051 (1 005-1 099)	1 613	694 (661-729)
2011	2 574	676 (651-703)	1 438	642 (610-676)	692	599 (555-646)	2 072	1 116 (1 069-1 166)	2 020	856 (820-895)
2012	2 310	598 (574-623)	1 684	741 (706-777)	627	536 (494-579)	1 986	1 055 (1 009-1 102)	1 895	792 (756-828)
2013	2 718	693 (667-719)	1 550	672 (639-706)	767	645 (600-693)	2 270	1 187 (1 138-1 237)	2 245	923 (886-962)
2014	2 871	720 (694-747)	1 637	698 (665-733)	694	575 (533-619)	2 031	1 045 (1 000-1 092)	2 374	961 (923-1001)
2015	3 066	769 (742-797)	1 395	595 (564-627)	736	609 (566-655)	2 088	1 075 (1 029-1 122)	2 397	971 (932-1010)

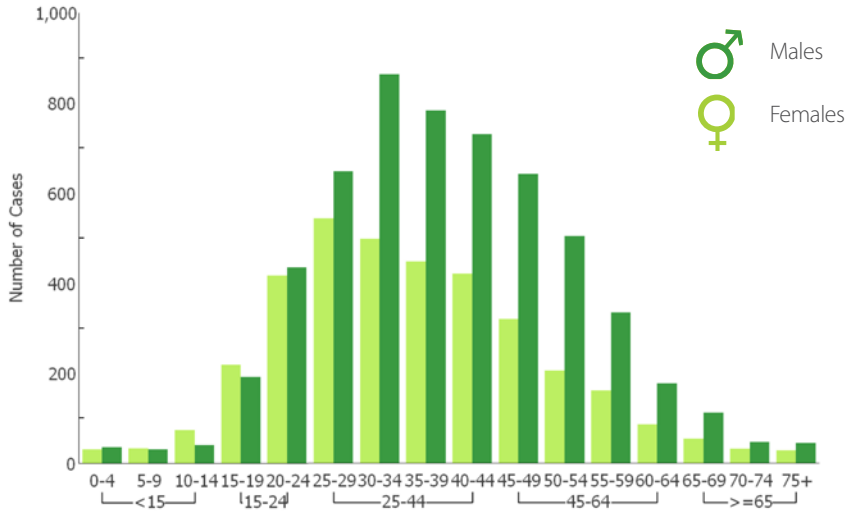
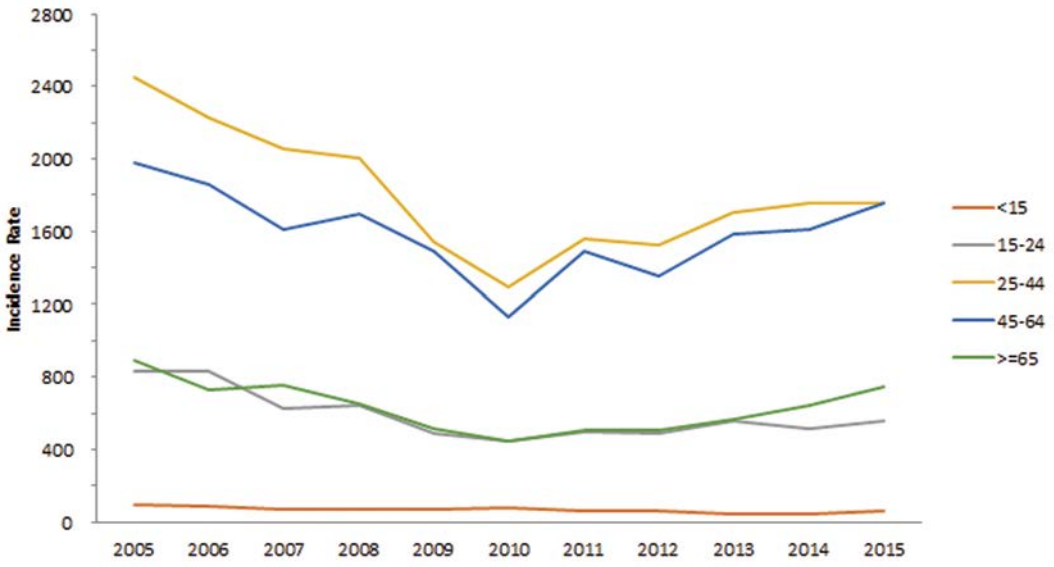


Figure 46: Age and gender population pyramid of mPTB cases, Northern Cape: 2015

♂ Age specific incidence trends – Males



♀ Age specific incidence trends – Females

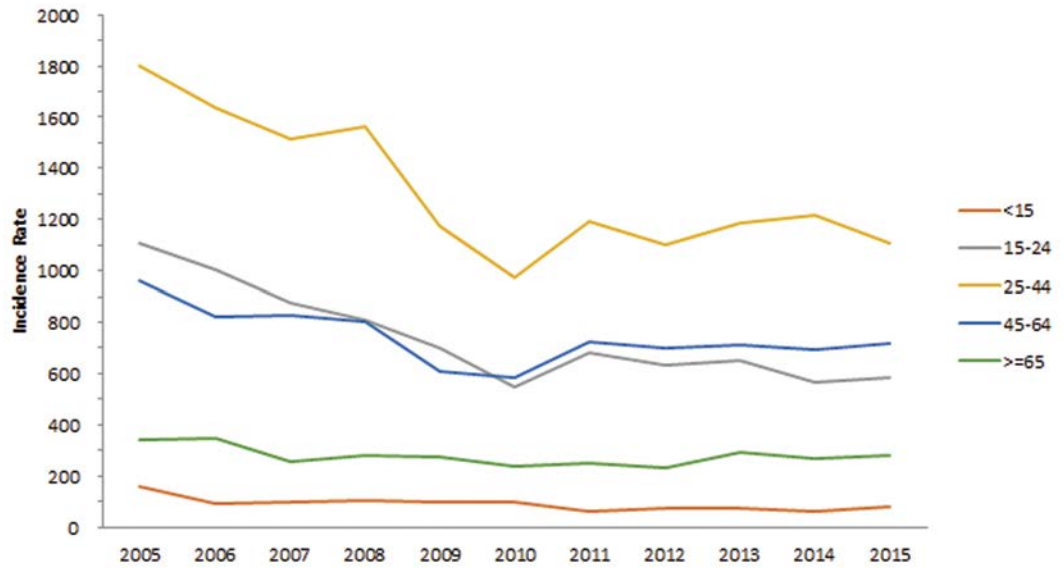


Figure 47: Trends in mPTB incidence rates by age and gender, Northern Cape: 2004-15

