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Analysis of the epidemiological impact of tuberculosis in Georgia

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ABSTRACT

An excellent understanding of the level of, and trends in, disease burden and how these have been (and can be) influenced by the implementation of prevention and treatment interventions is of considerable importance to national health programmes and international donor agencies. It can help to ensure the appropriate allocation of funding and ultimately help to save more lives in the future. This epidemiological and impact analysis was included as a systematic part of national health sector reviews and tuberculosis (TB) programme reviews. Such analyses are now required in the concept notes that form the basis for applications to the Global Fund in the new funding model introduced in 2013. This report delivers TB epidemiological and impact analyses conducted as part of the national TB programme review of Georgia, as inputs to health sector reviews and for the epidemiological stage of the Global Fund's new funding model.

Keywords

EPIDEMIOLOGY
GEORGIA (REPUBLIC)
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Abbreviations

ART	antiretroviral therapy
CI	confidence interval
CPT	cotrimoxazole preventive therapy
DST	drug susceptibility testing
ICD	International Classification of Diseases
MDR	multidrug-resistant
OR	odds ratio
PAF	population-attributable fraction
TB	tuberculosis
XDR	extensively drug-resistant

Assessment of current national tuberculosis surveillance and vital registration systems

Description

TB surveillance system

Tuberculosis (TB) is a notifiable disease in Georgia. All detected TB cases must be notified to the Ministry of Labour, Health and Social Security Centre for Medical Statistics and Information. The TB surveillance system consists of national, regional and local TB units. Seventy local TB units (including the penitentiary system) use paper forms to document patient-level sputum collection, TB diagnosis, HIV testing, anti-TB drug treatment progress and treatment outcome. Regional TB centres are responsible for collecting the paper-based forms from the local TB units, reviewing and monitoring data quality and entering patient-level variables from the forms into the national electronic register. The regional-level surveillance team includes 13 data managers (one for each geographical region, one from the penitentiary system and four from Tbilisi). National oversight of the surveillance system is carried out for the National Centre for Tuberculosis and Lung Diseases by a surveillance team consisting of the head of the surveillance department, one data manager, three epidemiologists and four data quality officers. This team is responsible for: maintenance of the national electronic register, periodic data quality checks, annual validation and reporting of country-level data to WHO and external partners, human resource development (training of regional staff), development and revision of national guidelines and instructions on data management, development and revision of national recording and reporting forms, and coordination of data exchange with the national AIDS Centre, National Reference Laboratory and other laboratories. Aggregated annualized surveillance data related to regional TB case notification (including stratification by new and previously treated cases and sputum-smear status), estimated TB incidence, TB treatment outcomes and routine anti-TB drug resistance surveillance are posted on the National Centre for TB and Lung Disease website *(1)*. These data are presented in tabular format with no in-depth analysis, interpretation or recommendations to translate them into public health action or policy.

A parallel system of recording and reporting exists via the National Centre for Disease Control. Epidemiologists at 11 regional public health centres track and confirm all reportable diseases. They enter patient-level data for all reportable cases (including TB) into the electronic infectious disease surveillance system – the national reporting and recording tool for all reportable diseases.

There is also an electronic case-based register designed for the notification and monitoring of treatment outcomes for TB, multidrug-resistant (MDR) TB and extensively drug-resistant (XDR) TB. The application was developed with the support of the French company, MEDES. This registry is a real-time web-based application with nationwide coverage (including the penitentiary system). It can generate national statistics disaggregated by core variables for TB case notification, notification of MDR-TB and treatment outcomes for MDR- and XDR-TB.

Data flow

Local TB units maintain registers for presumptive TB cases. All such cases are assigned case identifiers. New and previously treated suspects are registered correspondingly in paper-based journals A and B. There is also a special paper-based journal for TB contacts.

The forms used in surveillance data collection are listed in Table 1. Once a patient is confirmed with TB, an individualized TB form (TB-10/12) is completed in triplicate to serve as the main

data source for the national electronic register. The first page includes data related to the patient's identity, demographics and laboratory test results. Upon completion, this page is sent by courier from the diagnostic facility to the regional TB centre for data entry into electronic register. The second page is retained by the TB facility to document the course of treatment. Once a treatment outcome has been achieved, the second page is also sent to the regional data manager for data entry into the electronic register. The third page, consisting of duplicate information from the first and second pages, is filed at the local TB facility.

Table 1. Surveillance data collection instruments and forms, Georgia, 2015

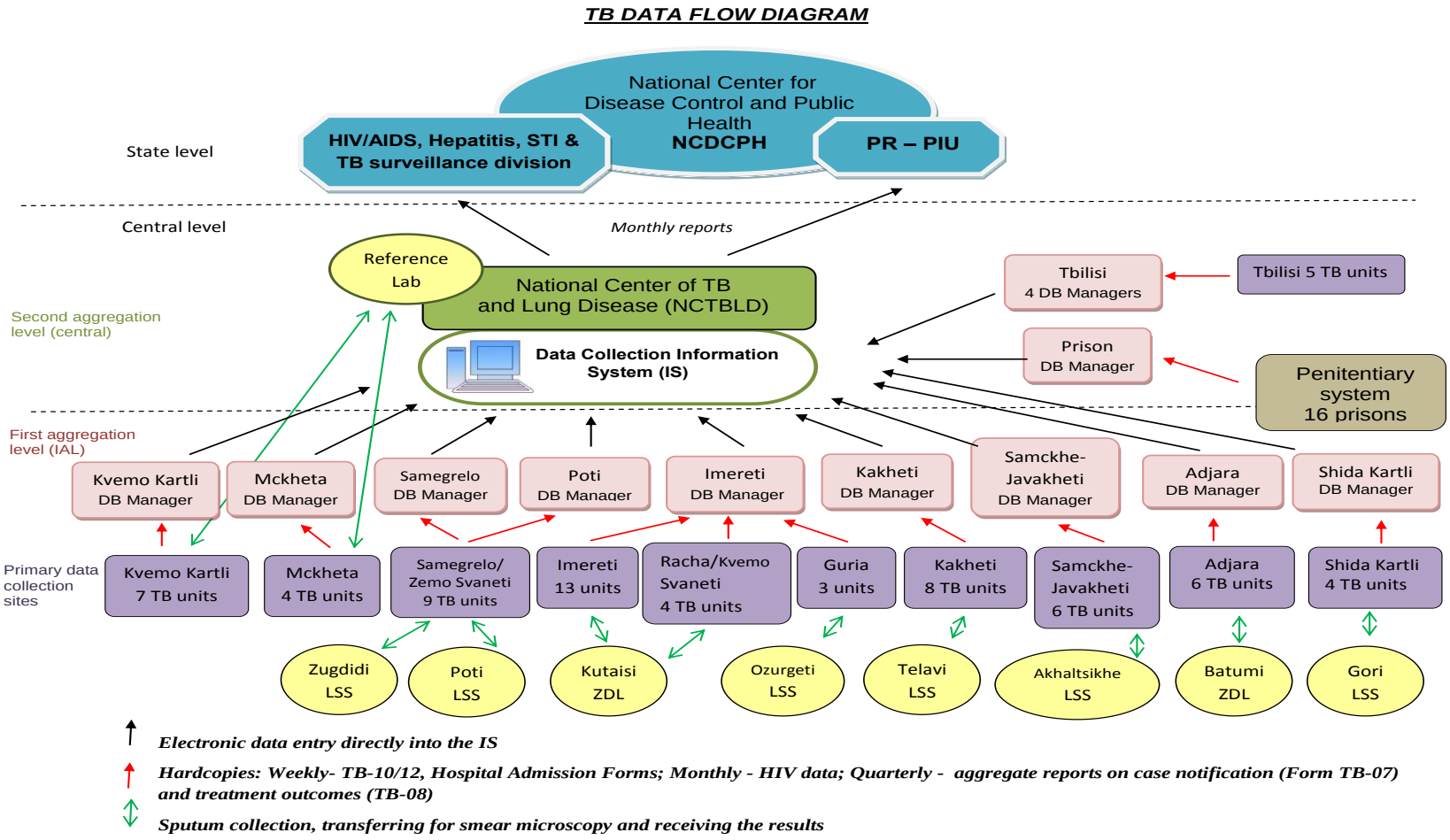
Forms	Purpose
Individualized TB form (TB-10/12)	Main data source for the national electronic register, to generate reports related to notification and treatment outcome
Hospital admission form (for second-line treatment)	Source for information to generate report on enrolment in second-line treatment
Important dates form (for second-line treatment)	Used to generate reports on treatment outcomes of patients with drug-resistant TB
TB facility register (TB-03)	Summarizes patient information from form (TB-10/12)
Second-line treatment register for TB facilities (TB-02)	Summarizes patient information from form TB-10/12 (hospital admission form and important dates form) for patients who start second-line TB treatment
Case notification quarterly report (TB-07)	Paper-based quarterly report on TB notification submitted by all district-level TB institutions to regional units of the national TB programme (NTP); the region's reports are sent to the NTP central unit
Treatment outcome quarterly report (TB-08)	Paper-based quarterly reports on TB treatment outcome submitted by all district-level TB institutions to the regional NTP units; the region's reports are sent to the NTP central unit
HIV forms (N1)	Submitted to database managers monthly by TB facilities with voluntary counselling and testing services and used to generate notifications of HIV/TB coinfections

As regards MDR-TB notification and treatment outcome monitoring, the main data source for the national electronic register are the hospital admission form and the important dates form (for second-line treatment). These are individualized forms for patients who start second-line treatment. For MDR-TB patients, apart from the demographic and core information, broader information is collected including health and risk factors (such as smoking, diabetes and employment status).

The other standard recording and reporting forms are the individual TB treatment forms for regular (TB-01) and MDR-TB patients (TB-01 MDR), the TB facility register (TB-03), second-line treatment register for TB facilities (TB-02) and HIV form (N1). The latter is used to submit HIV test results from voluntary counselling and testing centres to regional database managers. Reporting forms include the quarterly case notification form (TB-07) and quarterly treatment outcome form (TB-08), which are submitted quarterly by all district TB facilities to regional units of the national tuberculosis programme (NTP) and thence to the National Centre for Disease Control. Paper reports are used for cross-checking aggregated data with the reports generated by the electronic register.

Fig. 1 shows the data flow process throughout the TB surveillance system.

Fig. 1. TB data flow diagram, Georgia, 2015

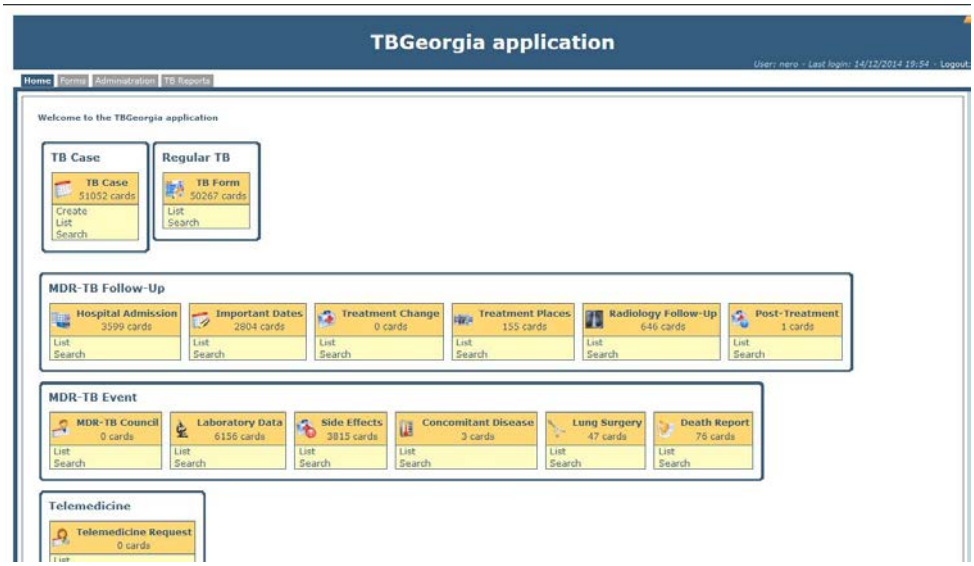


Source: Tuberculosis Monitoring and Evaluation Plan *(2)*.

MDR-TB surveillance

Since 2008, the National Reference Laboratory and the second-level culture laboratory in Kutaisi have maintained a web-based electronic laboratory register. This register includes fields documenting the patient's identity, purpose of testing, treatment of category, sputum-smear microscopy results, culture results (solid and liquid media), drug susceptibility testing (DST) results, GeneXpert results, line probe assay results and corresponding dates. Laboratory request forms serve as the main data source to enter patient-related data into the laboratory register. The register is not linked to the national electronic TB register, so DST results are entered manually.

Fig. 2. Screenshots of National Centre for Tuberculosis and Lung Diseases electronic TB register



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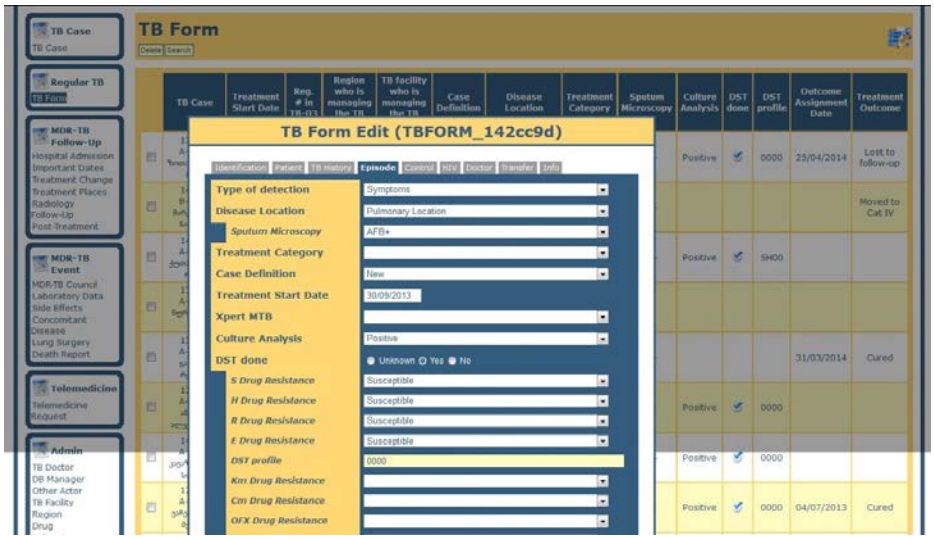


Source: National Centre for Tuberculosis and Lung Diseases electronic TB register *(3).*

Monitoring, evaluation and human resource development

Several procedures are in place to ensure the quality of the data collected. National surveillance statistics are generated by the national surveillance team following a data validation process.

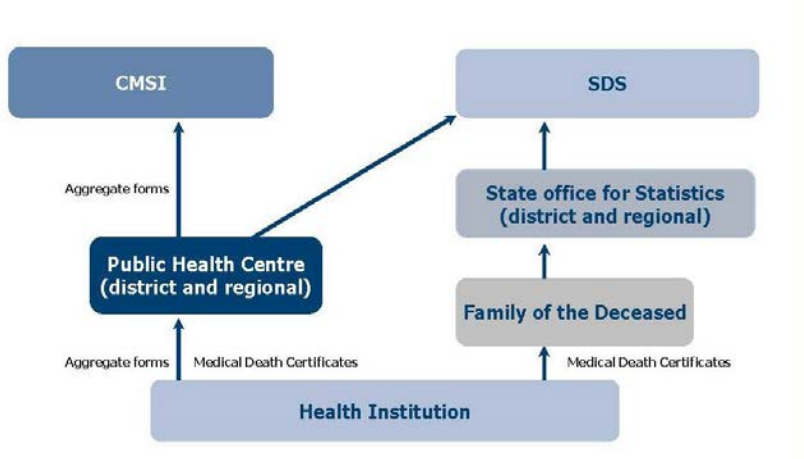
At district and regional levels, representatives of the national surveillance team visit sites every quarter to conduct audits, recheck data and cross-check the paper, electronic and laboratory registers. Other data quality assurance aspects at regional level are related to the design of electronic databases: the electronic database is designed so that during data entry some data validation checks are undertaken to prevent errors. For example, for most variables (sex, geographical location, case type, previous history, laboratory results), only predefined options are available in drop-down menus. Fields are enhanced with checks so that it is only possible to enter numbers in numeric fields and dates in date fields. Validation of the data at national level includes de-duplication and checking for consistency and completeness. Training for the surveillance staff is organized regularly – once every second year during the field supervisory visits and on an ad-hoc basis following revisions to the national recoding and reporting procedures.

Vital registration system

Vital registration was mandated by a presidential decree on 31 December 2002 outlining civil registration.

The civil registration of deaths relies primarily on a hand delivery system. Once a death occurs, the relatives of the deceased person apply to their physician for official documentation of cause and time of death. This is taken to the State Office for Statistics, where an official death certificate is issued which the registrar submits to the State Department of Statistics for filing under the national civil registration system. At the same time, aggregate health information, including births and deaths registered by health institutions, are sent to the Centre for Medical Statistics and Information. A second copy of the medical notification of death is sent to the appropriate public health centres (at district and regional levels), who in turn send it to the State Department of Statistics (Fig. 3).

Fig. 3. Death registration information flow, Georgia, 2015



Source: Tefft *(2)*.

Beginning in 2002, and with the support of several international organizations, the government has undertaken a number of activities to improve the coverage and quality of the national vital

registration system, including the establishment of a web-based real time electronic database and training for health providers in death certification, International Classification of Diseases (ICD) coding and death registration.

The medical death certificate was designed according to WHO guidelines and includes both primary and underlying causes of death. The primary cause statistical reports of mortality data are used. The electronic system is enhanced with the drop-down menu of ICD-codes in Georgian script which enables all registrars throughout the country to set the primary cause of death.

The completeness of death registrations has improved significantly *(3)*, as was demonstrated by comparison of mortality in children aged under five years (under five mortality) measured by three rounds of nationwide household reproductive health surveys and official statics. In 1995–1999, the difference between official and survey estimates of mortality was about 64%, which had dropped to 22% in 2010 *(4)*.

National and regional statistics are generated for annualized death counts and for primary cause of death by sex and age. National and subnational analyses are published as statistical yearbooks by the National Statics Office of Georgia *(5)* as well as health statistics yearbooks produced by the National Centre for Disease Control.[1]

Based on World Bank data sources *(6)*, the estimated completeness of death registration is close to 100% (see details in Benchmark B1.10 below). There are, however, no quality assurance procedures for validating the cause of death. For example, 33.8% of the reported causes of death in 2012 were classified as ill-defined and unknown causes of mortality (as defined in Chapter XVIII of the 10th revision of the International Classification of Diseases) *(4)*.

Conclusion

Because more than one in three recorded deaths do not specify the primary cause of death, it was not possible to assess the quality of TB-related death reporting. Special studies of TB mortality should be considered to assess whether the vital registration system can be used as a reliable source of surveillance information.

Capacity of national TB notification and vital registration system to provide a direct measure of the burden of TB disease

Standard B1.1

Case definitions are consistent with WHO guidelines.

Benchmarks

All the following benchmarks should be satisfied to meet this standard.

- *Laboratory-confirmed cases are distinguished from clinically diagnosed cases.*[2]
- *New cases are distinguished from previously treated cases.*
- *Pulmonary cases are distinguished from extrapulmonary cases.*

The following documents were reviewed to assess the above benchmarks:

[1] http://ncdc.ge/AttachedFiles/2013_eng_2b165575-911e-4596-b6b0-f1e0f1540c6c.pdf
[2] By smear, culture or WHO-endorsed molecular test such as GeneXpert MTB/RIF.

- Tuberculosis Monitoring and Evaluation plan
- National Tuberculosis Strategy and Operational Plan for Georgia 2013–2015
- National Health Statistical Report[3]
- surveillance data submitted to the WHO global TB database *(7)*.

The performance indicator and recording and reporting forms distinguish bacteriologically confirmed cases from clinically diagnosed cases, new cases from previously treated cases and pulmonary from extrapulmonary cases. Electronic registers and laboratory request forms contain designated fields for entering the results of GeneXpert MTB/RIF and culture. Annual surveillance data submitted to the WHO global TB database were distinguished by all available laboratory confirmation methods (smear, culture, GeneXpert MTB/RIF) as well as by history and site of disease.

A working group at National Centre for Tuberculosis and Lung Disease is updating recording and reporting and case definitions to ensure that they are in line with the revised WHO 2013 surveillance guidelines; full alignment of definitions is still in progress.

Conclusion

Key policy documents and the data management system provide disaggregation of cases by laboratory confirmation results, previous history of TB treatment and site of disease according to WHO guidelines. The system fully satisfies all three benchmarks.

Standard B1.2

The TB surveillance system is designed to capture a minimum set of variables for all reported TB cases.

Benchmarks

Data are routinely collected for at least each of the following variables for all TB cases:

- *age or age group*
- *sex*
- *year of registration*
- *bacteriological results*
- *history of previous treatment*
- *anatomical site of disease*
- *a patient identifier (for case-based systems).*

Both paper and electronic case-based surveillance systems are used. Patients' core data are collected and recorded on individual forms for registration of TB case (TB 10/12) and facility TB registers. All persons presumed to have TB attending TB facilities for diagnosis are assigned an individual code. Once a patient is diagnosed with TB, all core information is captured on an individual registration form, which is sent to the regional epidemiological centre for data entry into the electronic register. In addition, WHO standard reporting forms are completed and submitted to the National Centre for Disease Control Medical Statistics Department on a quarterly basis. A national report is prepared based on the case-based national electronic register. Paper-based TB registers and the electronic register include all essential variables (age, sex, year of registration, bacteriological results, history of previous treatment and site of disease) for all

[3] http://ncdc.ge/AttachedFiles/2013_eng_2b165575-911e-4596-b6b0-f1e0f1540c6c.pdf

notified TB patients. All notified TB patients are assigned an identity code, which contains elements to identify the year of registration, the TB facility where the diagnosis was made and history of previous treatment.