Unsurprisingly, those most affected by mPTB are in the economically active age groups (25-44 and 45-49 years), with a clear male dominance overall in 2015 (Figure 46). Incidence trends showed the sharpest decline among women (25-44), but this was also observed among men in the same age group, which dropped by almost 50% between 2005 and 2010 (Figure 47). The incidence rate in 2005 for women was almost 2 000 per 100 000 people, and for males close to 2 500 per 100 000 people, which is among the highest nationally and closely comparable to previous observations in high risk congregate groups like mine workers and inmates. Of concern is the increase in mPTB incidence rates occurring since 2010 among adult males above the age of 24 years. This seems the likely driver of the provincial increase and efforts tailored for this population group are needed.

Microbiologically confirmed rifampicin resistant tuberculosis

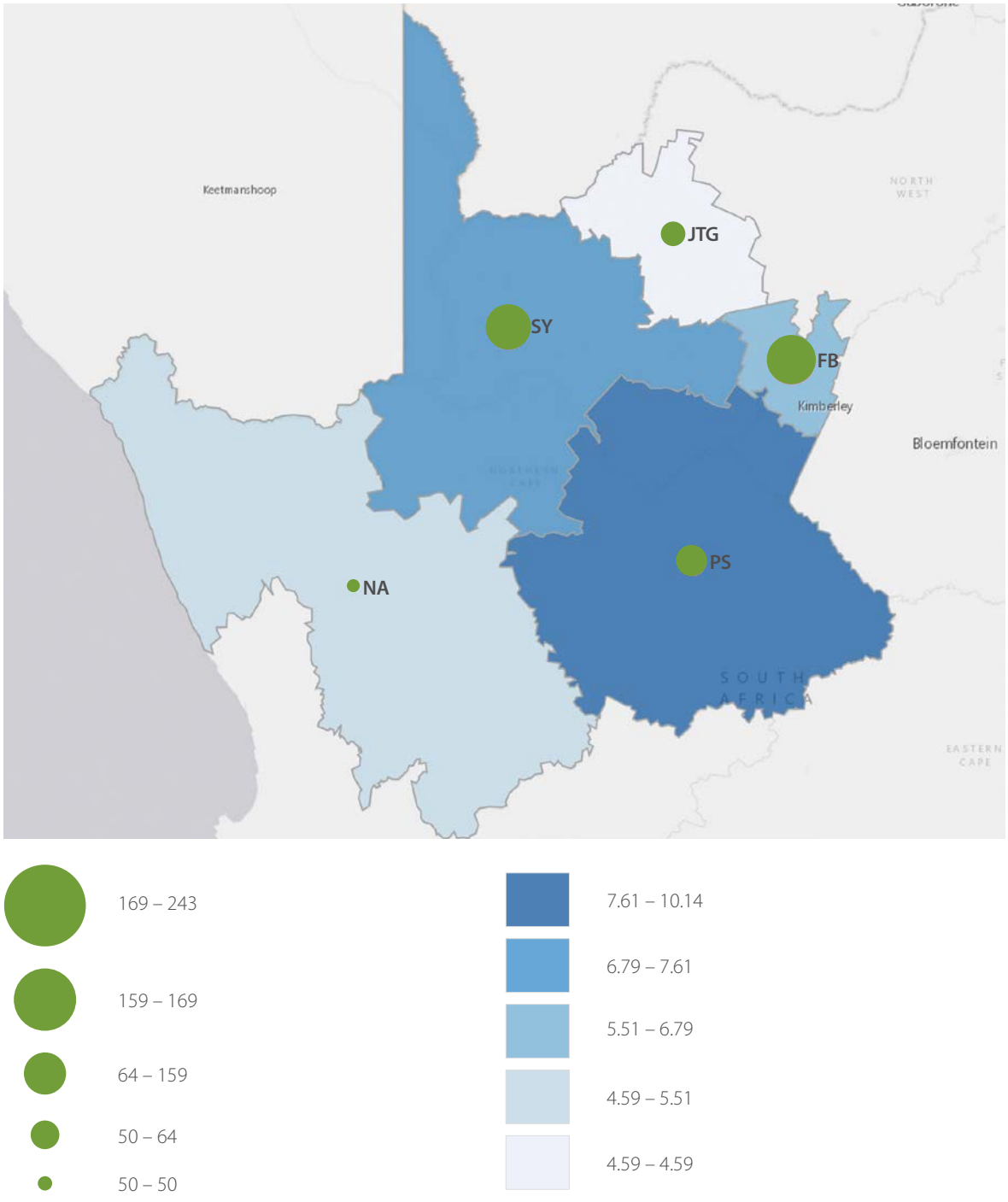


Figure 48: Rifampicin resistant mPTB case burden (circles) and incidence rates (shading), Northern Cape: spatial distribution, 2015

The geographic distribution of the number of mPTB RR-TB cases and incidence rate of RR-TB per 100 mPTB cases is shown in Figure 48 and Table 28. The highest absolute burden and incidence rate of RR-TB cases is in ZF Mgcawu district with 240 cases and an incidence rate of 10 (8.8-11.4). Although the absolute burden in the province is low, the latter incidence rate is above the national average and also closely comparable to high incidence areas in Eastern Cape, KwaZulu-Natal and Mpumalanga – provinces with a known drug resistance problem. This district is a concern and efforts to determine the relative importance of underlying risks, including health service access for the large farming sector and cross-border economic migration, will need a tailored response to improve control efforts.

Table 28: Rifampicin mPTB case burden and incidence rates among mPTB cases by district, Northern Cape: 2015

District	Incidence (95% CI)
Frances Baard	5.8 (5-6.7)
John Taolo Gaetsewe	4.7 (3.7-6)
Namakwa	6.9 (5.2-9.1)
Pixley Ka Seme	7.7 (6.6-9)
ZF Mgcawu	10 (8.8-11.4)

Summary

- 118 995 mPTB cases occurred between 2004 and 2015.
- The two highest burden districts are Frances Baard and ZF Mgcawu, accounting for 56.4% of the absolute mPTB burden and also the districts showing the sharpest inclines.
- mPTB incidence rates are on the increase and unlike the national pattern, show a year-on-year change of +10.6%, -1,0% and +0.7% for 2013, 2014 and 2015 respectively.
- Increases have been observed particularly among adult males aged 25 years and older as well as in the Frances Baard and ZF Mgcawu districts.
- The overall RR-TB burden in this province is small; however the ZF Mgcawu district has among the highest RR-TB incidence rates in the country and will require further investigation.

WESTERN CAPE

Between 2004 and 2015, a total of 525 548 microbiologically confirmed cases of pulmonary TB (mPTB) were diagnosed in the Western Cape (Table 29). The peak number of mPTB cases identified for the reporting period was in 2006 (55 295) and in the most recent year (2015), the number of cases was 37 967. The highest burden of mPTB cases occurred in the City of Cape Town and accounted for 56.5% of the total burden in 2015 (Figure 49 and Table 30). This pattern has remained unchanged over the period from 2004 to 2015.

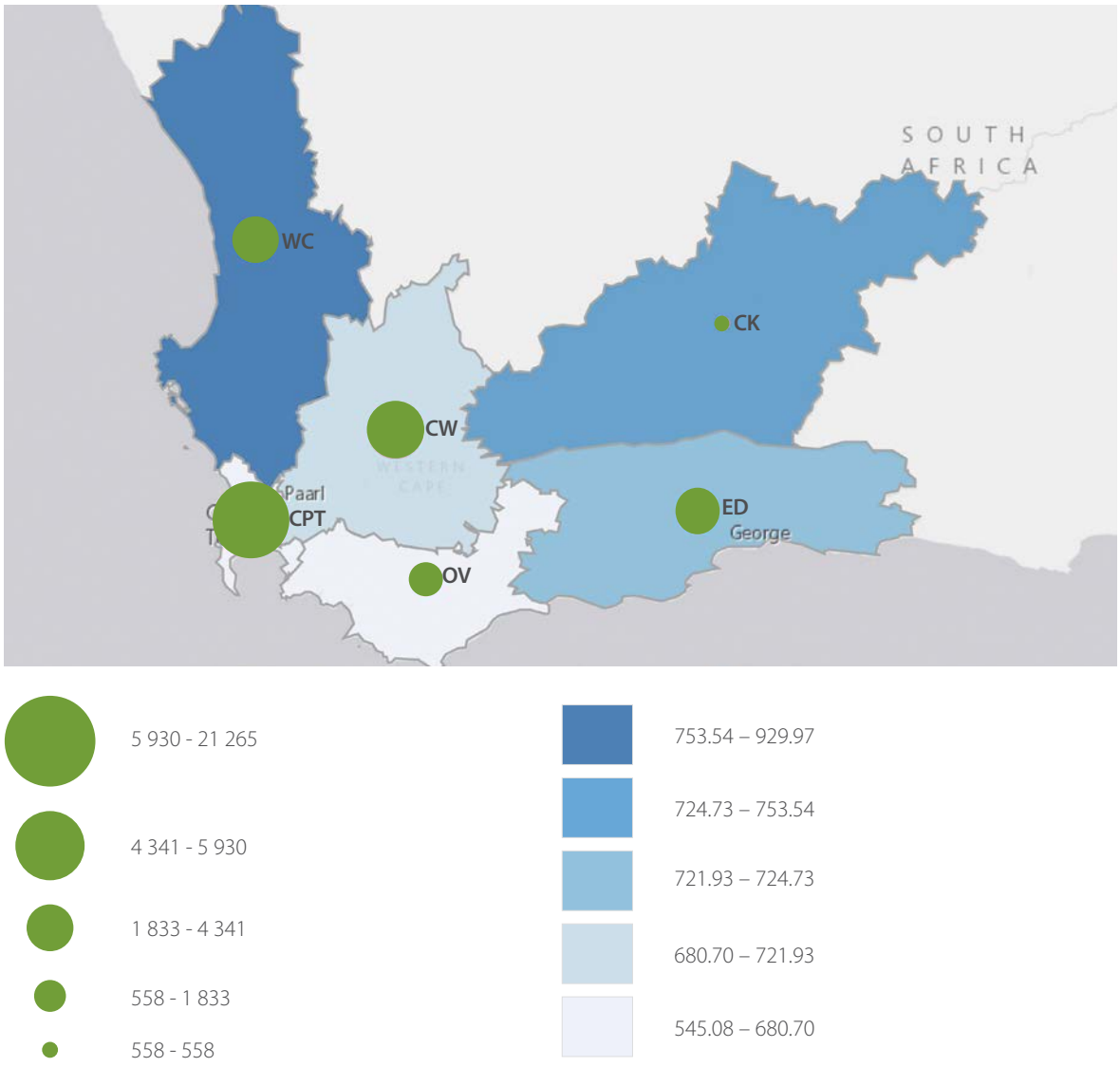


Figure 49: mPTB case burden (circles) and incidence rates (shading), Western Cape: spatial distribution, 2015