All core variables were consistently recorded in the electronic register for 2013. The standard is fully met.

Recommendation

The NTP should ensure the transition to the WHO 2013 revised definition and reporting framework. This should include the revision of recording and reporting forms, followed by printing and distribution, training for the staff engaged in data recording and analysis and revision of the monitoring and evaluation plan.

Standard B1.3

All scheduled periodic data submissions have been received and processed at the national level.

Benchmarks

- *For paper-based systems: 100% of expected reports from each TB basic medical unit have been received and data aggregated at the national level.*
- *For national patient-based or case-based electronic systems that import data files from subnational (provincial or regional) electronic systems: 100% of expected data files have been imported.*

The electronic registration system is real-time and web-based; data for each notified case are entered at regional TB facilities and prison system, so no import of data file is needed. The completeness of notification data is assessed by comparing outputs of notification data from the electronic surveillance system and paper-based quarterly reporting. Another method is the routine cross-validation of basic medical units' TB registers and the electronic surveillance system in the regions. Regular cross-checking of data also takes place.

No data have been exchanged with the subnational areas of South Ossetia (estimated population 50 000) and Abkhazia (estimated population 180 000). It appears that the NTP has no leadership and management over the TB situation in those areas.

Conclusion

Because all expected data submissions from TB reporting unit (including prisons) are received and processed at the national level, the standard could be assumed to be met.

Standard B1.5

Data in the national database are accurate, complete, internally consistent and free of duplicates (for electronic case-based or patient-based systems only).

Benchmarks

All the following benchmarks should be met to reach this standard.

- *Data validation checks are in place at the national level to identify and correct invalid, inconsistent and/or missing data in the minimum set (standard B1.2).*

- *For each variable in the minimum set (standard B1.2), ≥90% of case records are complete, valid and internally consistent for the year being assessed.*
- *<1% of case records in the national dataset for the year being assessed are unresolved potential duplicates.*

The electronic register is designed so that during the data entry process data validation checks are undertaken to prevent errors. For most variables (sex, geographical location, case type, previous history, laboratory results), only predefined options are allowed to enter that appear as a drop-down menu during data entry. Fields are enhanced with checks so that it is only possible to enter numbers in the numeric fields and dates in the date fields. Core variables are "must enter" fields, so there are no missing values for them. For most of the fields that are supposed to be entered manually, however, there are no restrictions on values within plausible ranges (as date of birth could be in the future).

De-duplication is performed at national level by the data manager. An automated query runs the process, for which name, surname and birth date are used.

The monitoring and evaluation plan describes the steps for data quality assurance procedures.

During data entry, the National Reference Laboratory database is used for reference for completion of laboratory results, although there is no way to ensure that all diagnostic samples are included in the surveillance report. Errors that are detected and corrected are not recorded.

The fields for age, date of registration, site of disease, microscopy results for pulmonary TB patients and previous treatment in the 2013 national electronic dataset of regular TB patients were 100% complete and consistent (free of unfeasible results). However, 116 potential duplicates (patients with the same surname, name and age but different identifiers) were detected for 2013 (2.7% of all cases). All those cases were examined by other variables as well, which showed that the reasons for potential duplicates were common names and surnames. A cross-check of the electronic database with the paper TB registers at the sites visited showed that all cases recorded in the electronic database were also in the paper registers. The surveillance data generated were in general complete for core variables, consistent and allowed for the prompt provision of statistics which constitute the main source for national statistics on TB.

It could, therefore, be concluded that the surveillance system satisfied all three benchmarks and that standard B 1.5 was met for 2013.

Recommendation

The NTP is advised to develop standard operating procedures for each level of data reporting for assessing and cleaning the data collected so as to ensure their quality. All corrections made should be recorded and feedback provided to regional data managers.

Standard B1.6

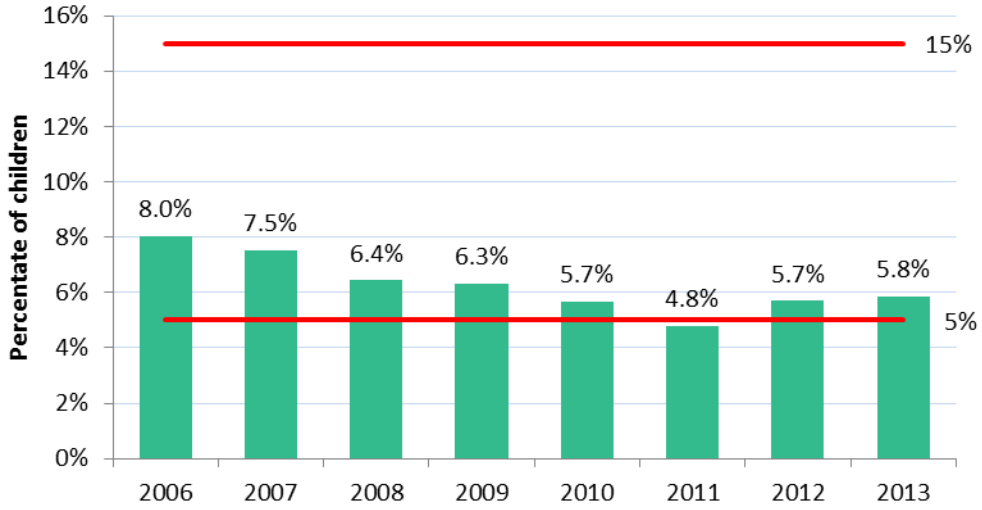
TB surveillance data are externally consistent.

Benchmark

Among new TB cases, the percentage of children diagnosed with TB is between 5–15% in low- and middle-income countries and <10% in high-income countries.

Case notifications of childhood TB depend on the intensity of the epidemic, the age structure of the population, the available diagnostic tools and the extent of routine contact investigation. The World Bank classifies Georgia as a lower-middle-income economy *(8)*. The expected percentage of children diagnosed with TB should, therefore, be in the range 5–15%. Of 3133 new TB cases notified in 2013, 183 were in children aged 14 years and below (5.8 % of new cases) (Fig. 4). This is within the acceptable range of values for a middle-income country. This benchmark is, therefore, satisfied and the standard is considered to be met. However, although the benchmark is satisfied, more work is needed to gain a better understanding of childhood TB in Georgia. Special operational studies exploring childhood TB should be considered.

Fig. 4. Proportion of children with TB among all new TB cases, Georgia, 2006–2013



Horizontal red lines indicate upper and lower level of benchmarks.
Source: Global TB database *(7)*.

Standard B1.7

TB surveillance data are internally consistent over time.

Benchmarks

If vital registration data are available, the following benchmark should be satisfied for this standard to be met.

- *The year-on-year change in the national number of reported TB cases is consistent with the year-on-year change in national TB mortality (HIV-negative, from national vital registration), that is, the trajectories are moving in the same direction.*

If vital registration data are not available, the following benchmarks should be satisfied for this standard to be met with, at national level, evidence of internal consistency over the previous five years for them.

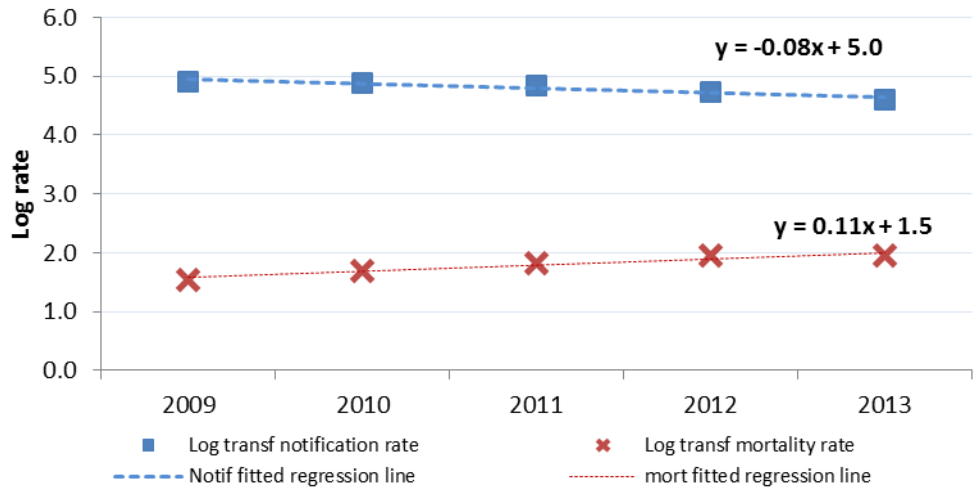
- *Ratio of notified pulmonary to extrapulmonary TB cases.*
- *Ratio of male to female TB cases.*
- *Proportion of childhood TB cases out of all TB cases.*
- *Year-on-year change in the case notification rate for all forms of TB.*
- *Year-on-year change in the case notification rate for new smear-positive TB.*
- *Ratio of the number of people with presumptive TB to total notifications of TB cases.*

If the surveillance and vital registration system are of an acceptable quality, trends in TB case counts are expected to follow the same trajectory as trends in TB mortality. Notification rates of all forms of TB as well as adjusted TB mortality rates (based on data reported by the vital registration system) 2009–2013 are presented in Table 2. The average rate of change was calculated using a linear regression model fitted to log-transformed case notification rates and to log-transformed adjusted TB mortality rates. A projected slope was calculated from each model. The average annual percentage change in the TB notification rate for 2009–2013 was -0.08, and the annual percentage change in mortality rate was +0.11. These data suggest that notification and mortality are moving in different directions: the slope of notification is negative, while the slope of mortality is positive. Thus, this benchmark is considered not satisfied.

Table 2. TB case notification and mortality rates per 100 000 population, Georgia, 2009–2013

Year	Notification rate (per 100 000)	Adjusted TB mortality rate (per 100 000)	Log-transformed notification rate	Log-transformed mortality rate
2009	135.8	4.7	4.9	1.5
2010	132.1	5.4	4.9	1.7
2011	126.5	6.2	4.8	1.8
2012	114.1	7.1	4.7	2.0
2013	99.5	7	4.6	1.9
Slope			-0.08	0.11

Fig. 5. Log-transformed TB notification rate (new and relapsed) and TB mortality rate fitted with linear regression line, Georgia, 2009–2013

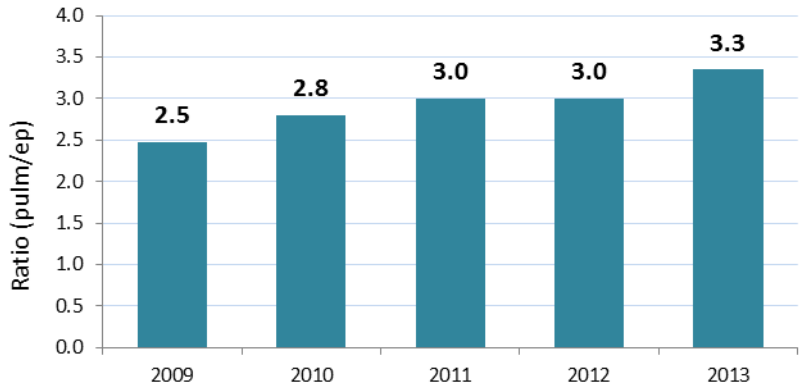


Source: Global TB database *(7)*.

Time series change of ratio of notified pulmonary to extrapulmonary TB cases

The ratio of notified pulmonary to extrapulmonary TB cases among all new TB cases from 2009 to 2013 gradually increased from 2.5 to 3.3. The trend was consistent without any major year-on-year fluctuations (Fig. 6). The proportion of extrapulmonary TB cases is decreasing; this may be explained in part by changes in diagnostic practice (such as the introduction of new diagnostic technologies).

Fig. 6. Ratio of notified TB cases by site of disease (pulmonary vs. extrapulmonary), Georgia, 2009–2013

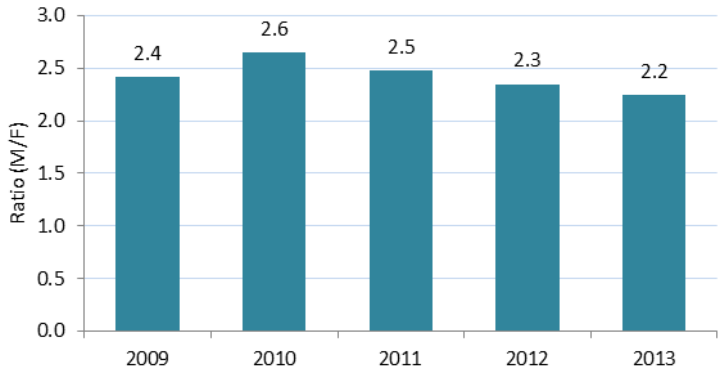


Source: Global TB database *(7)*.

Time series change in ratio of male to female TB cases

Between 2009 and 2013 the ratio of male to female TB cases varied between 2.6 and 2.2. Data appeared to be internally consistent with a gradual decreasing trend in the number of males, suggesting that women were more likely to be diagnosed with TB or that men were less likely to seek health care. Epidemiologically, however, it was not possible to determine if there was a real increase in the number of women (or decrease in men) who developed TB during these years. The trend line for these data was stable, suggesting no issues in reporting or surveillance. According to local experts, the decrease in the male to female ratio may be related to a true decrease in the number of men with TB as a result of a prison amnesty in 2012. In 2011, about 20% of TB cases were reported among prisoners (24 000 people, the vast majority males). In 2013, the number of prisoners dropped to 10 000 and only 5.3% of the country's notified TB cases occurred in prisons.

Fig. 7. Ratio of notified new TB cases by sex (male vs. female), Georgia, 2009–2013



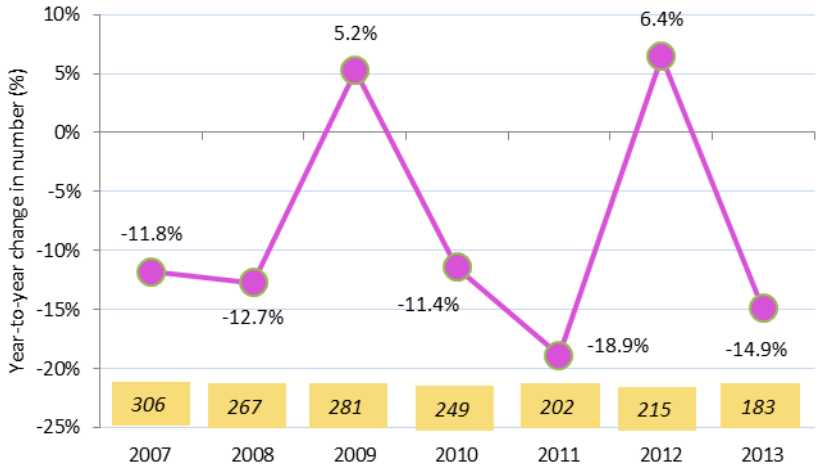
Note: 2013 data are for incident TB cases.
Source: Global TB database *(7)*.

Time series change in proportion of childhood TB cases among all TB cases

Fig. 8 shows that the proportion of children with TB decreased from 8.0% in 2006 to 4.8% in 2011 and then slightly increased to 5.8% during 2011–2013. The changes observed between 2010–2011 and 2012–2013 are especially notable. The explanation for such rapid changes is unlikely to be due to changes in the population structure, especially since the changes show no

clear trends. This suggests that the data related to childhood TB surveillance are not internally consistent, which is related to difficulties in diagnosing childhood TB.

Fig. 8. Year-on-year change in notification of number of child TB cases, Georgia, 2006–2007 to 2012–2013

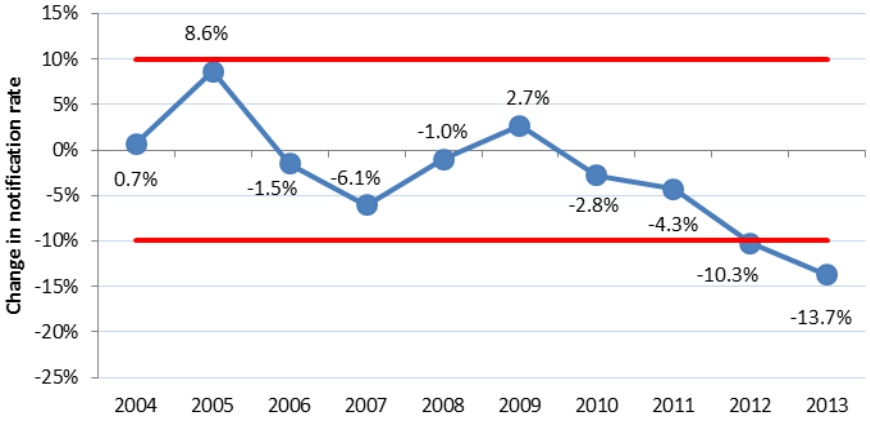


Note. The numbers highlighted at the bottom of the graph are the absolute number of TB cases in children.
Source: Global TB database *(7)*.

Year-on-year change in the case notification rate for all forms of TB

As mentioned above, TB notifications seldom vary by more than 10% between consecutive years. Unexplained sharp variations suggest gaps in the surveillance system. Fig. 9 shows the overall time series percentage of change in the rate of all TB cases in Georgia. Throughout 2003–2004 to 2012 the change in notification rate was within 10% of change. From 2010, there was a decreasing trend in notification, which was above the expected level especially during 2012–2013, suggesting some level of internal inconsistency for those years.

Fig. 9. Year-on-year change in notification rate of TB cases (all forms) (%), Georgia, 2003–2004 to 2012–2013

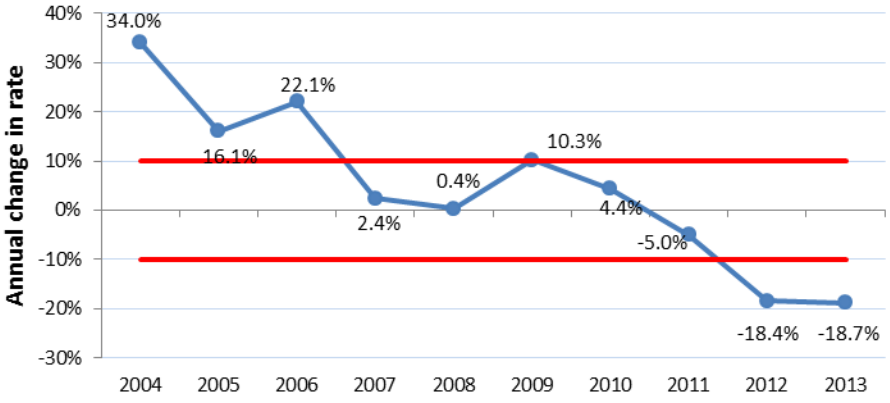


Note. Horizontal red lines indicate upper and lower levels of internal consistency.
Source: Global TB database *(7)*.

Year-on-year change in the notification rate of new sputum-smear-positive TB cases

Analysis of the annual change in the notification rate of new sputum-smear-positive cases suggests internal inconsistencies between 2011–2012 (by -18.4%) and 2012–2013 (by -18.7%). These are beyond the expected level of change, indicating some weakness in the surveillance system (Fig. 10).

Fig. 10. Percentage of year-on-year change in notification rate of new sputum-smear-positive TB cases, Georgia, 2003–2004 to 2012–2013



Note. Horizontal red lines indicate upper and lower levels of internal consistency.
Source: Global TB database *(7)*.

Year-on-year change in ratio of the number of people with presumptive TB to total notifications of TB cases

The ratio of people with presumptive TB to all TB notifications in the civilian population was stable from 2008 to 2011, although during that period the numbers of both presumptive TB cases and all notified TB cases decreased by 15%. In 2012 and 2013, the ratio increased sharply from 2.0 to 2.7, although the increase in presumptive TB cases was not associated with a further decrease in notified TB cases, which is unusual (Table 3).

Table 3. Ratio of the number of people with presumptive TB to the total number of notified TB cases, Georgia, 2010–2013 (civilian population only)

Year	Number of people with presumptive TB	Number of notified cases, all forms of TB	Ratio
2008	11 320	5461	2.1
2009	11 927	5365	2.2
2010	10 023	4901	2.0
2011	9 575	4733	2.0
2012	10 604	4517	2.3
2013	11 553	4220	2.7

Standard B1.8

All diagnosed cases of TB are reported.

Benchmarks

Both the following benchmarks should be satisfied to meet this standard.

- *TB reporting is a legal requirement.*
- *≥90% of TB cases are reported to national health authorities, as determined by a national level investigation (such as an inventory study conducted in the previous 10 years).*

TB is a notifiable disease in Georgia regulated by policy documents issued by the National Centre for Disease Control on notification of contagious diseases.

No investigation has been carried out to estimate the underreporting of TB cases. Therefore, this benchmark is deemed to be not satisfied and the standard is only partially met.

Recommendations

- The NTP should undertake an inventory study using recommended WHO guidelines to measure the number of underreported TB cases.
- Regular cross-check surveillance of the paper and electronic registers with the laboratory registers at national and regional level should continue routinely to ensure that all diagnosed cases are included in the surveillance system. The reason for missing TB patients from the surveillance system should be analysed and, on the basis of those findings, an action plan developed to minimize underreporting.

Standard B1.9

The population has good access to health care.

Benchmarks

Both the following benchmarks should be satisfied to meet this standard.

- *The under-five mortality rate per 1000 live births is <10.*
- *<25% of total health expenditure is out-of-pocket.*

For notification data to provide a direct measurement of TB incidence, apart from the accurate reporting of diagnosed TB cases (standard B1.8) the number of *undiagnosed* cases must be a small or negligible fraction of the total number of TB cases. To ensure that all TB cases are diagnosed and reported (in other words, notification is proxy of incidence), the population must have good access to a well-functioning health care system. The under-five mortality rate and the percentage of health expenditure that is out-of-pocket provide a very broad overall indication of the quality and coverage of health care, as well as the affordability and accessibility of services.