The overall trend over the period showed declines in mPTB incidence rates starting at 1024 (95%CI: 1016-1033) per 100 000 people in 2006 and declining to 627 (95%CI: 620-633) in 2012 (Table 29). These early declines, although very encouraging, have not been sustained; with mPTB incidence rates relatively stable towards 2015 and a small incline observed in the last year of the reporting period. The early declines are likely explained by the early introduction and wide implementation of ART in the province. However, since the province has the lowest HIV rates nationally, other factors besides HIV are equally important in this province. In order to reach the target of a 10% year-on-year decline in TB incidence as set in the End TB strategy, other contributory factors will need to be addressed, including following up patients lost from care, substance abuse and adherence, as well as delays in accessing care.

Table 29: mPTB case burden and incidence rates by year, Western Cape: 2004-2015

Year	n	Incidence/100000 (95% CI)	Annual change in cases (n)	Annual change in incidence (%)
2004	51 509	980(972-989)		
2005	54 465	1 023(1 014-1 031)	2956	4.4
2006	55 295	1 024(1 016-1 033)	830	0.1
2007	53 501	978(969-986)	-1 794	-4.5
2008	47 607	858(850-866)	-5 894	-12.3
2009	38 084	676(670-683)	-9 523	-21.2
2010	37 523	657(650-664)	-561	-2.8
2011	38 242	660(653-666)	719	0.5
2012	36 890	627(620-633)	-1 352	-5.0
2013	37 193	622(616-628)	303	-0.8
2014	37 272	614(607-620)	79	-1.3
2015	37 967	625(619-631)	695	1.8

Incidence rates by district have been generally high across the province and have shown declines in the earlier years, with a subsequent neutral pattern in the more recent period (Figure 50 and Table 30). As the pattern is common to all the districts, a province-wide approach needs to be undertaken. Of note is the upward trend in the Central Karoo which, although at an absolute number is a small contributor to the burden in the province, would require a localised intervention. Reasons for this trend will need to be investigated and should include service provision to reach these hard to access populations.

Incidence Trends

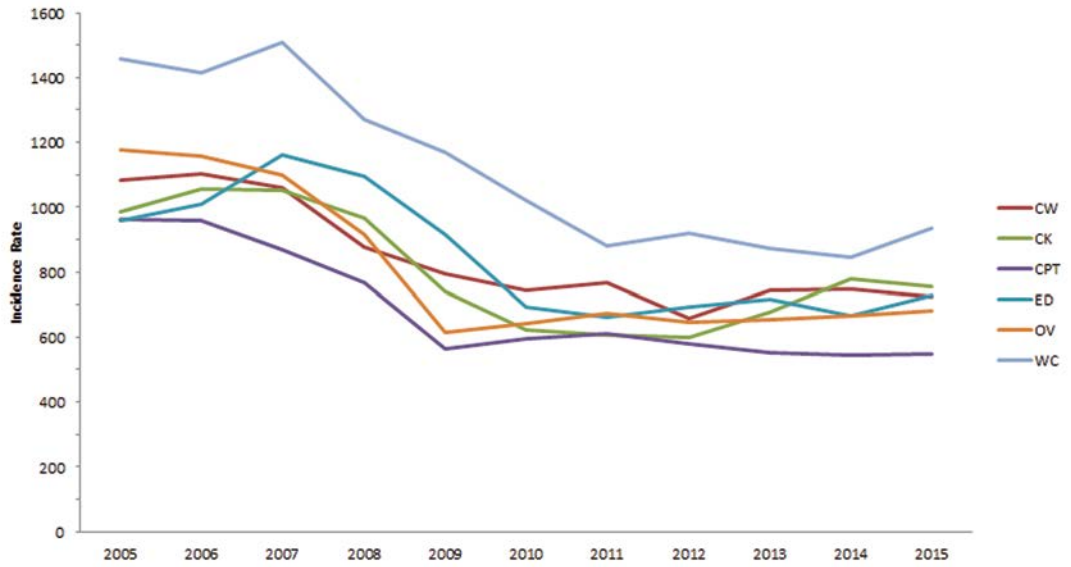


Figure 50: Trends in mPTB incidence rates by district, Western Cape: 2004-15

Table 30: mPTB case burden and incidence rates by district, Western Cape: 2004-2015