According to the WHO Global Health Observatory data repository *(9)*, the under-five mortality rate in 2013 was 13 (range: 11–16) per 1000 live births, suggesting some suboptimal access to quality health care. Moreover, in 2012 out-of-pocket expenditure was 65% of total health expenditure *(10)*, suggesting the existence of notable financial barriers to health services.

Under current conditions, it is likely that there are people with TB who are not being diagnosed with the disease. TB notification data are thus not a good proxy for TB incidence. Thus, neither of the benchmarks is satisfied and the standard is not met.

Recommendation

The action needed to address the gaps is beyond the influence of a TB surveillance system and is long-term in nature, including strengthening health care services, increasing financial investments and introducing mandatory national health insurance.

Standard B1.10

The vital registration system has high national coverage and quality.

Benchmarks

Both the following benchmarks should be satisfied to meet this standard.

- *Cause of death documented in >90% of total deaths recorded in: (a) the national vital registration system or (b) the sample vital registration system.*
- *<10% of deaths have ICD codes for ill-defined causes (defined as ICD-9 780–799 and ICD-10 R00–R99).*

The following formula was used to calculate completeness of death registration by the vital registration system *(11)*:

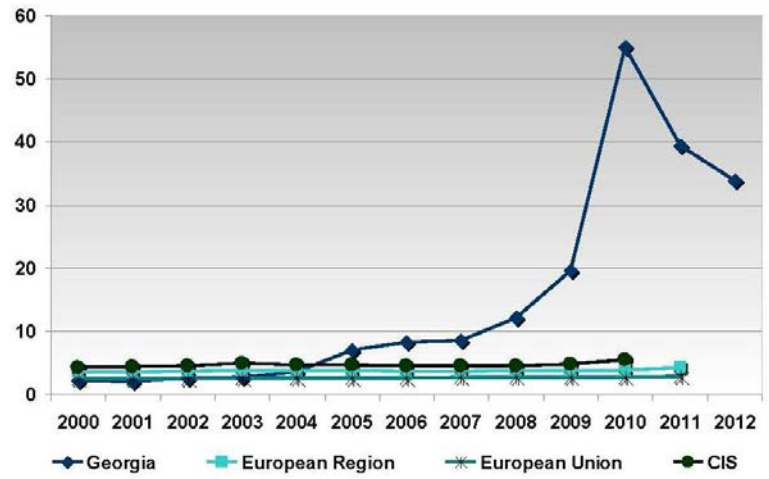
$$YD = RD/(CDR \times P) \times 100$$

where YD is the estimated completeness of death registration (%)
RD is the actual number of registered deaths
CDR is the crude death rate, as estimated by the United Nations (per 1000)
P is the total population size (divided by 1000).

The United Nations estimates that the crude death rate for Georgia in 2010–2015 was 13.1 per 1000 population *(12)*. In 2013, the population was reported as 4 340 000 *(13)* and the civil registration system registered 48 553 deaths with the registered cause of death *(14)*. Thus, the completeness of death registration would be estimated as: YD = 48 553/(13.1 × 4340) × 100 = 85.4%. Thus, the benchmark for completeness of death registration above 90% was not met, although the World Bank estimates the completeness of death recording as 97% in 2012 *(6)*.

According to the Health Care Statistical Yearbook, in 2012 about 34% of recorded deaths were recorded with ill-defined causes with codes R00–R99 *(4)*. Between 2009 and 2013 the proportion of deaths with ill-defined causes varied between 25% and 60% (Fig. 11), suggesting unsatisfactory data quality on causes of death. Thus, neither benchmark is considered satisfied and the standard is not met.

Fig. 11. Ill-defined causes of death (%), Georgia, WHO European Region, European Union, Commonwealth of Independent States



Source: WHO's Health for all database [4], and Health care statistical yearbook, Georgia, 2012 *(4)*.

Recommendations

Although the operation of the vital registration system is outside the NTP's sphere of influence, the Ministry of Labour, Health and Social Security can play an active role in improving its poor quality by initiating a dialogue with the other government bodies and stakeholders involved to develop an action plan and proposal for legislative changes to improve the quality of death registration.

Standard B2.1

Surveillance data provide a direct measure of drug-resistant TB in new cases.

Benchmarks

One of the following two benchmarks should be satisfied to meet this standard.

- *Rifampicin susceptibility status (positive/negative) is documented for ≥75% of new pulmonary TB cases.*
- *Rifampicin susceptibility status (positive/negative) is documented for a nationally representative drug resistance survey of new pulmonary TB cases.*

All bacteriologically confirmed pulmonary TB cases were tested for drug resistance at the National Reference Laboratory. Concordance for first-line TB drugs of the most recent round of proficiency testing conducted with the supranational reference laboratory for Georgia was 100%.

The 2013 Georgia TB Annual Report shows that a total of 2412 new pulmonary TB cases were notified. Of them, 1736 (72.0%) patients were found with positive culture or were positive by WHO recommended rapid diagnostics such as GeneXpert MTB/RIF. Of the 1736 culture-positive patients, 1629 had documented rifampicin resistance results. Thus, the percentage of new pulmonary TB patients with documented rifampicin resistance results in 2013 was 67.5% (1629/2412), within the 50–75% range, so the standard could be assumed to be partially met.

[4] http://www.euro.who.int/en/data-and-evidence/databases/european-health-for-all-database-hfa-db

Standard B2.2

Surveillance data provide a direct measure of the prevalence of HIV infection in TB cases.

Benchmarks

One of the following two benchmarks should be satisfied to meet this standard.

- *HIV status (positive/negative) is documented for ≥80% of all notified TB cases.*
- *HIV status is available from a representative sample of all TB cases notified in settings with a low-level epidemic state[5] or where it is not feasible to implement routine surveillance.*

WHO recommends that all patients with presumptive or diagnosed TB should receive HIV testing and counselling to ensure early case detection and rapid initiation of treatment *(15)*. Data on HIV status among TB cases should be collected through routine surveillance in all settings regardless of the HIV epidemiology.

The country is in the concentrated epidemic stage[6] of HIV. Of the total 4319 cases of TB (all forms) notified in 2013, the HIV status of 2698 TB patients (62.5% of total cases) was documented. This is within the 50–75% range, so the standard could be assumed to be partly met.

Recommendation

There is ample scope to increase HIV testing coverage. The introduction of a rapid HIV test might improve the situation. The TB and AIDS centres should work more closely to exchange HIV/TB data.

Standard B2.3

Surveillance data for children reported with TB are reliable and accurate, and all diagnosed childhood TB cases are reported.

Benchmarks

Both the following benchmarks should be satisfied to meet this standard.

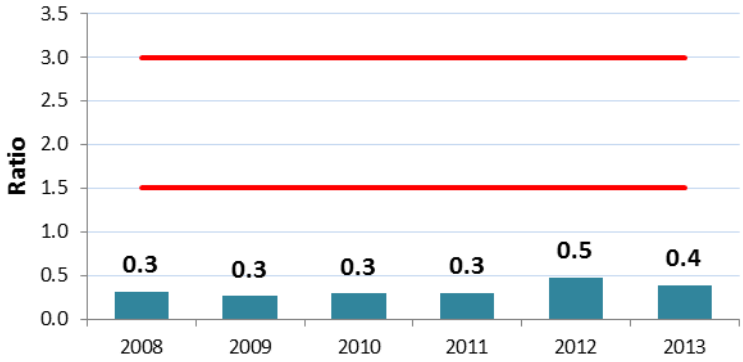
- *The ratio of the group aged 0–4 years affected by TB to aged 5–14 years is in the range 1.5–3.0.*
- *>90% of childhood TB cases are reported to national health authorities, as determined by a national-level investigation (such as an inventory study conducted in the past 10 years).*

TB is often not considered as a possible diagnosis in case of childhood diseases and often goes undetected. Diagnosing TB in children is challenging, as it is rarely laboratory confirmed and therefore presents a problem in establishing a definitive diagnosis. Children can present with TB at any age, but the most common age is between one and four years. Children aged 0–4 years are at highest risk of contracting TB and TB cases in this age group occur more often than in the group aged 5–14 years. The lowest risk of TB is observed in the group aged 5–10 years, known

[5] HIV prevalence has not consistently exceeded 5% in any defined subpopulation.
[6] Concentrated epidemic state: HIV prevalence is consistently >5% in at least one defined subpopulation, and is <1% among pregnant women in urban areas.

as the safe school years. According to routine notification data in 2013, 51 of the 183 children diagnosed with TB were aged under five years and 132 were aged 5–14 years. Thus, the number of children with TB aged 0–4 years is much lower than the number of children aged 5–14 years, suggesting that many cases of TB in children aged under five years probably remain undetected and/or underreported (Fig. 12). The ratio of TB cases in children aged 0–4 years to those aged 5–14 years in 2013 was 0.4, far below the expected level. Thus the first benchmark is considered not satisfied. Since a national investigation (such as an inventory study) has not been undertaken, the second benchmark also is not satisfied either. As a result, standard B 2.3 is not met.

Fig. 12. TB ratio of group aged 0–4 years to group aged 5–14 years, Georgia, 2008–2013



Note. Horizontal red lines indicate the range of the benchmark at levels of 1.5 and 3.0.
Source: Global TB database *(7)*.

Recommendations

The NTP should make further investigations and the potential reasons for these discrepancies should be hypothesized and discussed with paediatricians, intensive care physicians from paediatric hospitals, pulmonologists and family practitioners and all those who make and report the diagnosis of childhood TB.

Corrective action may be required, including training health care providers and revising the differential diagnostic algorithm adopted at the general hospital.

An inventory study using recommended WHO guidelines should be conducted to assess the underreporting of cases directly.

Strengths and weaknesses of surveillance system

Of 12 standards for TB surveillance, five were met, four were partially met and three were not met (Table 4). This suggests that there are still gaps that must be met before the surveillance system can provide a direct measure of the number of TB patients detected and ultimately a direct measure of TB patients occurred.

On the basis of the WHO TB surveillance checklist, the strengths of the TB surveillance system include:

- the presence of highly skilled staff at national level with relevant educational backgrounds
- availability of case-based data at national level

- universal access to culture and DST for all TB patients
- availability of data quality control procedures (regular cross-checks, completeness of data);

and the weaknesses include:

- low quality and coverage of the vital registration system
- low coverage of HIV testing
- limited validity of surveillance data for childhood TB.

Table 4. Summary of standards for TB surveillance, Georgia, November 2014

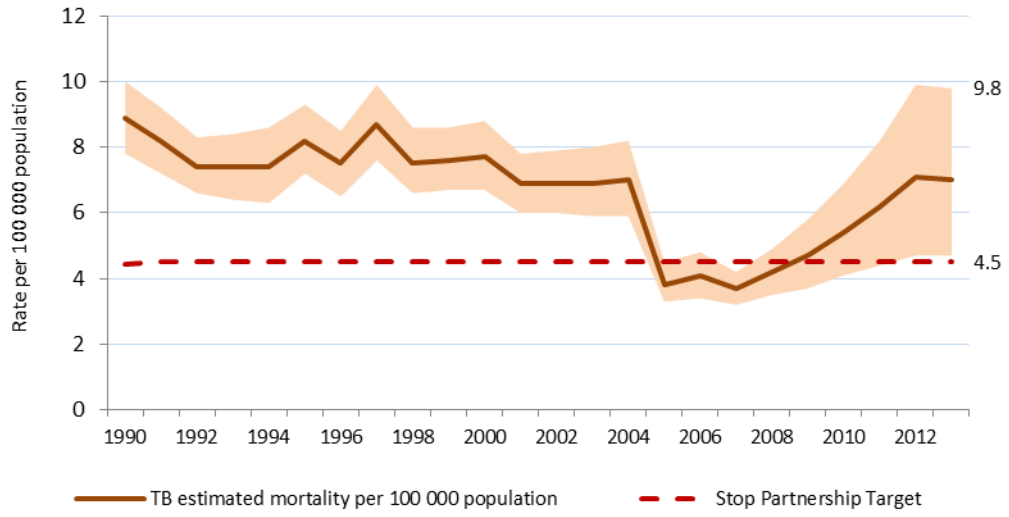
No.	Name	Met	Partly met	Not met	Not applicable
B1.1	Case definitions consistent with WHO guidelines	X			
B1.2	TB surveillance system designed to capture a minimum set of variables for reported TB cases	X			
B1.3	All scheduled periodic data submissions received and processed at national level	X			
B1.4	Data in quarterly reports are accurate, complete and internally consistent				X
B1.5	Data in national database are accurate, complete, internally consistent and free of duplicates	X			
B1.6	TB surveillance data are externally consistent	X			
B1.7	Number of reported TB is cases internally consistent		X		
B1.8	All diagnosed cases of TB are reported		X		
B1.9	Population has good access to health care			X	
B1.10	Vital registration system has high national coverage and quality			X	
B2.1	Surveillance data provide a direct measure of drug-resistant TB in new cases		X		
B2.2	Surveillance data provide a direct measure of the prevalence of HIV infection in TB cases		X		
B2.3	Surveillance data for children reported with TB are reliable and accurate			X	

Assessment of the level of, and trends in, TB disease burden

Analysis of the level of, and trends in, TB mortality

Estimates of TB mortality are based mainly on information from the vital registration system (Fig. 13) *(7)*. Thus, in 1990 the TB mortality rate was estimated at 8.9 per 100 000 population. Between 1990 and 2005, the rate gradually decreased with some fluctuations from 8.9 to 7.0. Then in 2005 the vital registration system reported a sudden sharp decrease of up to 3.8 per 100 000 population, and later from 2007 it notably increased until 2012. Such a sharp decrease and then increase in mortality between 2005 and 2012 are most probably artefacts related to the weakness of the vital registration system in accurately capturing and reporting the causes of death. By the end of 2013, estimated TB mortality was reported to be 7.0. This is still higher than the Millennium Development Goal 6 target of halving TB mortality by 2015 compared to 1990, which would bring it down to 4.5 per 100 000 population, a level which the country will not be able to achieve.

Fig. 13. Estimated TB mortality rate (excluding TB/HIV mortality) per 100 000 population, Georgia, 1990–2013



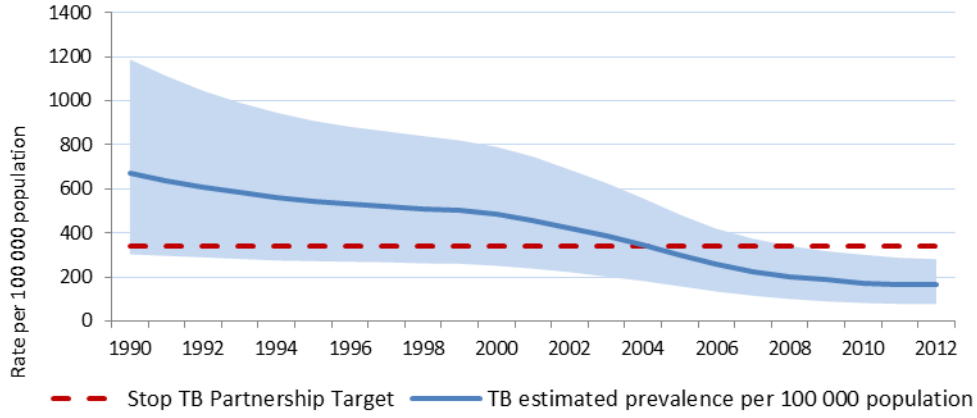
Shaded areas represent the uncertainty band of WHO estimated TB mortality. The horizontal dashed line represents the target of reducing the TB mortality rate by 50% by 2015 compared to 1990.
Source: Global TB database *(7)*.

Analysis of the level of, and trends in, TB prevalence and incidence

There are no data from direct measurements of TB prevalence. The only available information on TB prevalence comes from WHO indirect estimates.

In 2013, the estimated number of prevalent TB patients was 7100 (3400–12 000), equivalent to a rate of 163 (79–277)/100 000 population. TB prevalence fell steadily after 1990 (Fig. 14), to the point where, in 2005, the Stop TB Partnership Goal of halving TB prevalence by 2015 compared to the estimate of prevalence in 1990 had been achieved.

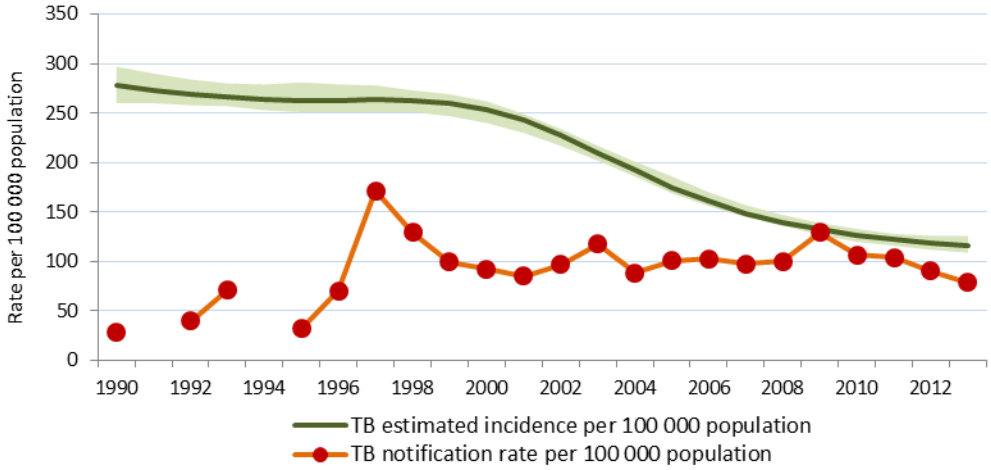
Fig. 14. Estimated TB prevalence rate per 100 000 population, Georgia, 1990–2013



Shaded areas represent uncertainty band of WHO estimated TB mortality. Horizontal dashed line represents Stop TB Partnership target of 50% reduction in prevalence rate by 2015 compared to 1990.
Source: Global TB database *(7)*.

In 2013, there were an estimated 5000 incident cases of TB (uncertainty range 4700–5500), equivalent to a rate of 116 (109–126)/100 000 population. TB incidence decreased steadily from 1990: the annual rate of decline from 2001 to 2013 averaged -5.8% (Fig. 15).

Fig. 15. Estimated TB incidence rate and notification of incident TB cases (new and relapsed) per 100 000 population, Georgia, 1990–2013



Shaded areas represent the uncertainty band.
Source: Global TB database *(7)*.

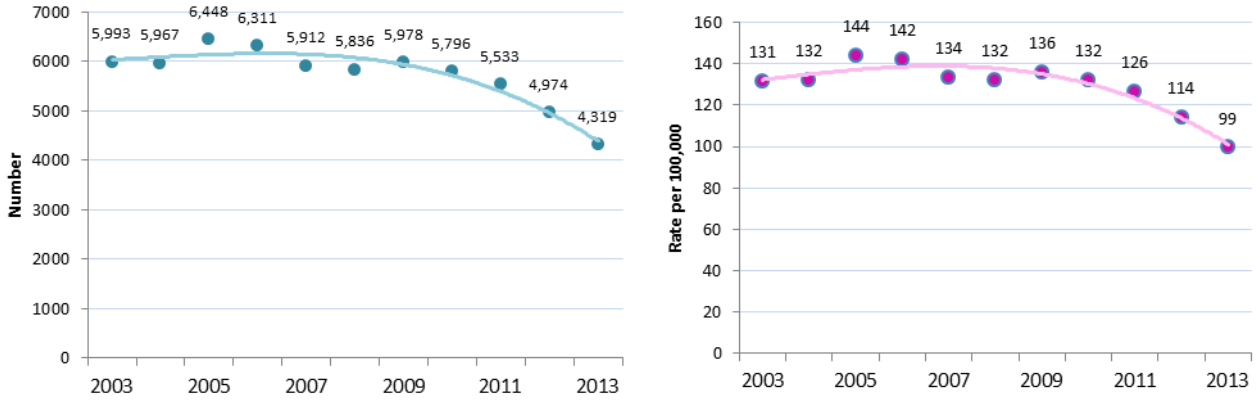
Despite such an impressive decrease in the TB burden, it was estimated that only 68% of TB cases (63–73) were detected by the health care system as of 2013, one of the lowest rates in the WHO European Region *(16)*.

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

Overall TB case notifications and time trends

At national level the number of notified TB cases (all forms) increased from 5993 (equivalent to 131 per 100 000) in 2003 to a peak of 6448 (144 per 100 000) in 2005 (Fig. 16) before declining again. In 2013, a total of 4319 TB cases (99 per 100 000) were notified by the health system. This is the lowest number and level of TB cases recorded since 2003. The average rate of decrease in the notification rate of all TB cases from 2005 to 2013 was 5.4% annually.

Fig. 16. Notification of TB (all forms), absolute number (left) and rate per 100 000 population (right) fitted with polynomial trend lines, Georgia, 2003−2013



Source: Global TB database *(7)*.

TB notification and trend by geographic distribution

The TB notification rate varies across a wide range of geographic regions and settings. The reasons for such a variation could be a true difference in TB burden, as well as different levels of access to quality health care and capacity to detect TB. On the other hand, Georgian TB policy dictates that the TB case is notified from the site of diagnosis. This is probably the reason for the high number of notifications of TB cases in Tbilisi city, as a notable proportion of TB patients from all regions are referred, or refer themselves, to the National Centre of Tuberculosis and Lung Diseases for diagnosis and initial treatment.