Year	Cape Winelands (CW)		Central Karoo (CK)		City of Cape Town Metro (CPT)		Eden (ED)		Overberg (OV)		West Coast (WC)	
	n	Incidence (95% CI)	n	Incidence (95% CI)	n	Incidence (95% CI)	n	Incidence (95% CI)	n	Incidence (95% CI)	n	Incidence (95% CI)
2004	7 779	1 094 (1 070-1 119)	623	972 (897-1 051)	30 470	903 (893-913)	4 839	934 (907-960)	2 493	1 070 (1 028-1 113)	5 305	1 500 (1 460-1 541)
2005	7 808	1 084 (1 060-1 108)	640	985 (911-1 065)	32 977	964 (954-975)	5 036	959 (933-986)	2 777	1 176 (1 133-1 221)	5 227	1 459 (1 420-1 499)
2006	8 054	1 103 (1 079-1 128)	695	1 056 (979-1137)	33 259	959 (949-970)	5 378	1 010 (983-1 038)	2 766	1 156 (1 113-1 200)	5 143	1 416 (1 378-1 455)
2007	7 829	1 058 (1 034-1 081)	703	1 054 (977-1 134)	30 488	867 (858-877)	6 262	1 160 (1 132-1 189)	2 661	1 097 (1 055-1 139)	5 558	1 510 (1 470-1 550)
2008	6 572	876 (855-897)	653	965 (892-1 042)	27 401	769 (760-778)	5 986	1 094 (1 066-1 122)	2 255	916 (879-955)	4 740	1 269 (1 234-1 306)
2009	6 049	794 (775-815)	508	740 (677-807)	20 483	566 (559-574)	5 080	915 (890-940)	1 535	615 (585-646)	4 429	1 169 (1 135-1 204)
2010	5 736	742 (723-762)	433	621 (564-683)	21 891	597 (589-605)	3 907	693 (672-716)	1 630	644 (613-676)	3 926	1 021 (990-1 054)
2011	6 028	769 (749-788)	430	608 (552-668)	22 838	613 (605-621)	3 779	661 (640-682)	1 731	673 (642-706)	3 436	881 (852-911)
2012	5 247	659 (641-677)	430	599 (544-658)	21 865	578 (571-586)	4 028	694 (673-716)	1 686	646 (616-678)	3 634	918 (888-948)
2013	6 011	743 (725-762)	495	679 (621-742)	21 203	552 (545-560)	4 235	718 (697-740)	1 734	654 (624-686)	3 515	874 (845-903)
2014	6 152	749 (730-768)	575	777 (714-843)	21 320	546 (539-554)	3 980	664 (644-685)	1 790	665 (634-696)	3 455	846 (818-874)
2015	5 935	723 (704-741)	558	754 (692-819)	21 463	550 (543-558)	4 353	727 (705-749)	1 833	681 (650-713)	3 825	936 (907-966)

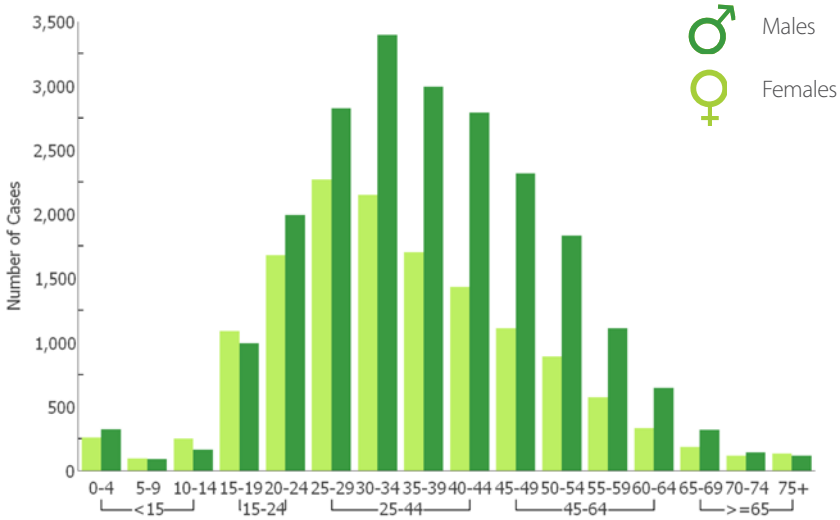
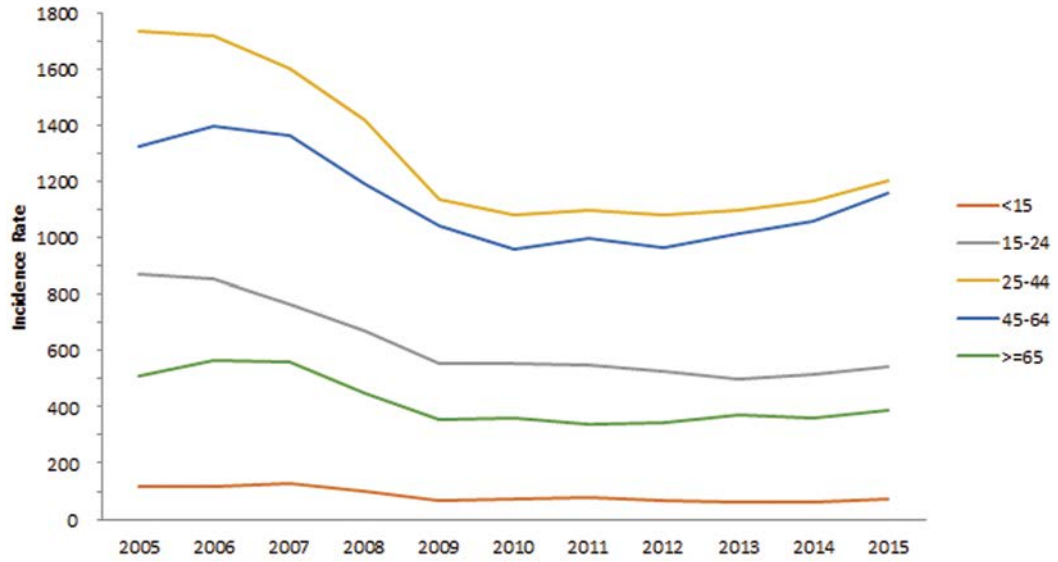


Figure 51: Age and gender population pyramid of mPTB cases, Western Cape: 2015

The population pyramid shows an overall male dominance in the mPTB case burden and shifted to the right compared to females (Figure 51). The early declines in mPTB incidence rates have been across almost all age groups and genders with distinctly different incidence rates between the age groups. A slight trend upward is observed, particularly among males aged 25-44 and 45-64 years in 2015 (Figure 52). The incidence rates among males aged 25-44 was almost 1 800 per 100 000 people in 2005 and is close to 1 400 per 100 000 people in 2015. The latter is almost twice the national rate and an important age group for targeting interventions.

♂ Age specific incidence trends – Males



♀ Age specific incidence trends – Females

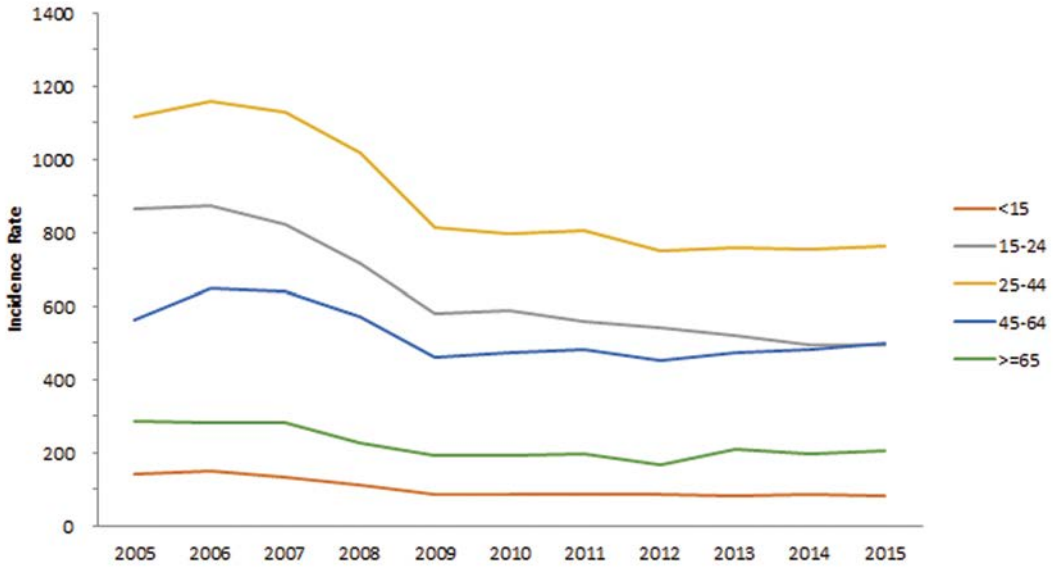


Figure 52: Trends in mPTB incidence rates by age and gender, Western Cape: 2004-15

Microbiologically confirmed rifampicin resistant tuberculosis

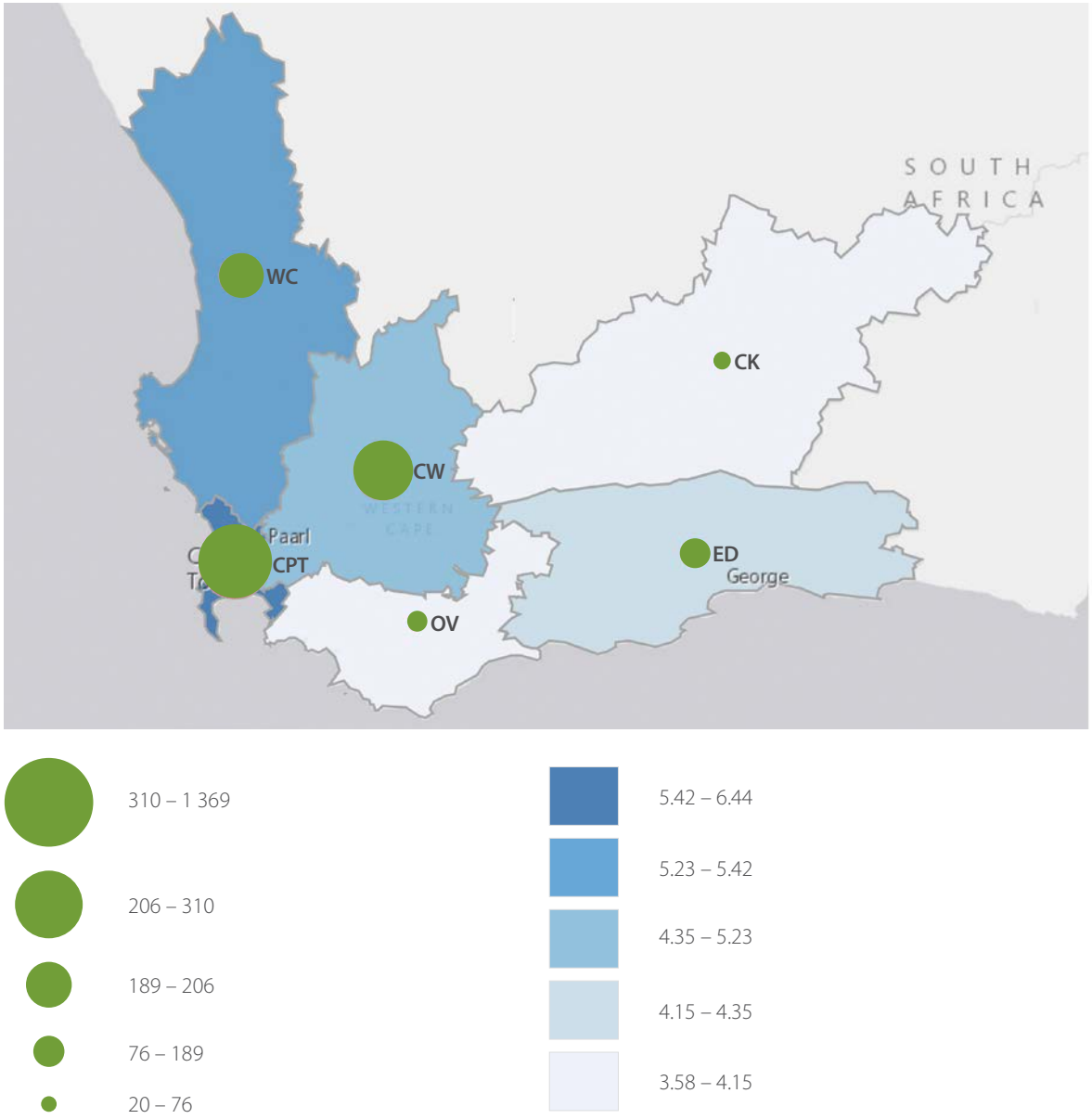


Figure 53: Rifampicin resistant mPTB case burden (circles) and incidence rates (shading), Western Cape: spatial distribution, 2015