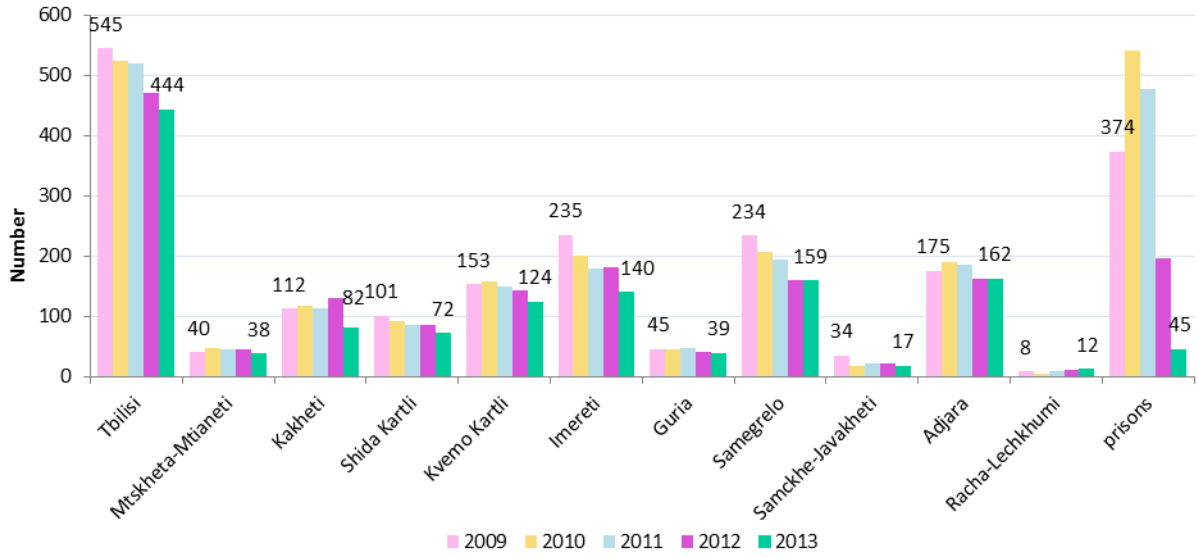
According to national statistics, in 2013 the lowest rate of TB (all cases) was recorded in Samckhe-Javakheti region (44/100 000) while in Adjara region the TB notification rate was over four times higher (Table 5). The TB rate in prisons was 25.5 times higher than in the civilian population.

Table 5. TB notification by region and prison and mean year-on-year change in number of all TB cases, Georgia, 2008–2013

Region	2008	2009	2010	2011	2012	2013	Mean annual change in rate (%)
Tbilisi	154.4	138.5	122.9	126.4	118.6	116.3	-5.4
Mtskheta-Mtianeti	103.8	98.8	117.3	101.4	103.4	82.6	-3.5
Kakheti	73.7	77.2	71.3	71.1	74.6	60.7	-3.4
Shida Kartli	99.4	95.8	88.8	83.5	83.1	72.4	-6.1
Kvemo Kartli	107.9	107.1	88.3	85.9	73.0	73.4	-7.1
Imereti	82.3	84.1	71.5	66.3	74.8	66.1	-3.8
Guria	105.7	105.5	100.6	73.4	77.3	91.4	-1.7
Samegrelo	132.1	142.5	116.3	111.2	106.4	103.7	-4.4
Samckhe-Javakheti	72.9	70.6	53.8	47.8	44.4	44.0	-9.2
Adjara	183.6	163.3	162.3	141.3	153.3	147.4	-4.0
Racha-Lechkhumi	No data?	54.5	35.8	63.6	36.4	54.2	12.4
Prisons	3296.0	4484.0	5400.3	4860.2	3483.4	2326.5	-3.0

The TB notification rate during the last five years [2009-2013] decreased in all geographic regions except in Racha-Lechkhumi, where it increased by an average of 12.4%. The average annual decrease in the other regions varied between -1.7 in Guria to -9.2% in Samckhe-Javakheti. However, given that there are few patients in Racha-Lechumi (Fig. 17), wide stochastic variations are possible.

Fig. 5. Trend in absolute number of new sputum-smear pulmonary TB cases by geographic distribution, Georgia, 2009–2013

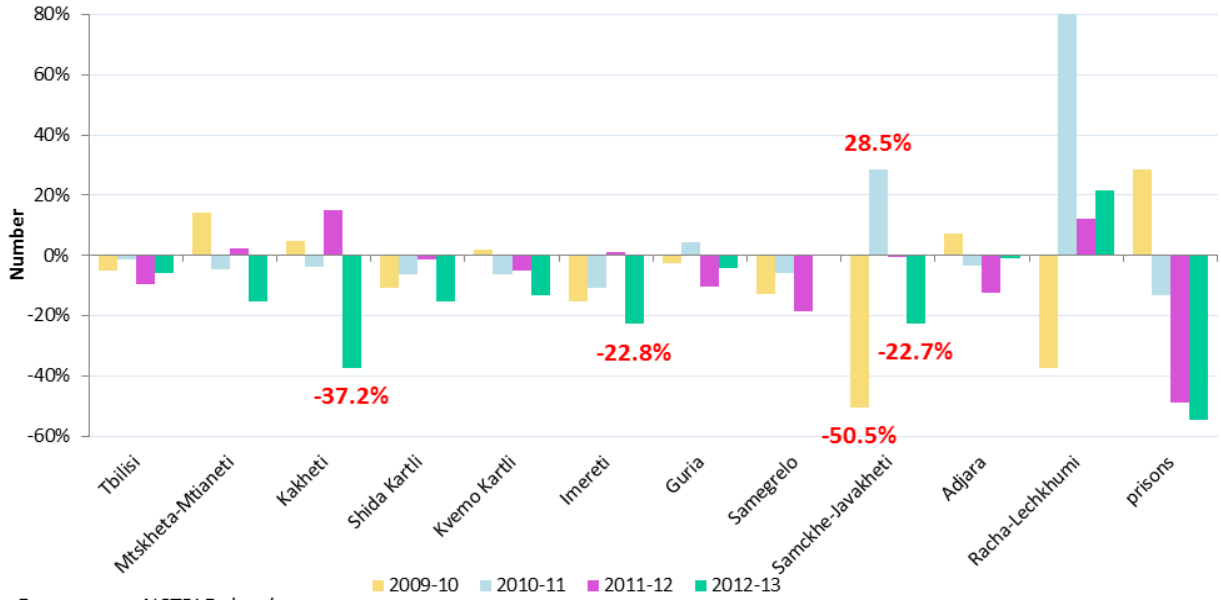


Data source: NCTBLD database

Source: National Centre of Tuberculosis and Lung Diseases database

Fig. 6 shows the year-on-year percentage of change in the notification rate of new smear-positive TB cases. Sharp annual changes are an indication of a problem with diagnosis and/or reporting if there is no other explanation. For example, the observed 15% increase in Kakheti region during 2011–2012, followed by a 37% decrease during 2012–2013, indicates instability in diagnosis and reporting. Another marked decrease is observed in Imereti during 2012–2013. The reasons for such changes need to be hypothesized and explored together with the local TB specialists and the monitoring and evaluation unit. Sharp annual changes might be present if there are only a few patients, as in Racha-Lechkhumi. There are also dramatic changes in TB case notifications in prisons related to the decrease in overcrowding associated with the amnesty in 2012; in other regions notifications are more or less stable.

Fig. 17. Year-on-year change in the new smear-positive TB notification rate by region and prisons, Georgia, 2009–2013

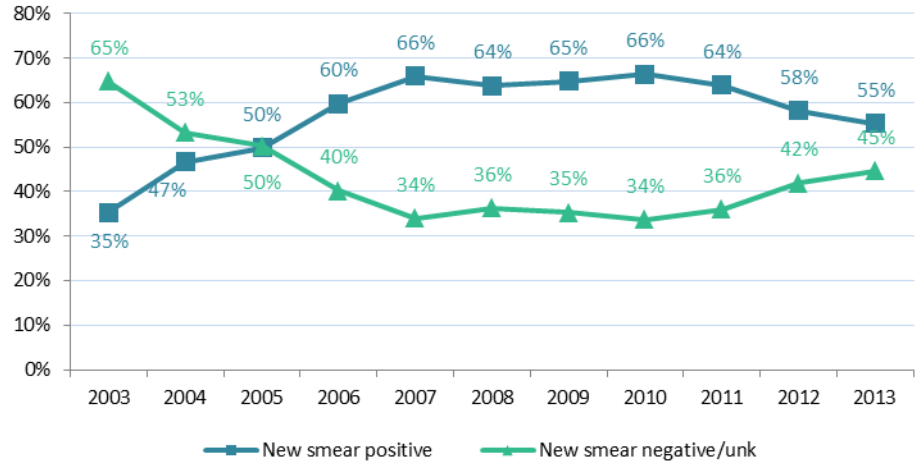


Columns labelled with red figures indicate areas and periods with inconsistent internal notification.
Source: National Centre of Tuberculosis and Lung Diseases database

Trend in TB notification by smear microscopy result

The proportion of new sputum-smear-positive pulmonary TB patients varied notably between 2003 and 2013. From 2004 to 2006, the proportion increased from 35% to 66%, suggesting improvements in laboratory diagnostics. This level was sustained up to 2010, when it decreased by 10% to 55% in 2013 (Fig. 18).

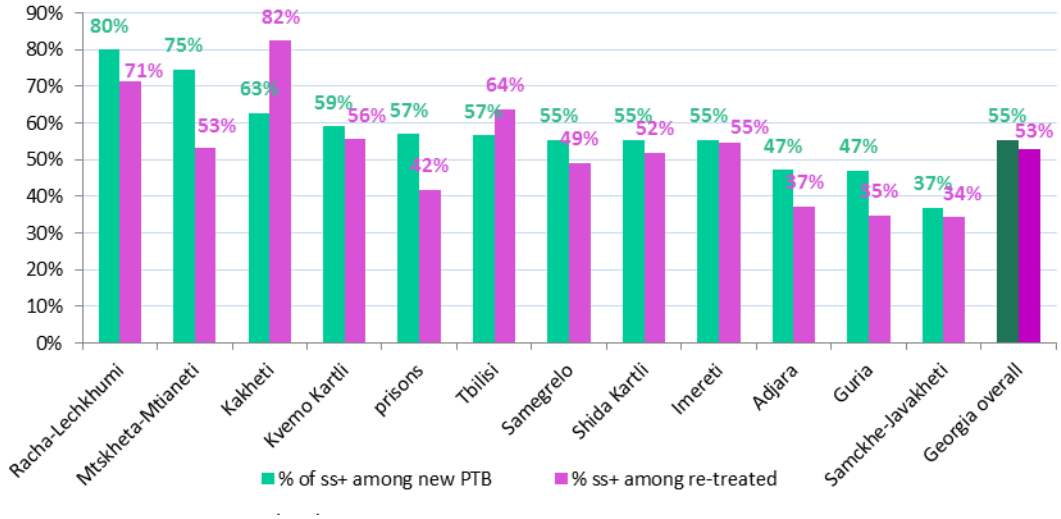
Fig. 18. Trend in proportion of new smear-positive and smear-negative pulmonary TB cases among new pulmonary TB cases, Georgia, 2003–2013



Source: Global TB database *(7)*.

The proportion of smear-positives varies widely across the regions, suggesting some differences in diagnostic capacities and practices (Fig. 19). Over more than a decade 2003–2013, the proportion of smear-positive TB cases varied by an average of 80% (in Racha-Lechkhumi) to 37% (in Samckhe-Javakheti). Among previously treated pulmonary TB patients, the highest rate of smear-positives was observed in Kakheti (82%).

Fig. 19. The proportion of new smear-positive and smear-negative pulmonary TB cases among new pulmonary TB cases, Georgia, 2003–2013

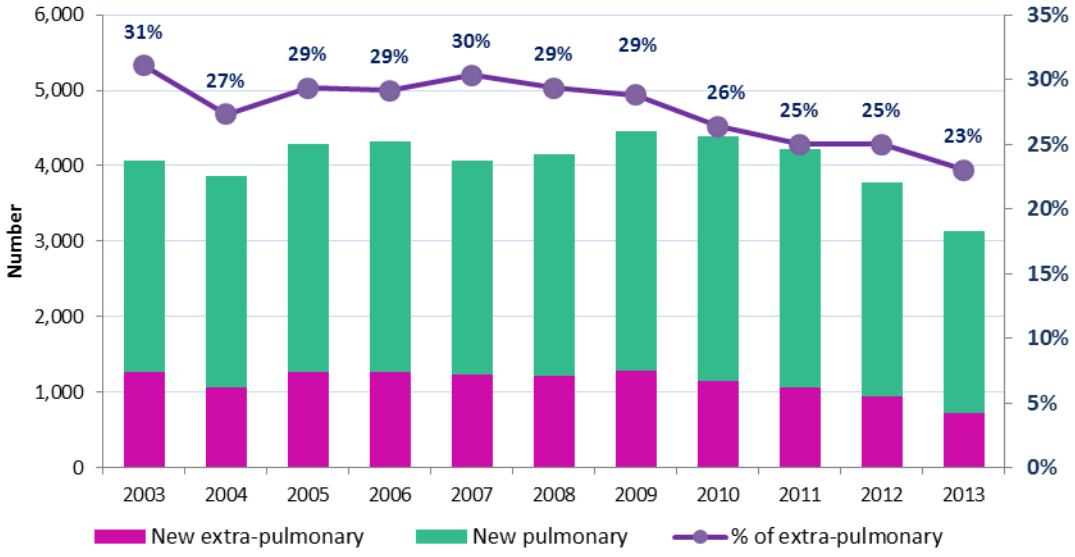


Source: National Centre of Tuberculosis and Lung Diseases database

Trend in TB by site of disease

The percentage of new extrapulmonary cases was stable between 2003 and 2009, but from 2010 the proportion gradually decreased to 23% in 2013 (Fig. 20).

Fig. 20. Trend in notifications of new pulmonary and extrapulmonary TB cases, and proportion of extrapulmonary cases among new TB cases



Source: Global TB database *(7).*

It is worthy of note that, together with the decrease in the absolute number of extrapulmonary TB cases, the proportion of those confirmed by culture between 2010 and 2013 increased from 12.3% to 17.9% (Table 6).

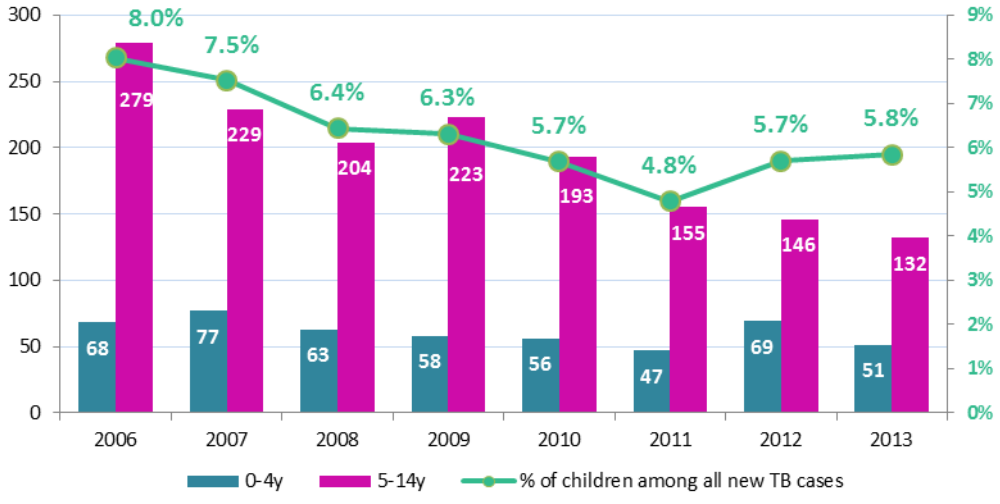
Table 6. Trend in absolute number of extrapulmonary TB cases by culture confirmation, Georgia, 2010–2013

Year	New extrapulmonary TB cases	No. of culture positives	Percentage confirmed by culture (%)
2010	1155	142	12.3
2011	1056	141	13.4
2012	944	146	15.5
2013	721	129	17.9

Trend in childhood TB

The absolute number of TB cases in children fell by almost half, from 347 in 2006 to 182 in 2013. The relative number of child TB cases also fell in the same period from 8.0% to 5.8%. This sharp reduction and the subsequent increase in the number of child TB cases in 2011 are obviously artefacts caused by weaknesses in diagnosis or reporting or both. The reduction in notifications of TB in children occurred mainly because of the fall in the number of children aged five to 14 years, suggesting some improvement of TB diagnoses in young children. Even so, the ratio of TB affected children aged 0–4 years to those aged 5–14 years is very low.

Fig. 21. Trend in notified number of TB cases in children disaggregated by age group, and proportion of child TB cases among all new TB cases, Georgia, 2006–2013



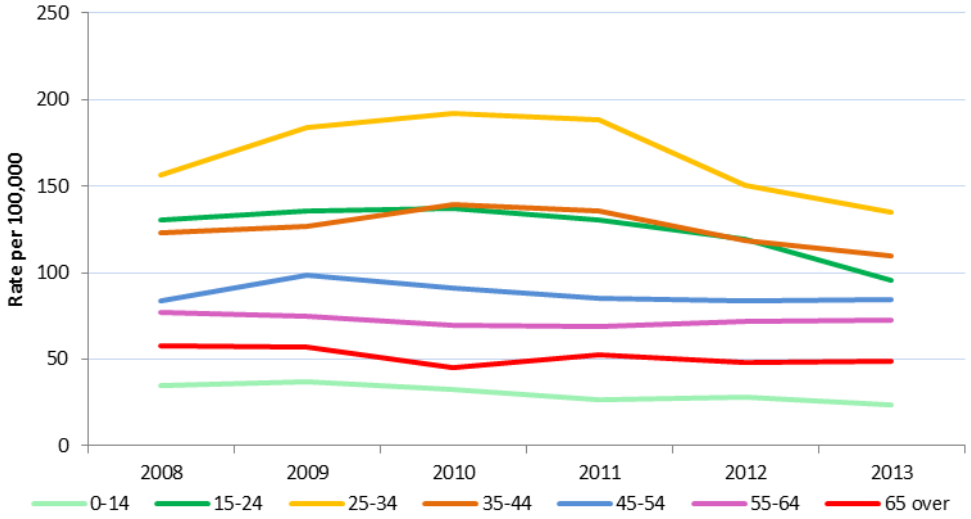
Source: Global TB database *(7)*.

In 2012, the percentage of children among new smear-positive pulmonary TB patients was 0.5% (9/1648) and among new smear-negative pulmonary TB patients it was -1.6% (19/1186); among new extrapulmonary TB cases, 19.8% (187/944) of cases were in children aged under 15 years.

Thus the proportion of pulmonary TB cases among all child TB cases is only 13%. This is unusually low,[7] suggesting issues in detection of child pulmonary TB cases.

Fig. 22 provides trends in age- specific notification rates of new TB cases from 2008 to 2013. The age-specific notification rates decreased mainly in the younger age groups (0–14, 14–24 and 25–34 years); in the group aged 45–54 years it remained unchanged while in the groups aged 55–64 years and 65 years and over it fell slightly. The decrease in age-specific notifications in the younger age groups is a sign of decline in the annual risk of infection, suggesting a decrease in the density of infectious TB cases in the population.

Fig. 22. Age-specific TB notification rate in new TB cases, Georgia, 2008–2013



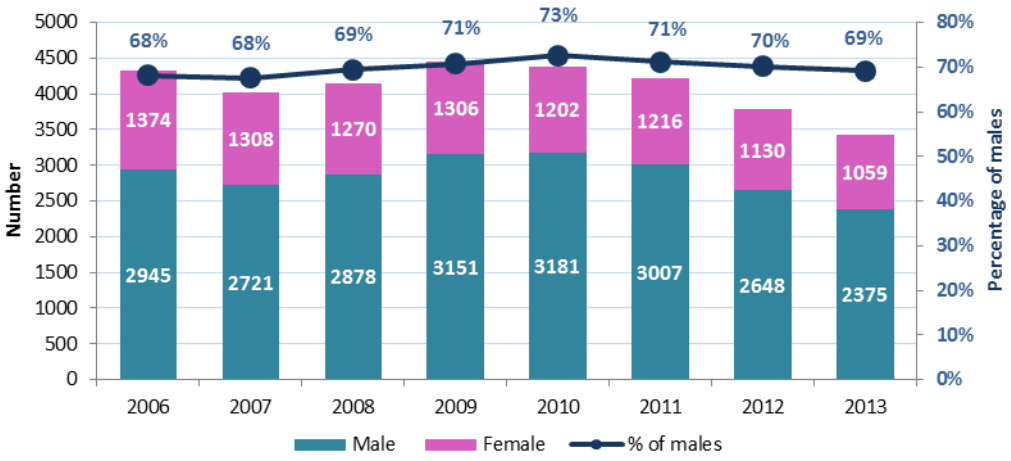
Source: Global TB database *(7).*

Trend in TB notification by sex

The proportion of TB cases who are males is more or less stable, ranging from 68% in 2006 to 73% in 2013 among new TB cases (the 2013 data include relapsed cases) (Fig. 23). The proportion of males rose to 73% in 2010 and then fell to 69% in 2013. Possible reasons for the decrease in the proportion of males are described in the first section above.

[7] There is no benchmark for the proportion of pulmonary TB cases (both adults and children because of wide possible range). However, recent evidence suggests that the proportion of pulmonary TB among children should be similar to that among adults (http://www.who.int/tb/challenges/childhood_tb_informationsheet.pdf).

Fig. 23. Number of notified new TB cases by sex and percentage of males, Georgia, 2006–2013

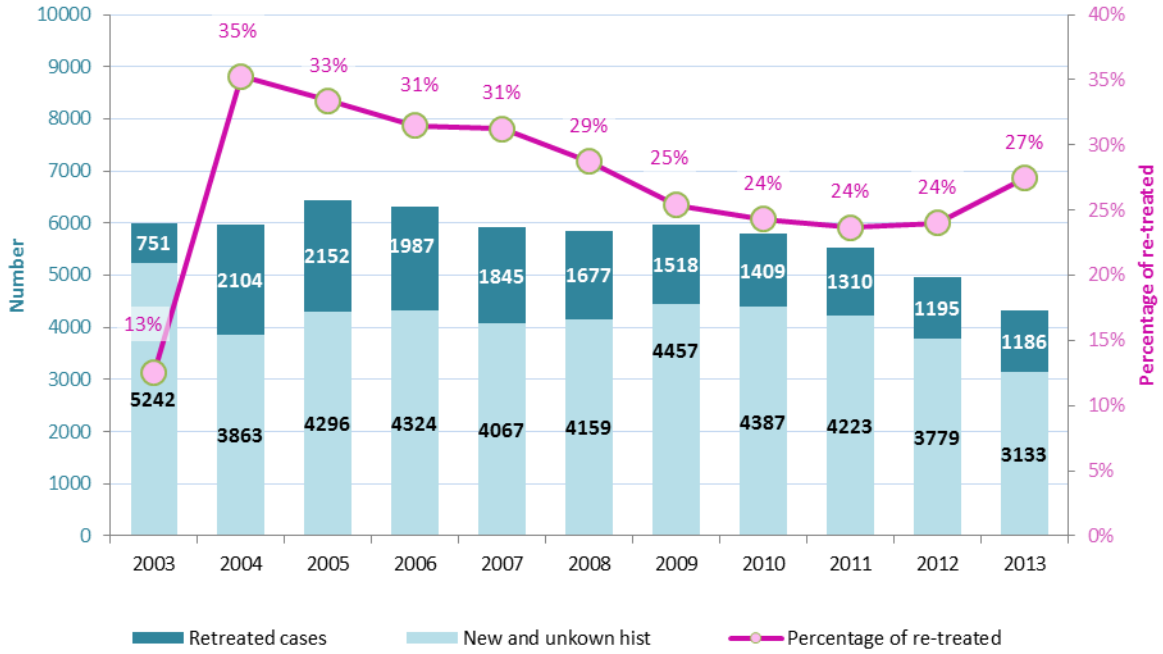


Note. 2013 data include new and relapsed cases.
Source: Global TB database *(7)*.

Trend in TB notification by category

The proportion of retreated TB cases among all notified TB cases fell markedly from 2004 to 2013. The overall proportion of retreated TB cases varied from 24% to 35% at national level. In 2013 there was a sharp increase in the proportion of retreated cases (Fig. 24) due to a sharp fall in the number of notifications of new TB cases.

Fig. 24. Number of notified new and retreated TB cases and proportion of previously treated TB cases, Georgia, 2003–2013

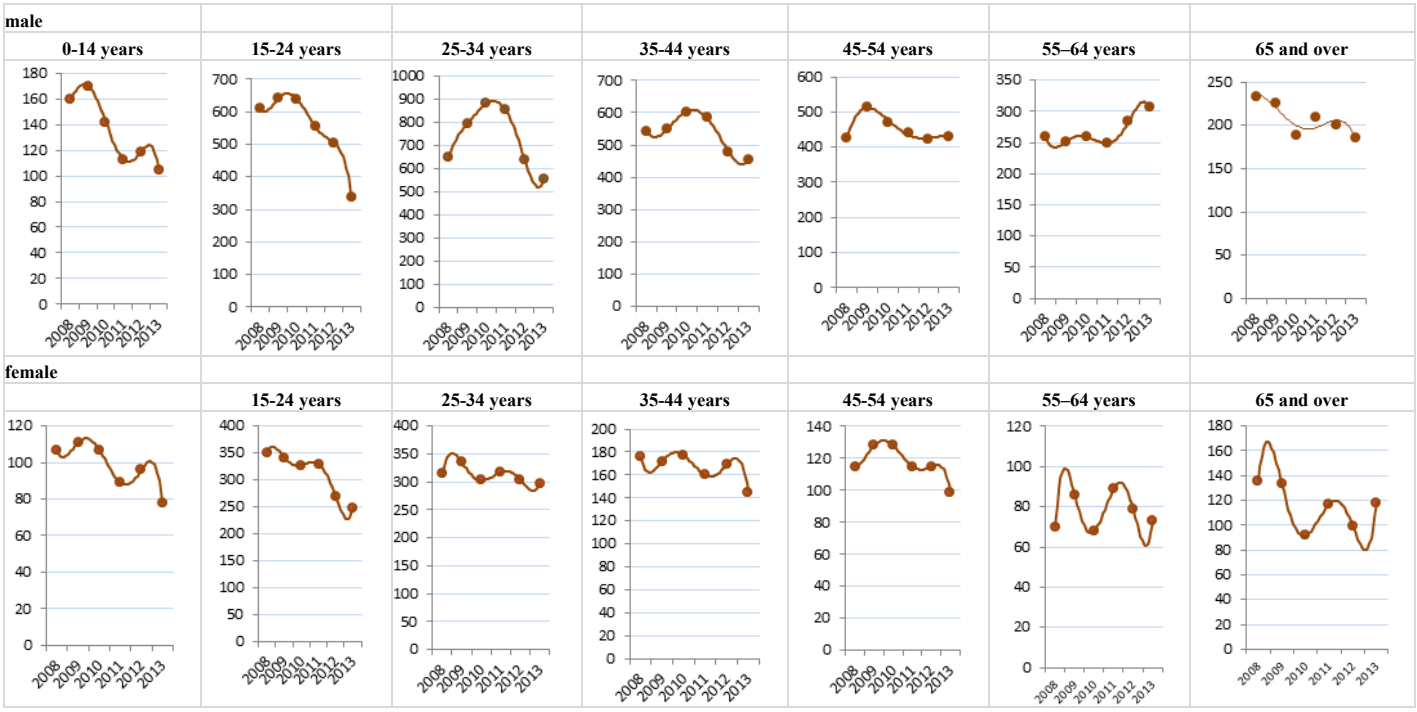


Source: Global TB database *(7)*.

Trends in TB notification by age and sex

Fig. 25 represents new TB notifications (all forms) by age groups and sex during 2008–2013. Notifications of new TB cases are falling in young males, while the number of notified TB cases in people aged 55–64 years is increasing. The increase in the number of notified TB cases in this age group is, however, likely to be because of changes in the demographic structure of the population as the age-specific new TB notification rate of 55–64 is decreasing (Fig. 22). Notification of TB cases in females aged 0–14 and 15–24 years also clearly decreased during recent five years 2009-2013. It can, therefore, be concluded that across age groups and sexes the trends in TB notifications are more or less consistent, albeit with some unexplained fluctuations (such as in males aged 25–34 years).

Fig. 25. New TB cases by age group and sex, Georgia, 2008−2013 (fitted with polynomial trend-lines)



Note. 2013 notification data are for new and relapsed cases.
Source: Global TB database *(7)*.

Average age of newly notified cases, and the extent to which these can be explained by demographic or other factors

According to current knowledge of TB epidemiology, TB notification rates among young adults are high in areas with a persistently high annual risk of infection. This is because TB cases in the young age groups indicate recent transmission. Once TB is controlled and the annual risk of infection starts to fall, the incidence of TB also falls and there are relatively more cases among older individuals, which are mainly due to reactivation. The age distributions of new TB cases were checked for normality and the mean age of new TB cases of annual cohorts were fitted with a linear regression line. Fig. 26 represents the mean age of new TB cases, male and female, from 2005 to 2013. This mean age increased from 36.1 to 40.1 years in males and from 34.2 to 35.8 years in females. Thus, between 2006 and 2013, the mean age of male TB patients rose annually by an average of 0.45 years and of female patients by 0.21 years. In both sexes the correlation

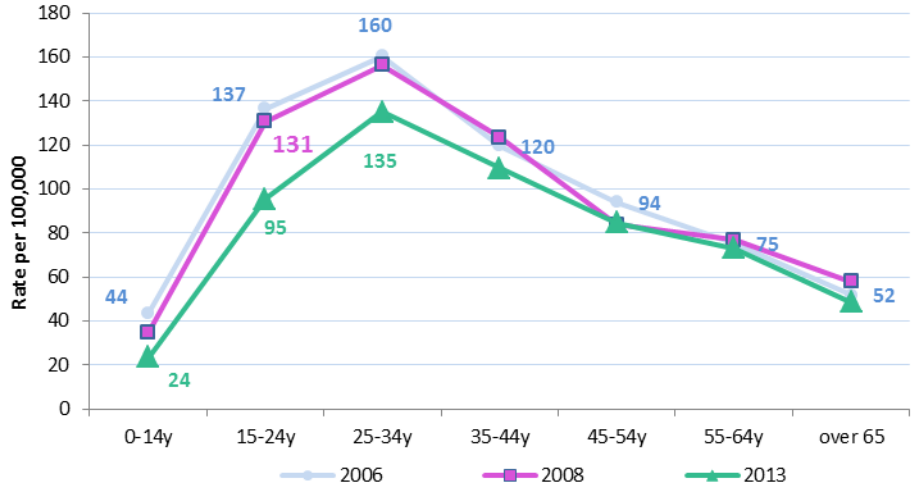
between the time and the mean age is strong: 73% of the variance in males and 50% of the variance in females is explained by the regression model. The rising trend in the mean age supports the hypothesis that the risk of contracting TB is decreasing.

Fig. 26. Trend in mean age of notified new TB cases, stratified by sex, Georgia, 2005–2013 (fitted with linear regression line)

Source: Global TB database *(7)*.

Changes in the population structure might also cause changes in the mean age. Thus, looking at the absolute number of the total population, it is clear that the "baby boom" generation was transitioning from middle to older age between 2005 and 2013. The increase in the mean age in recent years might, therefore, be partially explained by the change in the wave-form population structure. To control for the effect of change in the population structure, age-specific new TB notification rates were plotted and compared across time. Fig. 27 shows that the risk of TB is highest in the group aged 25–34 years. In 2013, the age-specific notification rate decreased particularly among the young age groups (which was expected), while TB control interventions had little impact on the older age groups as in these groups the occurrence of TB is mainly due to re-activation of latent infection.

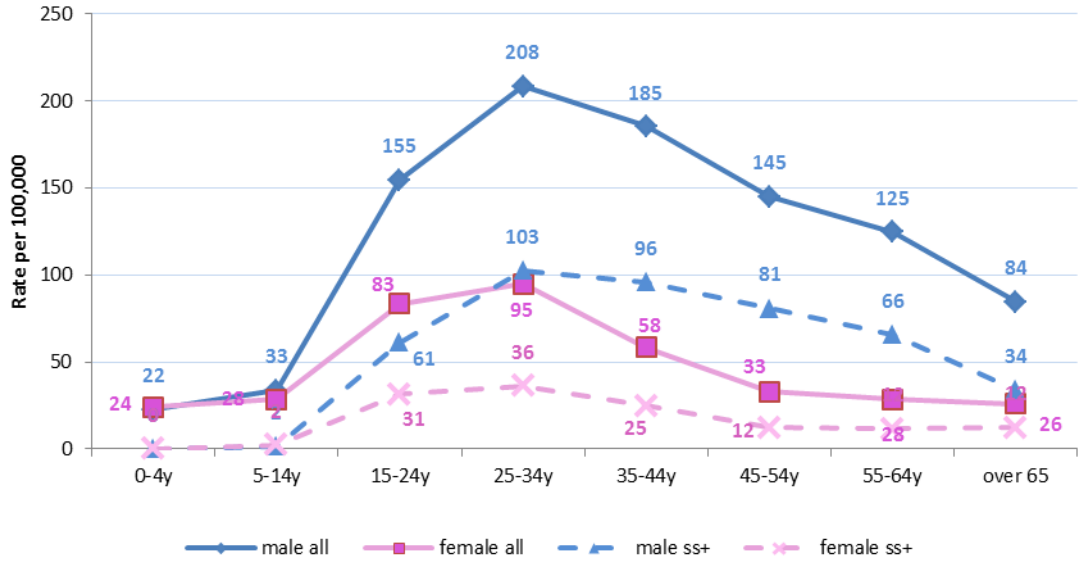
Fig. 27. Change in pattern of age-specific notification rates of new TB cases, Georgia, 2006, 2008 and 2013



Source: Global TB database *(7)*.

The age distribution of TB cases across the age groups is similar among males and females for all new and all sputum-smear-positive TB cases. In both sexes, the risk is lowest in the youngest age groups, sharply increases to a peak in the group aged 25–34 years and then gradually decreases (Fig. 28).

Fig. 28. Age- and sex-specific notification rate of new TB cases (all forms) and of new sputum-smear-positive pulmonary TB cases, Georgia, 2012



Source: Global TB database *(7)*.

Key findings

- TB mortality and its trends are largely uncertain because of the inadequate quality of the vital registration system. TB mortality estimated by WHO is increasing and is far above the Millennium Development goal target for TB mortality of 4.5 per 100 000 population.

- The estimated prevalence and incidence of TB since 2001 have been declining at an annual average rate of 8.7% and 5.8%, respectively.
- In recent five years 2009–2013, TB notifications decreased in all regions and in prisons.
- The proportion of smear-positives among new pulmonary TB cases fell over the recent five years, 2009 to 2013.
- The proportion of extrapulmonary TB cases gradually fell over the recent five years, from 2009 to 2013.
- TB notifications decreased for both males and females, but the decrease for males was much more rapid resulting in a decrease in the male to female ratio over time.
- From 2010 to 2012, the proportions of new and retreated cases declined. The observed sharp decline in TB notifications in 2013 was, however, only due to new TB cases.
- Age-specific notification rates of new TB in recent five years fell in all age groups except in the group aged 45–54 years. The decline was especially marked in the younger age groups (0–34 years).
- The mean age of new TB cases increased in both males and females in the recent years, from 2009 to 2013. This increase is partially related to demographic changes (apart from the decrease in age-specific notifications in the younger age groups).

Relationship of recent trends in TB disease burden to changes in TB-specific interventions

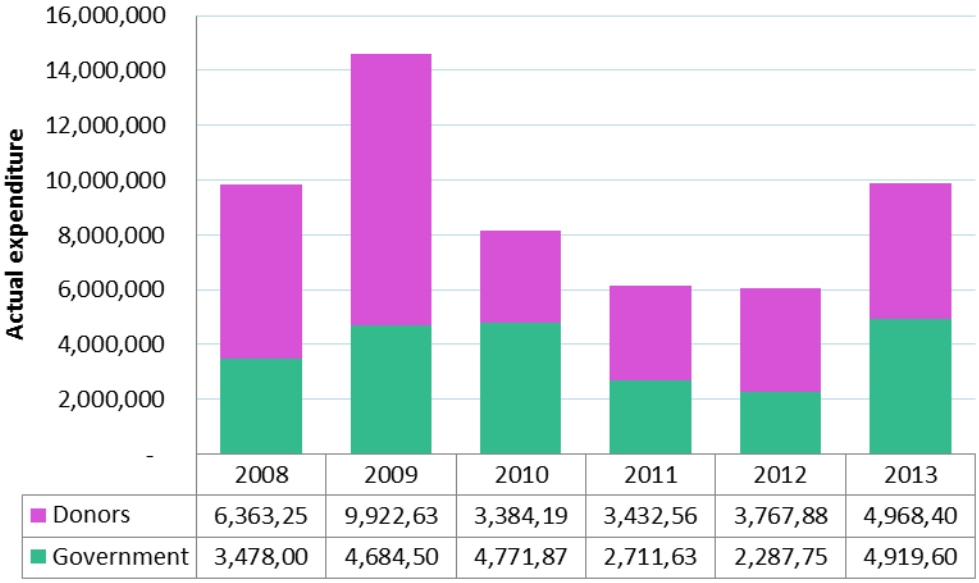
Funding for and implementation of high-quality TB-specific interventions should result in the detection of people with TB and curative treatment for them. These, in turn, should have a direct impact on TB mortality through cutting case fatality rates compared with no or substandard treatment. Shortening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

Factors related to the NTP

Government and donor funding for TB care and control

In 2013, total expenditure for the NTP was around US$10 million, 50% of which was funded domestically and the rest covered by international donors (mainly the Global fund and the United States Agency for International Development). Between 2008 and 2013 TB funding fluctuated widely with no clear trend (Fig. 29). Expenditure fell sharply in 2011 and 2012 but markedly increased in 2013. No gap in TB financing was reported.

Fig. 29. Actual TB expenditure in US$, disaggregated by funding source, Georgia, 2008–2013



	2008	2009	2010	2011	2012	2013
Donors	6,363,25	9,922,63	3,384,19	3,432,56	3,767,88	4,968,40
Government	3,478,00	4,684,50	4,771,87	2,711,63	2,287,75	4,919,60

Source: Global TB database *(7)*.

Diagnostic services

In 2011, the NTP decided to reduce the number of microscopy laboratories from 30 to nine and to establish a sputum transport system to ensure the quality of laboratory testing (Table 7). With only nine microscopy laboratories for a population of over four million, access to laboratory diagnostics is limited. Currently the number of microscopy laboratories is four times lower than that required by the Stop TB Partnership target of at least one laboratory per 100 000 population. The decrease in the number of laboratories can have a negative impact on case detection and increase delays in starting TB treatment. Because the closing of so many diagnostic laboratories coincided with the decline in notification of sputum-smear-positive TB cases, it is plausible that the observed decline in notifications is related to barriers to diagnosis rather than to a true decrease in TB incidence.

Table 7. Number of microscopy laboratories, external quality assurance coverage and number of microscopy laboratories with external quality assurance certificate, Georgia, 2009–2013

Year	Functional	Subject to external quality assurance	Received external quality assurance certificate	Equipped with light-emitting diode microscopy	Equipped with GeneXpert
2009	30	30	29		
2010	29	29	29		
2011	29	29	29		1
2012	11	11	8	1	1
2013	11	11	10	1	1

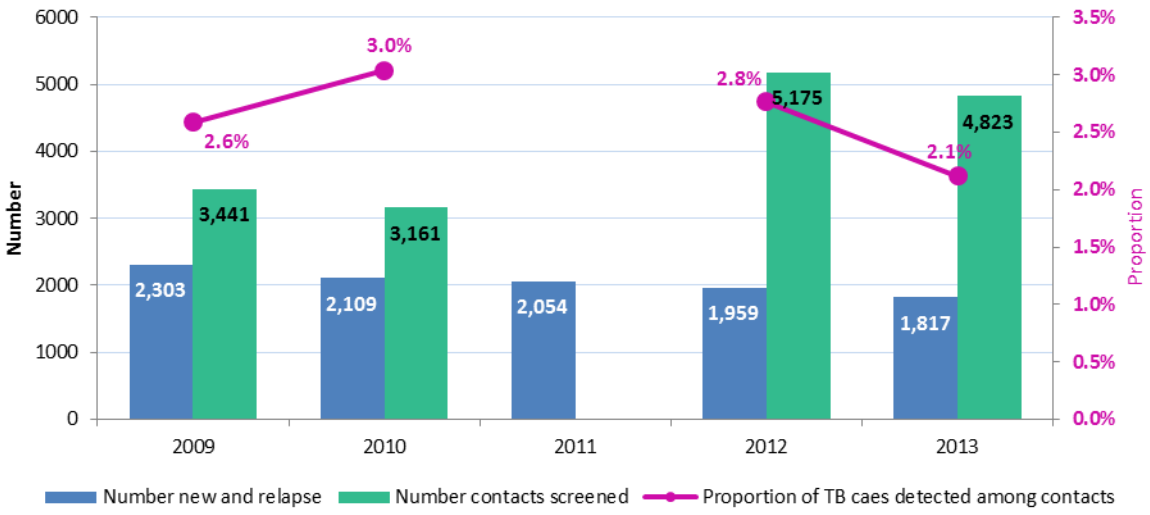
Active case-finding

All close contacts of TB patients are subject to active screening for TB. According to the country's reports to the WHO global TB database, the number of TB contacts ranged from 3161 in 2010 to 5175 in 2012, with an increasing trend over the last five years (Table 8). The average number of contacts screened per notified sputum-smear-positive pulmonary TB case in the civilian population between 2009 and 2013 gradually increased from 1.49 to 2.65. Intensified case-finding was associated with an increase in TB case detection, indicating that contacts of TB patients represent an important risk group for the disease. The yield of TB cases among the contacts screened was quite high, varying between 2.1 in 2013 and 3.0 in 2010, with no trends (Fig. 30). On the basis of the results of screening among TB contacts in the civilian population, there is no evidence that over time fewer TB cases are detected among the contacts. Thus, the decrease in TB notification cannot be explained by changes in active screening.

Table 8. Number of TB contacts screened and yield of TB cases among contacts, Georgia, 2009–2013

Year	No. of sputum-smear-positive TB cases in civilian population	No. of contacts screened	Mean no. of contacts screened per sputum-smear-positive TB case	TB cases detected among contacts		Contacts received isoniazid preventive therapy	
				No.	%	No.	%
2009	2303	3441	1.49	89	2.6	1010	29.4
2010	2109	3161	1.50	96	3.0	268	8.5
2011	2054	n/a	n/a	n/a	n/a	n/a	n/a
2012	1959	5175	2.64	143	2.8	148	2.9
2013	1817	4823	2.65	102	2.1	142	2.9

Fig. 30. Trend in number of TB contacts screened and yield of TB diagnosed among them, Georgia, 2009–2013



Source: Global TB database *(7)*.