The geographic distribution of the number of mPTB RR-TB cases and incidence rate of RR-TB per 100 mPTB cases is shown in Figure 53 and Table 31. The district with the highest absolute RR-TB burden is the City of Cape Town Metro, with more cases than the other districts put together, and in total accounts for 62.1% of the burden in the province. The incidence rate across the districts is generally lower than the national average (7.6; 95%CI 7.5-7.7) and is suggestive of good control measures in keeping the rate down. It should be noted that the data presented only include RR-TB and M/XDR-TB is not specifically analysed in this report. Therefore the situation may be different for other types of drug resistant TB. This, as well as an assessment of the trends over time for drug resistant TB, will be addressed in future reports.

Table 31: Rifampicin mPTB case burden and incidence rates among mPTB cases by district, Western Cape: 2015

District	Incidence (95% CI)
Cape Winelands	5.6 (5-6.2)
Central Karoo	3.9 (2.5-6)
City of Cape Town Metro	6.5 (6.2-6.9)
Eden	4.7 (4.1-5.4)
Overberg	4.4 (3.5-5.4)
West Coast	5.6 (4.9-6.5)

Summary

- 525 548 mPTB cases occurred between 2004 and 2015.
- The highest burden district is the City of Cape Town which accounts for 56.5% of the absolute mPTB burden of cases.
- Declines in mPTB incidence rates have stagnated post 2012 with year-on-year change of -0.8%, -1.3% and +1.8% for 2013, 2014 and 2015 respectively.
- Increases have been observed particularly among adult males aged 25-64 years, as well as in the Cape Winelands district.
- Western Cape is one of the high burden RR-TB provinces and the City of Cape Town accounts for 62.1% of the absolute number of cases for the province.

CONCLUSION

South Africa is on the World Health Organization (WHO) list of priority countries in the categories Tuberculosis (TB), Drug Resistant Tuberculosis (DR-TB) and HIV associated TB[1]. The absolute burden of TB in South Africa is among the highest in the world and when adjusted for population we have the highest incidence globally at 834 cases per 100 000 people estimated by WHO. Important changes have occurred globally with positive signs in declining TB incidence which has led to the launch of the End TB Strategy by WHO. It aims at reducing incidence and mortality with ambitious targets set for 2035. The decline in microbiologically confirmed pulmonary TB (mPTB) in SA has been previously published in the *Lancet Infectious Diseases* journal and correlates with that observed globally. It is important to note that the use of mPTB incidence rates excludes clinically diagnosed cases, but provides an objective and robust trend analysis. This report builds on what was previously published, updating data to 2015 and providing analysis at lower levels of the health system.

The report confirms the year-on-year reductions in mPTB incidence rates which have continued since 2012 and which were -4.8%, -6% and -4.8% nationally for the years 2013-2015. Although this is half of what is required by the WHO End TB Strategy (10%), it is higher than the global average of 2% [4]. The national achievements are a sum total of the efforts of the nine provinces in South Africa. KwaZulu-Natal, which carries the highest absolute burden in the country, has shown the greatest success in the recent past with annual reductions of mPTB incidence rates in line with the End TB targets; -13.4%, -9.7% and -8.5% for 2013-2015. This trend was also observed in Limpopo Province, but with a much lower burden. Similarly encouraging has been Free State with successive improvement in year-on-year reductions (-2.5% in 2013, -4.8% in 2015 and approaching target in 2015 at -9.2%).

Gauteng, North West and Western Cape showed excellent reductions in the early years but in the most recent years these have slowed down. The latter showed an annual change of -0.8%, -1.3% and +1.8% for the period 2013-2015. The impact of the ART Programme on reducing mPTB incidence has been shown to be an important contributor; however this alone will not be enough. These provinces initiated ART programmes on scale much earlier than other provinces and as a result have reaped those rewards in the earlier years but more needs to be done. The newly revised national TB Plan, updated for the period 2017-2021, has targeted five strategic interventions along the cascades of care, starting with finding undiagnosed cases and ending with the final objective of successful patient outcomes. In addition two cross-cutting themes, namely quality improvement and data utilisation, are envisioned. These sets of interventions will hopefully address the stagnation observed.

The Northern Cape demonstrated a relatively low mPTB burden (9 682 (3.4%) of the of the 281 055 mPTB cases nationally), but by incidence it is the second highest, with the increase in mPTB incidence rates observed being even more concerning. Incidence rates are an important measure of programme success at addressing TB at a community level. The observed increases in this province will need to be investigated including health systems and access to services as key elements impacting on success or failure. The increase in incidence may be explained by the increased availability of the Xpert MTB/Rif assay (GXP) and thus case finding; however this observation will need further analysis.

A striking clue to the success and failure of the achieved reduction in incidence was observed when disaggregating by gender. Most of the declines observed across provinces and reflected nationally have been driven by successes achieved among females between 25-44 years of age with a 33.6% reduction between 2008 and 2015 nationally. This links closely with the large emphasis of the HIV programme, as well as greater health seeking behaviour in this population. The North West Province has showed the most dramatic declines, nearing 50%, but over a longer period. In stark contrast, the reduction among males in the same age category nationally was only 13.4% for the same period and in this addition is the age group with the highest mPTB incidence. Incidence rates among males have been above 1 000 in several provinces and in Eastern Cape above 2 000 per 100 000 people in 2015. Specific strategies aimed at this population are urgently required if the country is to reach the End TB targets, including targeted public messaging, increased access through men's health and wellness centres or days, and male role models. Breaking through this barrier will be challenging, but is likely to see even greater reductions than in the past.