Delays in TB diagnosis and treatment

Delays in TB diagnosis result in patients being infectious for prolonged periods of time and thus increasing the risk of transmission to contacts. A study conducted in 2011 to explore delays in diagnosis and treatment in Georgia indicated that prolonged delays in detecting TB were

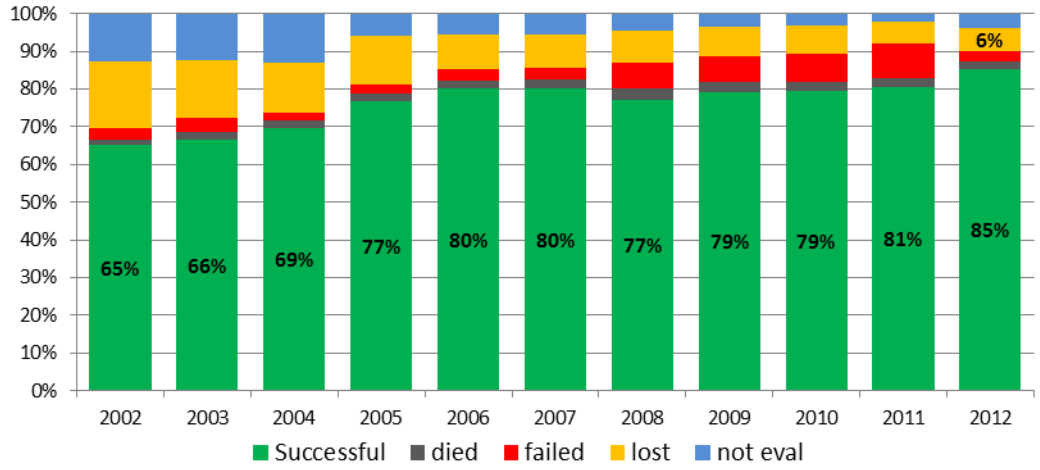
common, while delays in starting treatment were quite short *(17)*. According to this study, the mean and median patient delays (time from first onset of any TB symptom until first presentation to the health care system) were 56.2 and 23.5 days, respectively, and the delays in health care (time from first presentation to the health care system until diagnosis of TB) were 33.7 and 14.0 days, respectively, giving a mean total diagnostic delay of 89.9 days (time from onset of first symptom until TB diagnosis). Two independent risk factors for delays in diagnosis were intakes of medications (self-administered or on prescription) and if the patient was female. The mean and median delays in starting treatment (time from diagnosis to start of anti-TB treatment) were 1.45 and 0 days, respectively, indicating adequate access to TB treatment.

Since 2011 broad public awareness interventions have been implemented, particularly with the support of TB control projects funded by the United States Agency for International Development and including training for primary health care providers. It would, therefore, be valuable to evaluate the contribution of these interventions to the current situation as regards delays by both patients and the health care system.

Treatment outcomes

TB treatment is one of the most effective interventions in TB control to reduce the prevalence of cases in the population and the transmission of infection. The proportion of new TB cases treated successfully increased from 65% in 2002 to 81% in 2011. In the early years the main reason for unfavourable outcomes was loss to follow-up; since 2008, however, the increasing burden of MDR-TB has led to the main reason being treatment failure. With the transition to the new definition framework, the proportion of successfully treated patients among new and relapsed TB cases in the 2012 cohort was 85%, which is quite high compared to other TB high-priority countries in the Region (Fig. 31).

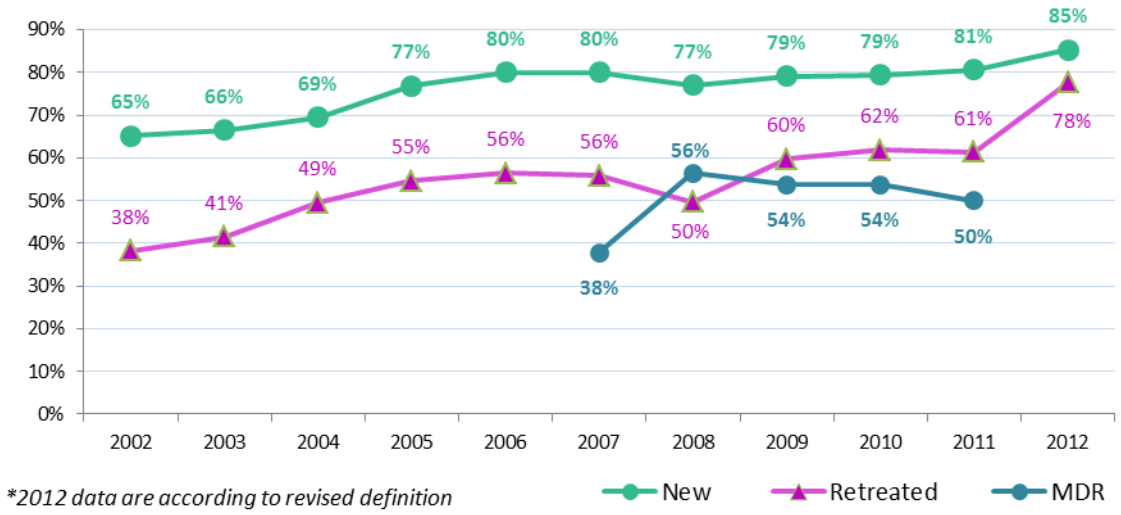
Fig. 31. Treatment outcome in new TB cases, Georgia, 2002–2012



Note. 2012 data are according to the 2013 revised definitions.
Source: Global TB database *(7)*.

Similarly, the proportion of retreated cases treated successfully increased from 38% in 2002 to 61% in 2011. In 2012, the proportion of retreated TB cases (excluding relapsed cases) treated successfully was 78% versus the regional average of 57%. The treatment succes rate for MDR-TB cases in the most recent 2011 treatment cohorts was corresponding to 50%.

Fig. 32. Trends in treatment success rate among new, retreated TB and MDR-TB cohorts, Georgia, 2002–2012*



Note. 2012 data are according to the 2013 revised definitions.
Source: Global TB database *(7)*.

Thus effective treatment of infectious TB cases could be a key factor in attenuating the TB epidemic.

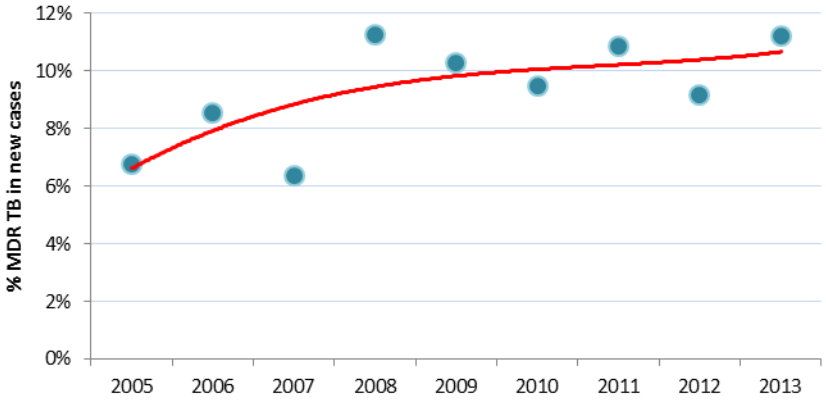
MDR- and drug-resistant TB

Trend in MDR-TB

Georgia is one of the 15 countries with a high burden of MDR among the 53 European Member States. MDR prevalence among TB patients was estimated in 2001–2004 through sentinel surveillance implemented in four selected sites. Among new and retreated cases, it was 4–5% and 19–25%, respectively *(18)*. A second, nationwide, survey indicated an MDR prevalence of 6.8% among new cases and 27.4% among retreated cases *(19)*. Following these two surveys, the NTP established a strong routine drug resistance surveillance system in line with WHO recommendations, including quality-assured DST, universal access to DST for all culture-positive TB cases and a comparatively high level of positive cultures among pulmonary TB cases with reliable classification of patients by treatment history.

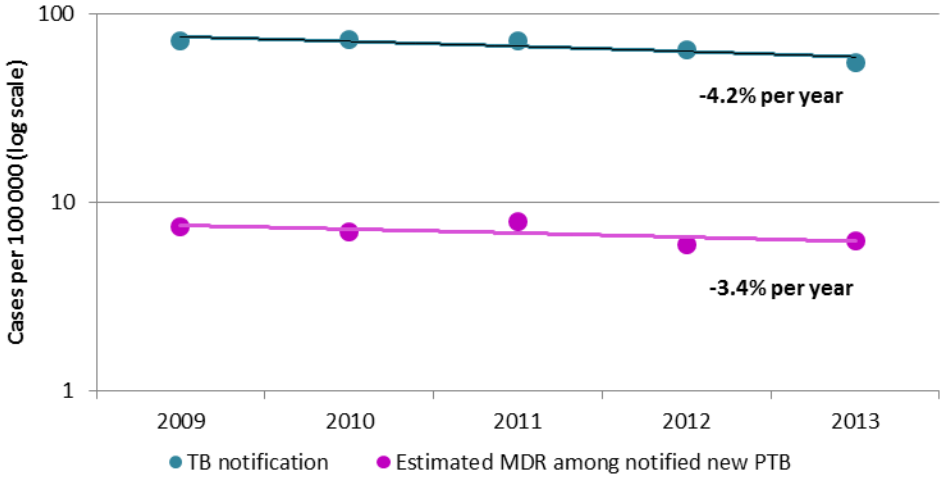
According to routine drug resistance surveillance results, the proportion of MDR among new pulmonary TB patients in 2013 was 11.2%. This suggests about a two-fold increase of the MDR burden among new TB cases between 2003 and 2013 (Fig. 33).

Fig. 33. Proportions of MDR-TB in new TB cases over time (fitted with polynomial trend-line), Georgia, 2005–2013



To assess the variation in the estimated number and rate of MDR-TB cases among notified new TB cases per 100 000 population, the estimated proportion of MDR-TB among new TB cases was multiplied by the number of notified new pulmonary TB cases per 100 000 population for each year. The results on a log scale were plotted per year and a slope was calculated from the fitted regression line *(20)*. The results of the analysis indicated that the estimated proportion of MDR cases per 100 000 population between 2009 and 2013 decreased on average by 3.4%, while the average decrease in new pulmonary TB cases was slightly faster at 4.2% per annum. Thus, the trends in pulmonary TB cases and MDR-TB cases per 100 000 population are similar, as the fitted linear regression lines are almost parallel (Fig. 34)

Fig. 34. Rates per 100 000 population of notified new pulmonary TB cases (blue circles) and estimated MDR-TB cases among notified new TB patients (purple circles) over time (fitted with a linear trendline), Georgia, 2009–2013

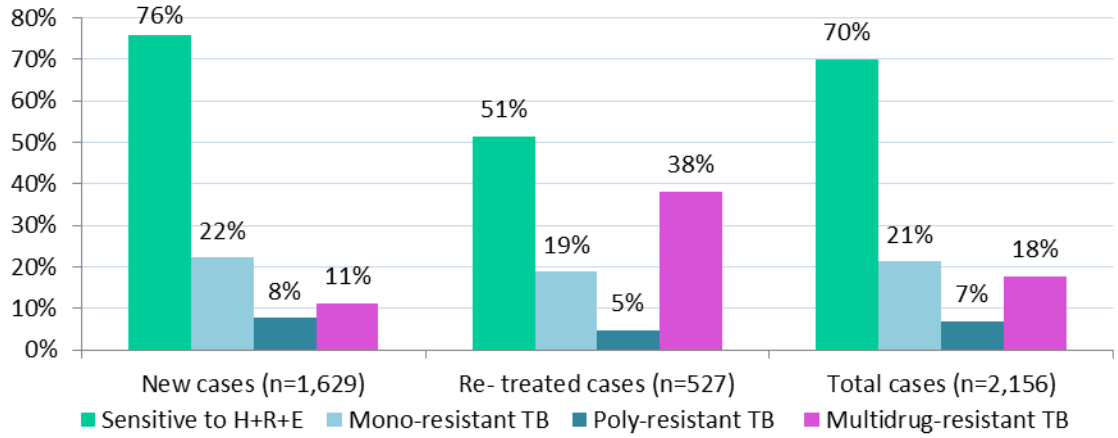


Source: Global TB database *(7)*.

An overview of the drug resistance pattern, based on routine drug resistance surveillance for 2013, is presented in Fig. 35. Three quarters of new pulmonary TB cases are susceptible to any of isoniazid, rifampicin or ethambutol, while 8% are polyresistant. The proportions of TB cases

that are isoniazid-resistant without rifampicin resistance are 11.8% among new cases and 11.2% among retreated cases.

Fig. 35. Pattern of drug resistance among pulmonary TB patients, Georgia, 2013



Source: National Centre of Tuberculosis and Lung Diseases database

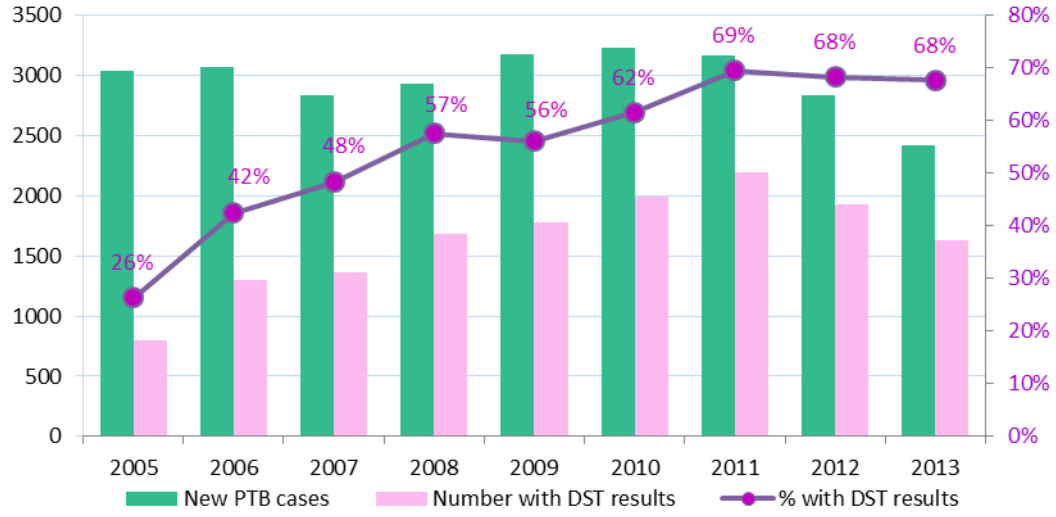
Monitoring the effectiveness of National TB programme

Detection indicators

Detection indicator 1. Percentage of pulmonary TB patients with DST results for isoniazid and rifampicin.

Access to drug sensitivity testing for isoniazid and rifampicin has increased markedly in recent decades. As a result, from 2011 to 2013 about 70% of new pulmonary TB cases had documented DST results (Fig. 36).

Fig. 36. Numbers of notified pulmonary TB cases, and pulmonary TB cases with first-line DST results and percentage of pulmonary TB cases with DST results, Georgia, 2009–2013

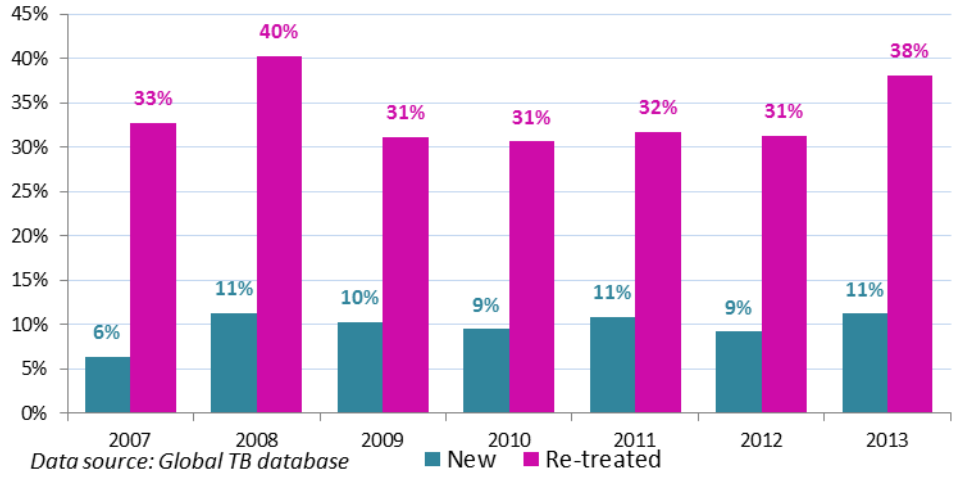


Source: Global TB database *(7)*.

Detection indicator 2. Confirmed MDR-TB cases detected among TB patients tested for susceptibility to isoniazid and rifampicin.

As mentioned above, the trends in MDR-TB stabilized between 2007 and 2013. From 2008 to 2013, the proportion of MDR among new TB cases ranged from 9% to 11%, and among previously treated cases from 31% to 40% (Fig. 37).

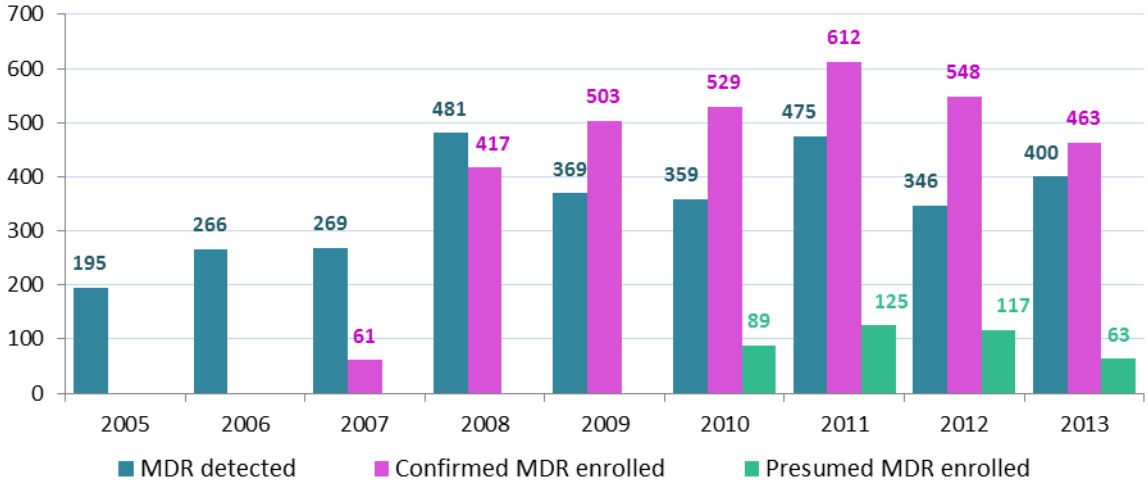
Fig. 37. Percentage of MDR-TB patients among new and previously treated pulmonary TB patients with DST results based on routine surveillance, Georgia, 2007–2013



Source: Global TB database *(7)*.

However, it should be noted that the actual number of MDR-TB cases detected is much higher than reported (Fig. 38). This is because the patients that were detected and notified in the previous year but confirmed with MDR-TB in the following year are not notified as MDR cases in the following year notification cohort. In addition, patients are diagnosed with MDR-TB during treatment (acquired MDR) are not notified as new MDR-TB cases. The number of MDR-TB cases detected is, therefore, underestimated if it is based on routine surveillance data.

Fig. 38. Nos. of pulmonary MDR-TB cases detected and of all confirmed and presumptive MDR-TB cases enrolled in MDR treatment, Georgia, 2005–2013

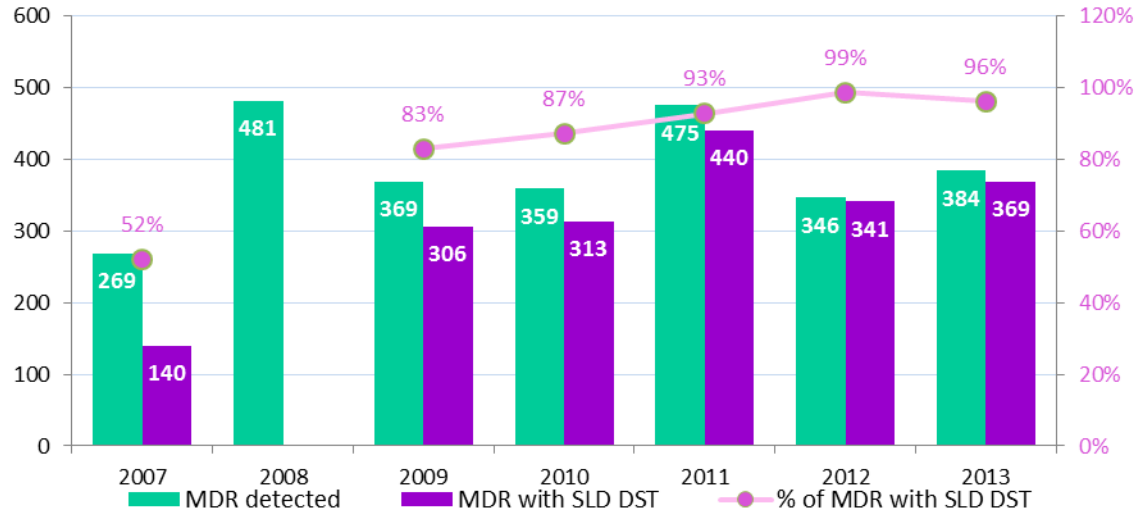


Source: Global TB database *(7)*.

Detection indicator 3. Confirmed MDR-TB cases tested for susceptibility to any fluoroquinolone and any second-line injectable drug.

As with access to first-line DST, access to second-line DST had improved. From 2011 to 2013, over 90% of confirmed MDR-TB cases had DST results for both fluoroquinolones and second-line injectables (Fig. 39).

Fig. 39. Nos. of MDR-TB patients detected and MDR-TB cases with second-line DST results, and proportion of MDR with second-line DST results, Georgia, 2007–2013

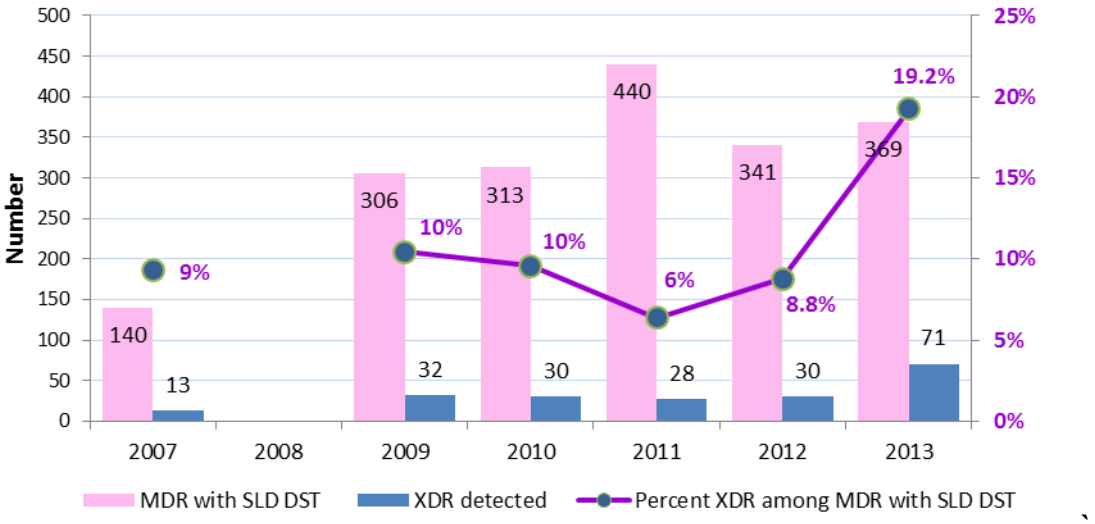


Source: Global TB database *(7)*.