South Africa carries an immense burden of mPTB; however this burden is not homogenous and becomes more apparent at each lower tier in the health system. The highest burden is carried by just four provinces, yet upon closer mapping it is clear that selected areas and in particular the urban metropolitan areas have the largest concentration. For this reason, efforts can be focused on specific geographic areas with achievable results. It is also encouraging to see that the NDoH's new TB Plan will use a data driven targeted approach and this report will provide a solid foundation for monitoring progress towards the End TB targets.

It should be noted that targeting high burden areas makes economic sense in respect of short-term success; however the distinction between burden and incidence is an important one in the long-run and specific interventions will need to be

tailored for identified areas with high incidence rates as these will lead to long term problems over time. The finding of over three million people diagnosed with mPTB over the reporting period highlights the magnitude of the burden and nature of the epidemic. Much like HIV, the epidemic is of a chronic nature, accumulating over time. However, unlike HIV, TB is curable and the majority of the aforementioned three million infected individuals have achieved cure – a statistic often underappreciated. This highlights the significant and direct value achieved by dealing with the TB epidemic effectively. Additionally, the reduction in incidence leads to a cumulative reduction in the number of cases of TB. There were 80 000 fewer cases diagnosed from the peak in 2008 ending in 2015, representing people who did not have to suffer from TB. Additionaly close contacts of these cases were protected, implying a protective benefit to hundreds of thousands of individuals.

In assessing the distribution of rifampicin resistant TB, we build on the most recent TB DRS report 2012-2014 which highlighted Mpumalanga as the province with the highest prevalence of drug resistant TB – again confirmed in the current report. In addition, high prevalence areas have also been identified in KwaZulu-Natal. For both provinces the highest incidences occurred in districts close to the Mozambique and Swaziland borders, showing that greater cooperation is essential to overcome the challenges faced by all three countries. Similar to what is observed for mPTB cases, there is considerable heterogeneity for drug resistant TB nationally, with KwaZulu-Natal having close to 30% of the rifampicin resistant TB burden. Identifying and targeting responses and providing decentralised services for the management of drug resistant TB will be important to improve adherence and achieve cure.

It is important to appreciate that this report cannot explain reasons for the changes observed nor the relative burden of disease. These questions will need to be interrogated by the relevant persons in the provinces or districts and research studies should be undertaken where appropriate. What the report has achieved is to report on the data as analysed, plus indubitably providing valuable insights necessitating further interrogation. The reporting of mPTB data does have its limitations and principal to that is the lack of clinically diagnosed cases. The latter is subjective but accounts for up to 30% of the case burden and varies across different regions. This may well explain the difference in incidence observed in 2015 of 510 per 100 000 people compared with the WHO estimate of 834 per 100 000 people.

It should be noted that the absolute numbers reported through the electronic registries are lower than those observed in terms of laboratory diagnosed cases. Reasons could simply include under reporting in the registries as previously shown, however it is also known that initial loss to follow up is relatively high in South Africa and therefore these cases would not appear in the treatment registries. The current TB plan aims to addresses this gap. The other reason is the possibility of over-reporting of mPTB cases due to under-linking of records. This can and does occur, as linking is based on demographic characteristics which may not always be recorded and reported in the same way across multiple interactions in the health system. The error is estimated to be between 5-10% and does not account for the large gap observed. However the error should be consistent across time as computer algorithms are systematically applied and trend analysis would still accurately reflect changes. Encouragingly, the new national strategic plan for HIV, TB and STIs places a strong emphasis on the use of the unique patient identifier in the health system and will not only improve the accuracy of the mPTB data, but also allow the data systems used in the care cascades to be linked and provide reliable data across the entire patient pathway.

The power of the data has been demonstrated using geospatial mapping down to sub-district level and provides a very useful and quick grasp of the situation across the country. It can be used for resource allocation, an important issue in resource constrained environments. There were however challenges in some provinces, particularly in Eastern Cape, as demarcations have changed recently and may not be fully reflective of the latest official demarcations at sub-district level nor of the more informal operational segregation of facilities to specific sub-groupings. We do welcome feedback to improve on the accuracy of the data for future reports.

There are notable gaps which will be addressed in future reports, including trend analysis of drug resistant TB (all forms), as well as extra-pulmonary TB and some work has already been performed but will require additional verification. It is unfortunate that data for KwaZulu-Natal was unavailable for the years prior to 2011, however the modelled data for the period 2004-2010 have been published and can be accessed online[3]. The current report provides valuable insights that should be closely integrated into TB control planning for the next five years. The report ends in 2015 and annual updates will be provided to more closely monitor the situation of this priority disease in South Africa.

Finally, we are greatly excited to announce the release of an online TB Surveillance Dashboard upon which this report is based and which will provide regular updates which cannot easily be achieved in a report format. The dashboard is accessible from the National Institute for Communicable Disease website: www.nicd.ac.za.

RECOMMENDATIONS

- Target appropriate interventions where the need is greatest (burden or incidence).
- Ensure the successes of the ART Programme are maintained.
- Initiate targeted efforts aimed at males aged 25-44 years to improve health seeking behaviour among this group.
- Review the stagnation in declining incidence in the provinces identified.
- Improve cross-border communication and cooperation between Mozambique, Swaziland and South Africa.
- Ensure decentralised services for rifempicin-resistant TB are delivered where they are most needed.
- Support and continue improvements of the current mPTB surveillance system to monitor trends.
- Ensure universal application of the unique patient identifier and link data systems to provide a more comprehensive picture of the status and trends in the TB epidemic.
- Mobilise resources to achieve the above objectives and deliver on the new National TB Plan 2017-2021.

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