Detection indicator 4. Confirmed XDR-TB cases detected among MDR-TB patients tested for susceptibility to any fluoroquinolone and any second-line injectable drug.

Between 2009 and 2012, about 28 to 32 XDR-TB cases were detected each year among confirmed MDR-TB cases with second-line DST results equivalent to an XDR rate of 6–10%. In 2013, there was an unexpectedly sharp increase in XDR-TB cases: 71 were notified, constituting about 19% of MDR-TB cases. Thus, about one in five MDR-TB cases notified was diagnosed with XDR-TB (Fig. 40).

Fig. 40. Nos. of MDR cases with second-line DST results and XDR-TB cases detected, and proportion of XDR-TB among MDR-TB cases, Georgia, 2007–2013



Source: Global TB database *(7)*.

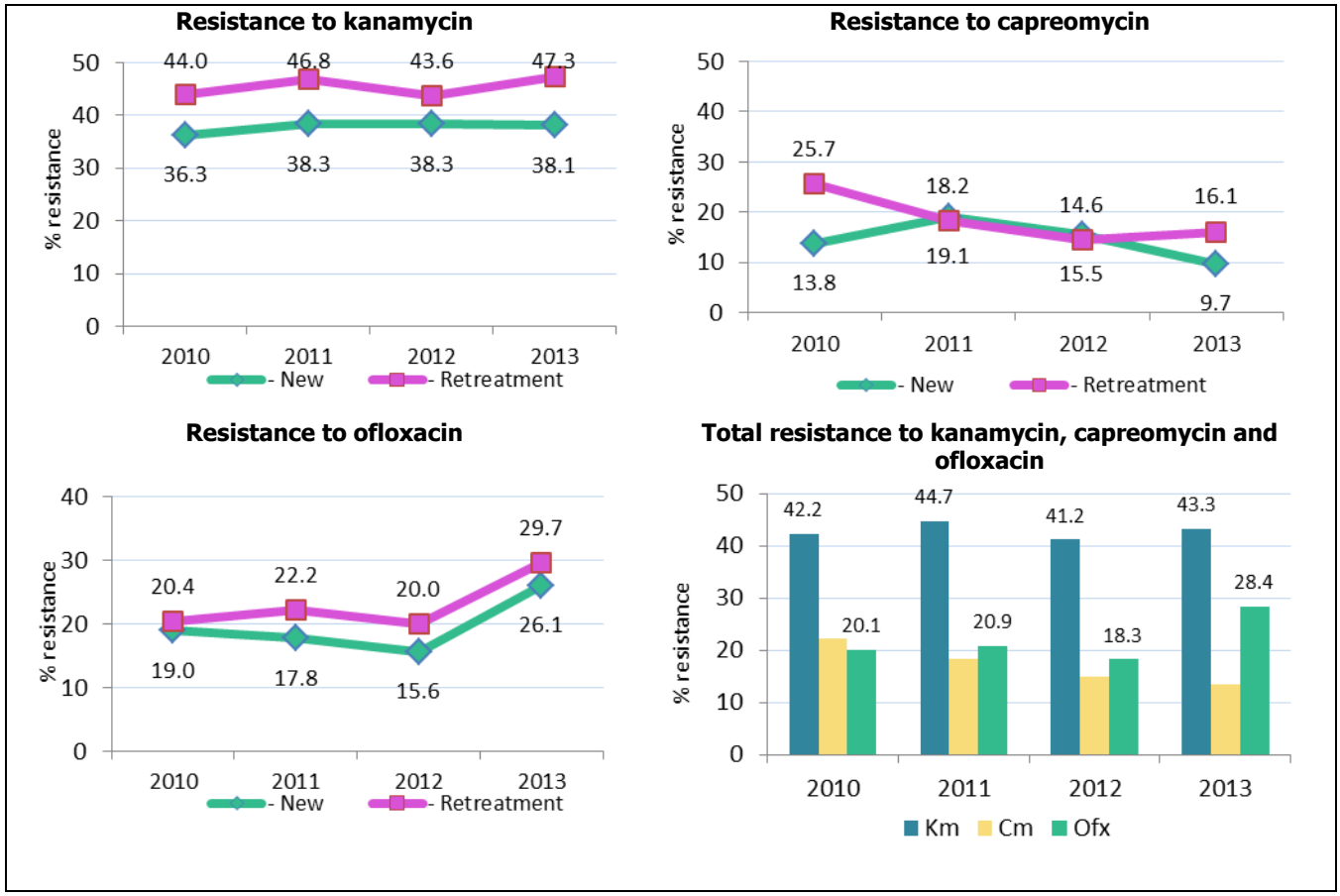
The pool of XDR-TB cases is shaped mainly by cases that are resistant to kanamycin and ofloxacin (Table 9).

Table 9. Pattern of second-line DST results among MDR-TB patients with DST results for any of kanamycin, capreomycin and ofloxacin, Georgia, 2013 (n=401)

Profile of resistance	Number	%
Any resistance to kanamycin, capreomycin or ofloxacin	230	57.4
No resistance to kanamycin, capreomycin or ofloxacin	171	42.6
Resistance to kanamycin only	92	22.9
Resistance to capreomycin only	11	2.7
Resistance to ofloxacin only	41	10.2
Resistance to kanamycin and capreomycin	13	3.2
Resistance to kanamycin and ofloxacin	45	11.2
Resistance to capreomycin and ofloxacin	5	1.2
Resistance to kanamycin, capreomycin and ofloxacin	23	5.7

The level of kanamycin resistance was fairly stable during 2010–2013, varying between 36.3% and 38.1% in new cases and between 43.6% and 47.3% in retreatment cases (Fig. 41). While resistance to capreomycin decreased from 22.3% in 2010 to 13.4% in 2013, ofloxacin resistance, which had been stable from 2010 to 2012 at around 20%, rose substantially in 2013 to 28.4%. However, because ofloxacin is not used in drug-resistant TB treatment regimens in Georgia (levofloxacin and moxifloxacin are used instead), and given that cross-resistance between ofloxacin and newer-generation fluoroquinolones is low, the practical value of second-line DST results remains limited as both drugs (kanamycin and ofloxacin) that are used to identify XDR-TB cases are not used in MDR/XDR treatment.

Fig. 41. MDR cases with resistance to kanamycin, capreomycin and ofloxacin among MDR-TB patients with second-line DST results, Georgia, 2010–2013 (%)



Source: National Reference Laboratory database *(?)*.

Detection indicator 5. Interval between presumption of rifampicin-resistant /MDR-TB and DST results.

This indicator is not collected routinely by the NTP**.**

Enrolment indicators

Enrolment indicator 1. Rifampicin-resistant/MDR-TB cases (presumptive or confirmed) enrolled on MDR-TB treatment.

Second-line TB treatment has been available since 2007. In 2009, universal coverage with second-line treatment was achieved for all patients notified with MDR-TB (Fig. 38). The ratio of enrolled in treatment to notified MDR-TB cases in 2009 was 136%. The ratio of enroled to notified reached up 192% in 2012 and then decreased to 132% in 2013. The proportion of presumptive TB cases among all TB cases enrolled in second-line treatment across the recent four years, between 2010 and 2013, varied from 12.0 to 17.6% (Fig. 38).]

Enrolment indicator 2. Confirmed rifampicin-resistant/MDR-TB cases enrolled on an MDR-TB treatment regimen.

After 2009 and the achievement of universal coverage of MDR-TB treatment, the number of cases enrolled by 2013 [correct?] exceeded the total number of notified TB cases. The difference between MDR-TB cases enrolled and notified over time arises from the fact that patients who

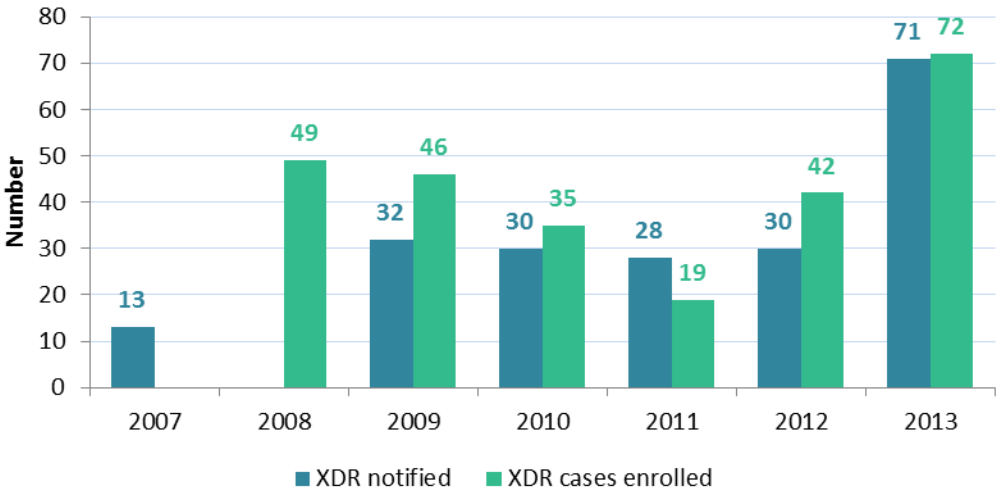
have experienced several attempts at treatment are not re-notified, although if DST indicates the presence of MDR-TB they are recruited into second-line treatment.

The difference between notified and enrolled confirmed MDR cases is due to TB cases notified in previous years and confirmed with MDR in the following reporting period not being included in MDR notification. In addition, only pulmonary MDR-TB cases are reported via WHO data collecting form, while extrapulmonary cases with confirmed MDR-TB are also enrolled into second-line treatment. A third group consists of those who have already been treated for MDR-TB and are recruited again into second-line treatment (because of relapse or interruption of treatment for MDR-TB).

Enrolment indicator 3. Confirmed XDR-TB cases enrolled on XDR-TB treatment regimen.

In 2012 and 2013, all confirmed XDR-TB patients were enrolled into XDR treatment. Fig. 42 indicates time trends of XDR-TB cases notified and the number of confirmed XDR-TB cases enrolled in XDR-TB treatment.

Fig. 42. XDR-TB cases notified and confirmed XDR-TB cases enrolled in XDR-TB treatment, Georgia, 2007–2013



Source: Global TB database *(7)*.

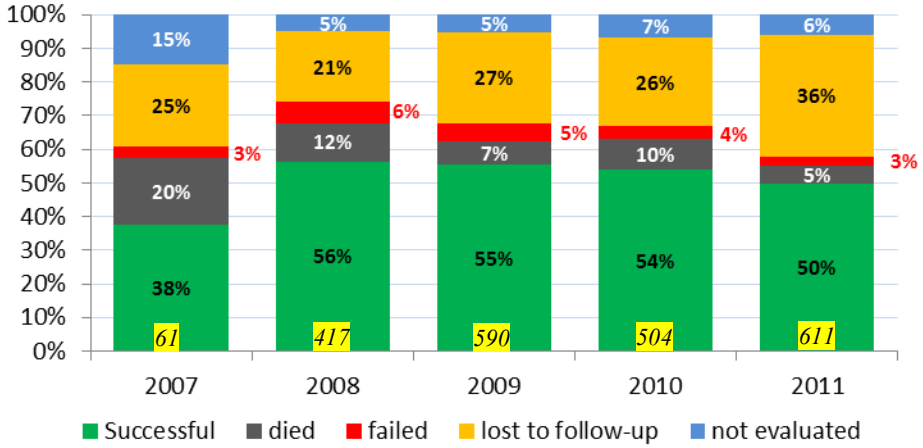
Final treatment outcomes

Outcome indicators 1–6. Rifampicin-resistant/MDR-TB cases on MDR-TB treatment regimen with an outcome.

In 2007, the success rate was quite low in the cohort of MDR-TB patients undergoing second-line treatment (Fig. 43). A low success rate at the beginning of second-line treatment programmes is common and is explained by the fact that in the treatment cohort of 2007, there is a large proportion of patients with severe clinical conditions and several unsuccessful attempts after a treatment with first-line drugs and the risks of unfavourable outcomes are, therefore, high. The treatment success rate for the second cohort was 56%, but this fell to 50% in the 2011 cohort, mainly due to losses to follow-up: in 2011, about one in three patients recruited into second-line treatment was lost to follow-up. A detailed analysis of risk factors for losses to follow-up indicated that over 40% occurred during the first eight months of MDR-TB treatment: 40% of patients had not achieved culture conversion at the time they were lost to follow-up. The

factors independently associated with patients being lost to follow-up included: male gender, illicit drug use, tobacco use, history of previous anti-TB treatment, site of TB disease and place initiating treatment. However, observation of records during the mission and discussions with the local specialists revealed that the classification of MDR-TB treatment outcomes is not always in line with WHO guidelines. Many patients who had persistent culture positivity after the intensive phase of treatment or who interrupted their treatment because of adverse events were commonly classified as lost to follow-up instead of treatment failure. Such an approach leads to overestimation of treatment default and underestimation of treatment failure.

Fig. 43. Treatment outcomes for MDR-TB patients, Georgia, 2007–2011 cohorts

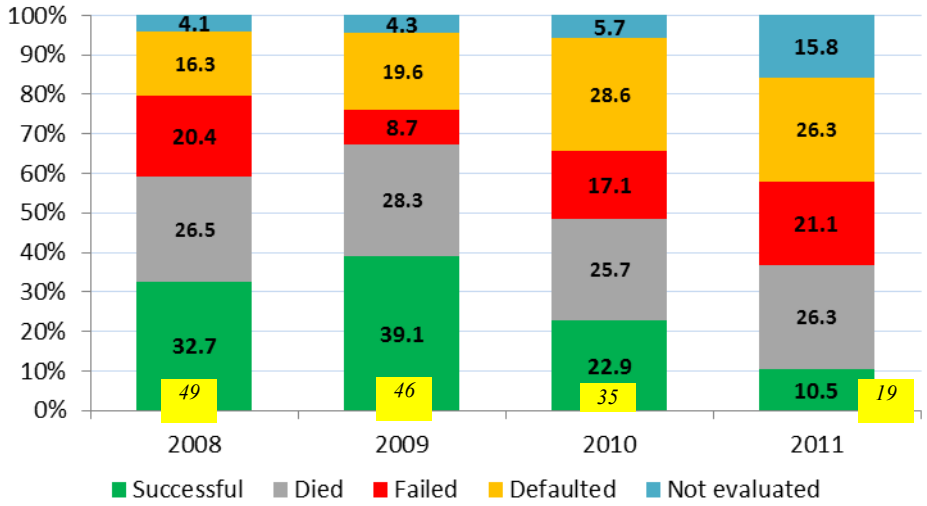


Numbers at the bottom of the columns highlighted in yellow indicate cohort size.
Source: Global TB database *(7)*.

Treatment outcome of XDR-TB patients

From 2008 to 2011, a total of 149 XDR-TB patients were enrolled into the XDR-TB treatment regimen. Overall, about 30% were successfully treated, 27% died, 16% were lost to follow-up and 20% failed. The treatment success rate peaked in 2009 at 39% and then gradually decreased. In the 2011 cohort the treatment success rate was 10% at the time of the mission but was expected to increase by the end of 36 months from start of treatment when all the cases in the cohort are evaluated. Interestingly, the proportion of patients lost to follow-up in the XDR-TB cohort was much lower than in the MDR-TB cohort (Fig. 44).

Fig. 44. Treatment outcomes for XDR-TB patients, Georgia, 2008–2011 cohorts



Numbers at the bottom of the columns highlighted in yellow indicate cohort size.
Source: Global TB database *(7)*.

Risk factors for MDR-TB

To assess the risk factors for MDR-TB, the odds ratio (OR) as a measure of effect for risk factors was analysed and its confidence interval of deviation from one was calculated based on routine drug resistance surveillance data.

Both drug resistance surveys conducted in Georgia *(18,19)* indicated that female gender is a risk factor for MDR-TB. According to recent data from the continues drug-resistance surveillance, the OR of MDR-TB is higher by 27% among males compared to females among 2156 TB patients with DST results notified in 2013. The observed difference was not, however, statistically significant (OR=1.27; 95% confidence interval (CI) 0.97–1.65), suggesting that patients' gender is not associated with MDR-TB.

Among 1414 TB patients for whom both DST and HIV test results had been notified in 2013, the OR of MDR-TB was 4.5 times higher among patients with positive HIV coinfection than among TB patients with negative HIV results, indicating a strong association between HIV and MDR-TB (OR=4.54; 95% CI 2.2–9.37). Thus, it can be concluded that HIV is very strong predictor for MDR-TB in Georgia.

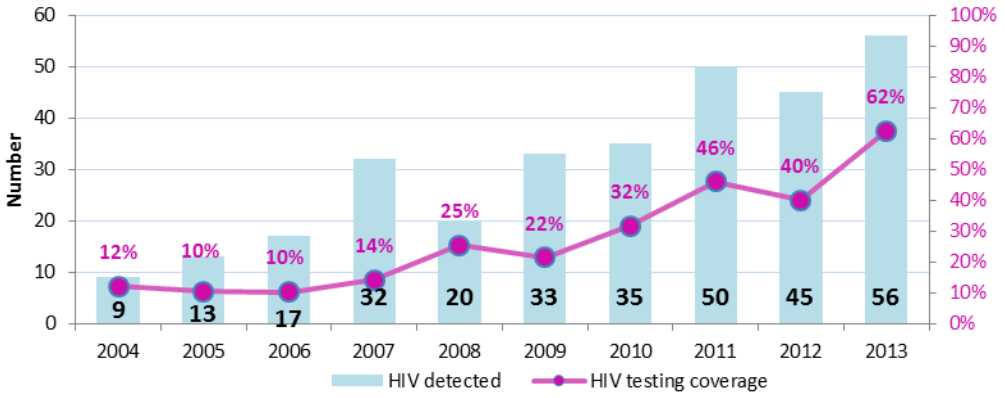
A study on spatial analysis conducted to identify the geographical variability of the MDR-TB burden in Georgia and patient-level MDR-TB risk factors revealed substantial geographical heterogeneity between districts *(21)*. The proportion of MDR-TB among new cases varied from 0.0% to 33.3% and among previously treated cases from 0.0% to 75.0%. Particularly among new cases, those in cities were at greater risk of MDR-TB than those in rural areas.

TB/HIV

To ensure effective and integrated delivery of TB and HIV services, WHO recommends HIV testing for all TB patients, provision of antiretroviral therapy (ART) and cotrimoxazole preventive therapy (CPT) to TB patients living with HIV, regular screening for TB for people living with HIV and the offer of isoniazid preventive therapy to people living with HIV who do not have active TB *(22)*.

In 2013, the number of notified TB patients with documented HIV test results was 2698, equivalent to 62% of notified TB cases (Fig. 45). This was a fivefold increase compared to the figure of 12% HIV testing coverage in 2004, suggesting an impressive improvement albeit still far below the regional target of 100% HIV testing coverage.

Fig. 45. No. of notified TB/HIV co-infections and HIV testing coverage among notified TB patients, Georgia, 2004–2013



Source: Global TB database *(7)*.

In 2013, national surveillance data showed that 2.1% of TB patients with documented HIV test results were HIV-positive. The level of HIV/TB coinfection peaked in 2007 at 3.8% then fluctuated between 1.3% and 2.6% over the next few years without showing any clear trends. This fluctuation is due to limited HIV testing coverage leading to selection bias. According to WHO, the estimated percentage of HIV/TB coinfection in recent decades increased from 0.61% in 2004 to 1.9% in 2013. Of the estimated 97 TB/HIV cases (range: 69–130) in 2013, only 56 were notified, resulting in an average 57.7% HIV/TB detection rate (Tab. 10).

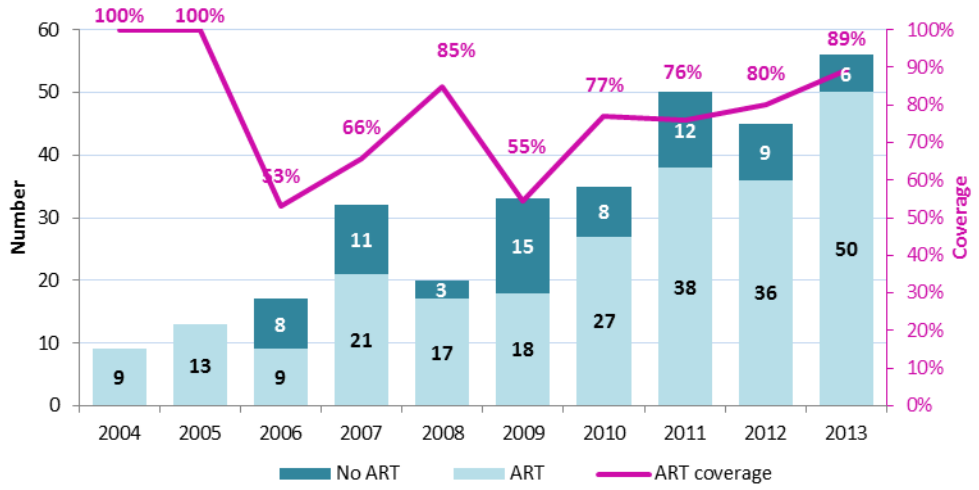
Table 10. TB/ HIV collaborative activities, Georgia, 2004–2013

Year	Notified TB cases	HIV tests performed among TB cases	HIV detected	HIV positives among TB patients (%)	No. of TB/HIV patients on ART	No. of TB/HIV patients on CPT
2004	5967	726	9	1.2	9	5
2005	6448	674	13	1.9	13	7
2006	6311	649	17	2.6	9	10
2007	5912	842	32	3.8	21	21
2008	5836	1482	20	1.3	17	17
2009	5978	1289	33	2.6	18	18
2010	5796	1841	35	1.9	27	22
2011	5533	2550	50	2.0	38	28
2012	4974	1992	45	2.3	36	36
2013	4319	2698	56	2.1	50	50

ART is a critical intervention for reducing the risk of TB among people living with HIV. It reduces the individual risk of HIV by 65% and, in combination with isoniazid preventive therapy, can prevent TB among HIV cases *(23)*. In Georgia, coverage with ART as well as CPT progressively increased from 55% in 2009 to 89% in 2013 (Figs. 46, 47). Nonetheless, given the

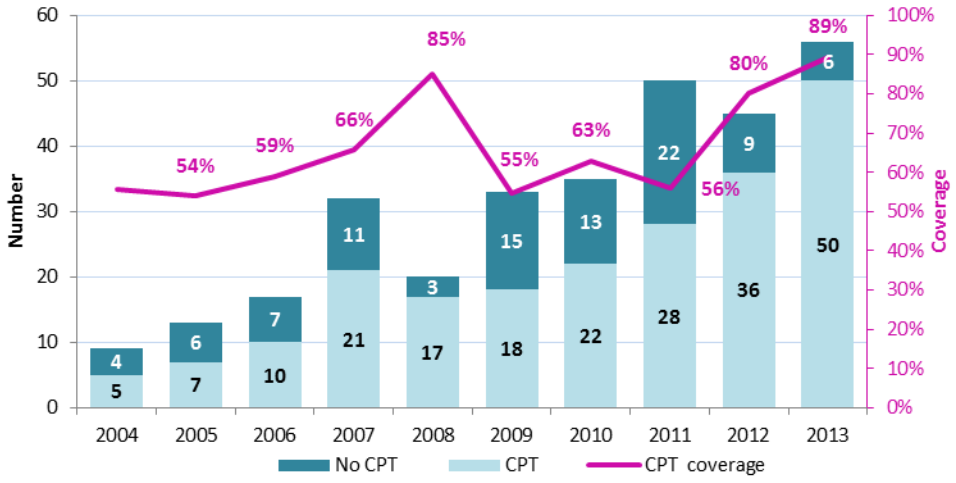
WHO recommendation that all HIV-positive TB patients are eligible for ART and CPT, coverage for HIV-positive patients still needs to be improved.

Fig. 46. No. and percentage of HIV-positive TB patients enrolled in ART, Georgia, 2004–2013



Source: Global TB database *(7)*.

Fig. 47. No. and percentage of HIV-positive TB patients enrolled in CPT, Georgia, 2004–2013

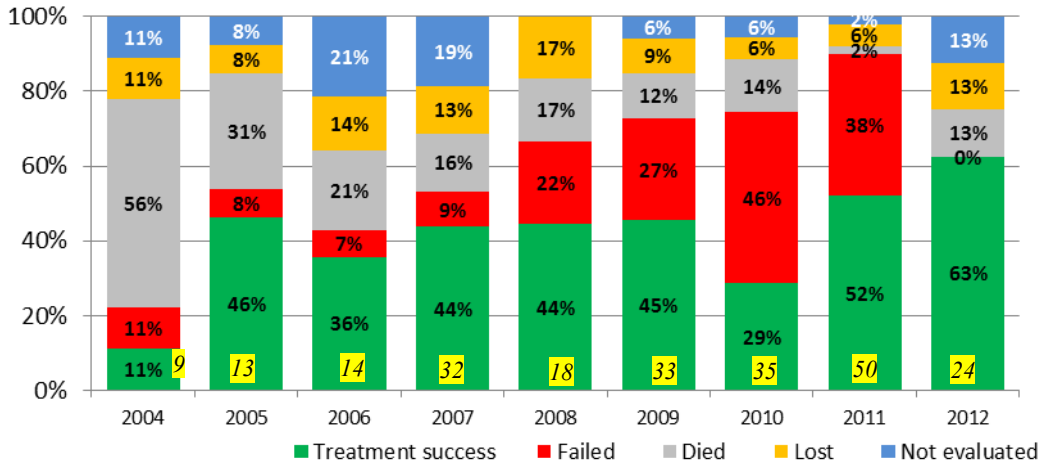


Source: Global TB database *(7)*.

In 2013, 2369 people enrolled in HIV care were reported to have been screened for TB, against 519 in 2012. Of the reported 2092 people newly enrolled in HIV care in 2013, 92 were provided with isoniazid preventive therapy. This is again very low since about 50% of those newly enrolled in HIV care and screening for TB are likely to be eligible for isoniazid preventive therapy.

The treatment success rate for all HIV/TB 2012 cohorts was 63%. Overall, the trend in treatment outcomes of HIV-positive TB cases shows a significant improvement. However, in 2012 the notified number of HIV/TB cases and the size of the reported treatment cohorts differ widely (the 2012 HIV/TB treatment cohort included only 24 cases against 45 HIV/TB cases notified) so the treatment outcome results might be not be representative of all cases (Fig. 48).

Fig. 48. Treatment outcome of HIV/TB patients, Georgia, 2004–2012



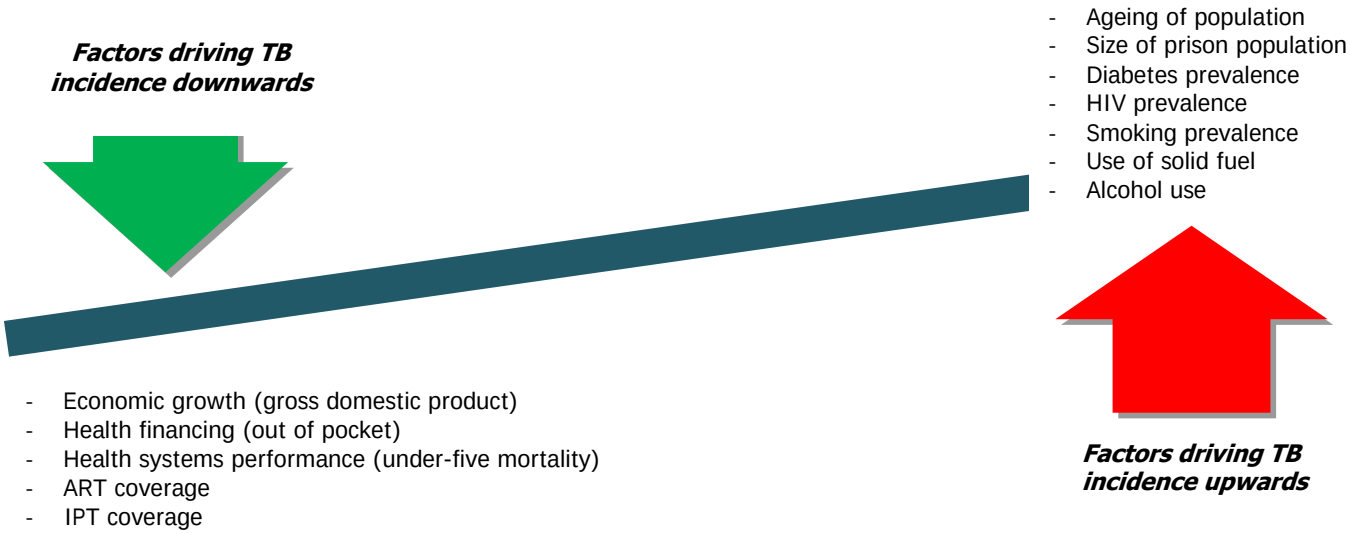
Yellow highlighted numbers at the base of columns indicate cohort size.
Source: Global TB database *(7)*.

Given that the HIV epidemic in Georgia is small, and considering that HIV testing coverage as well as ART and CPT coverage were until recently at suboptimal levels, it is unlikely that HIV/TB collaborative activities could make any substantial impact on TB epidemiology in the country. Thus, the recent decrease in TB notifications is not likely to be related to TB/HIV collaborative activities.

External factors not related to the National TB Program

The factors driving the TB epidemic that were analysed in the current document are presented in the conceptual framework below (Fig. 49).

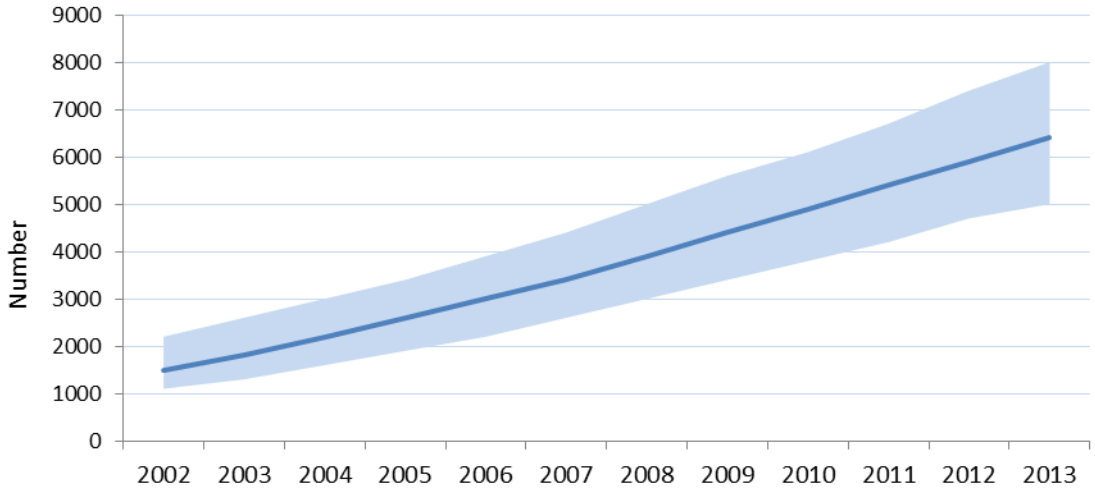
Fig. 49. Conceptual framework on direction in which factors associated with TB are expected to drive the disease burden



Prevalence of HIV among general population and ART coverage

HIV is the most potent risk factor for TB within the individual. The number of people living with HIV is rising in Georgia. The estimated number of people with HIV increased about four times since 2002 to about 6400 in 2013 (range: 5000–8000), although the epidemic remains concentrated with an estimated prevalence of 0.3% (range 0.2–0.4) among the group aged 15–49 years *(24)* (Fig. 50).

Fig. 50. Estimated numbers of adults and children living with HIV, Georgia, 1990–2012

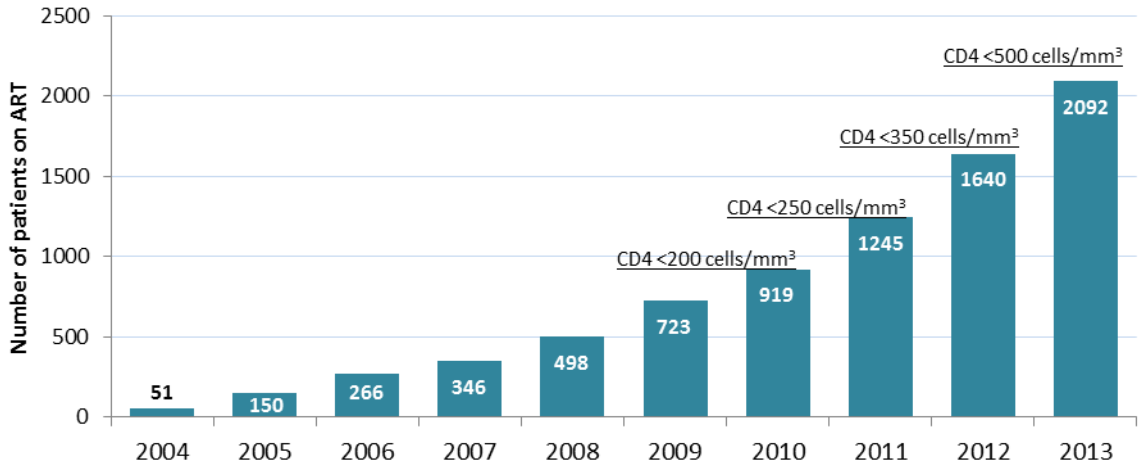


Shaded areas represent uncertainty band.
Source: Joint United Nations Programme on HIV/AIDS data repository.

The HIV epidemic is largely concentrated among males and high-risk groups such as injecting drug users, men who have sex with men and female sex workers. The estimated prevalence of HIV ranges from 0.4% to 9.1% among injecting drug users *(25)* and 0.8%–1.3% among female sex workers *(26)*, depending on locality. The increase in HIV prevalence has shown a steady and alarming trend among men who have sex with men in Tbilisi, from 7% in 2010 to 13% in 2012 *(27)*

There is strong evidence that ART and isoniazid preventive therapy initiated promptly may reduce the risk of progression from infection to disease. According to the Georgia country progress report *(28)*, universal access to ART has been ensured since 2004 with the support of the Global Fund. At the end of 2013, 2092 people living with HIV were on ART, representing >90% coverage among those diagnosed and eligible for treatment (Fig. 51). On the other hand, retention in treatment improved: 12-month retention increased from 79% in 2011 to 86% in 2012 and 85% in 2013.

Fig. 51. Time-series change in number of people living with HIV receiving ART, according to WHO revised guidelines, Georgia, 2004–2013

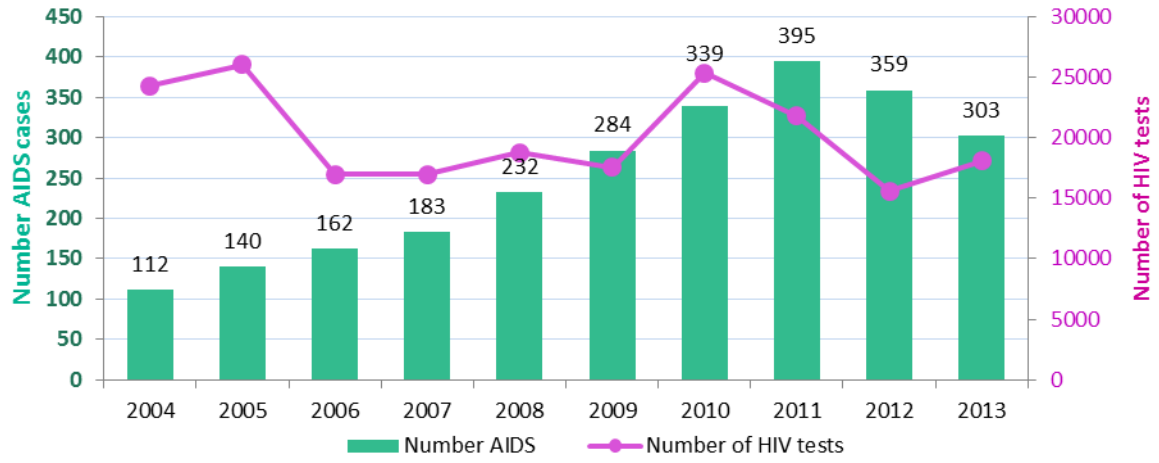


Source: National Centre for Disease Control and Public Health *(28)*.

A recent retrospective cohort study investigating mortality and cause of death among HIV-infected individuals showed that the mortality rate decreased significantly following the universal availability of ART, from 10.74 deaths per 100 annually to 4.02 per 100 annually in 2012 *(29)*. TB was the leading cause of death, accounting for 21% of the deaths reported.

HIV surveillance data suggest a continued increase in AIDS cases which could be due to late HIV diagnosis (when cases are detected at an advanced stage of disease) and/or low efficiency in of ART treatment *(30)*. Fig. 52 shows the total number of recorded AIDS cases and the number of HIV tests. In 2012 and 2013 there was a fall in the number of AIDS cases from 395 (in 2011) to 303 (in 2013), although this might also be related to a decrease in HIV testing.

Fig. 52. Nos. of AIDS cases notified by health systems and HIV tests performed, Georgia, 2004–2013



Source: European Centre for Disease Prevention and Control *(30)*.

Prison population

Following a gradual tripling in the prison population from 8000 in 2004 to 24 000 in 2011, there was a sharp decline related to the amnesty announced in 2012. Such a rapid fluctuation in the

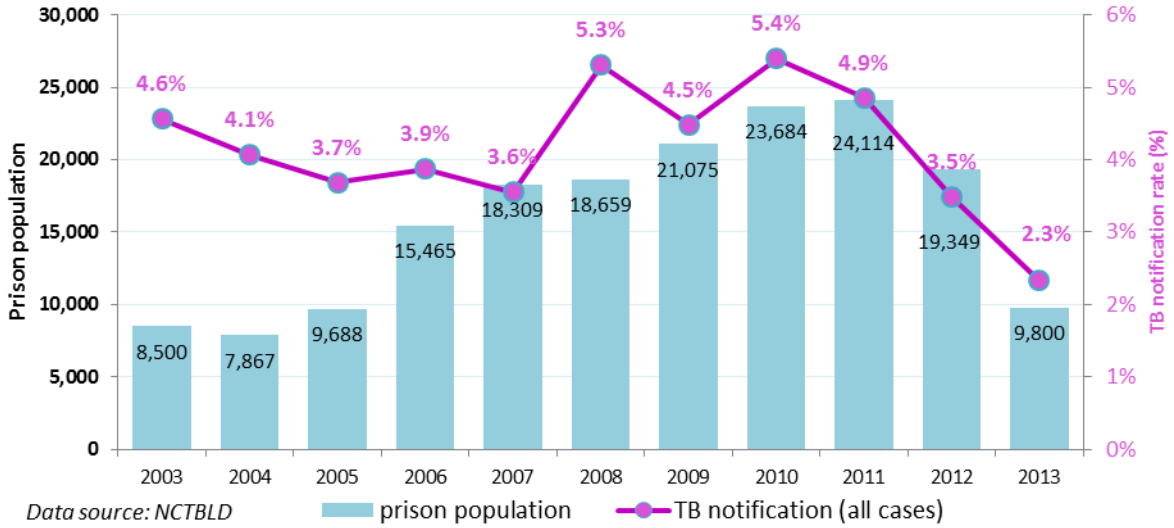
prison population markedly affected the TB epidemic situation as the proportion of people with TB in prison was as high as 20% of the total in the country (Table 11).

Table 11. TB in prisons, Georgia, 2003–2013

Year	Prison population	TB cases (all forms)	TB notifications (all forms) (%)	Proportion of TB cases in prison out of the country total (%)	TB relative risk in prisons (%)
2003	8 500	388	4.6	6.5	37.2
2004	7 867	320	4.1	5.4	32.5
2005	9 688	357	3.7	5.5	27.1
2006	15 465	599	3.9	9.5	30.1
2007	18 309	650	3.6	11.0	29.9
2008	18 659	990	5.3	17.0	48.3
2009	21 075	945	4.5	15.8	39.2
2010	23 684	1279	5.4	22.1	52.5
2011	24 114	1172	4.9	21.2	48.7
2012	19 349	674	3.5	13.6	35.3
2013	9 800	228	2.3	5.3	24.7

With the fall in the prison population the rate of TB notifications also fell by more than half from 5.4% in 2010 to 2.3% in 2013. The observed TB rate of 2.3% in 2013 in prisons (still about 25 times higher than the risk of TB in the general population) is the lowest TB rate recorded in Georgia since 2003 (Fig. 53)

Fig. 53. Time trend in number of prisoners and all TB notification rates (%) in prisons, Georgia, 2003–2013



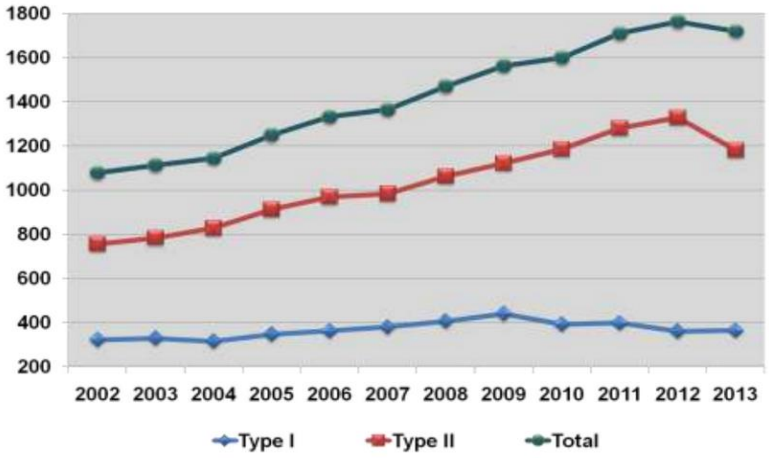
Source: National Centre of Tuberculosis and Lung Diseases

There are several explanations for the rapid fall in the rate of TB in prisons. Following the amnesty overcrowding was reduced in the penitentiary system, resulting in a decrease in transmission of TB. The intensified active screening implemented on entry and several times a year in all prisons allowed the prison authorities to detect TB cases at an early stage and prevent its transmission to other inmates. The recent decline in TB notification can, therefore, be attributed to the reduction in the prison population and preventive measures such as intensified active screening in prisons.

Diabetes, tobacco use, indoor air pollution, alcohol misuse

Georgia is experiencing a growing burden of *diabetes*. According to the annual report of the National Centre for Disease Control, diabetes prevalence in the general population increased from 1.1% in 2002 to 1.7% in 2013 (Fig. 54). It is estimated that 97 610 patients (aged 20–79 years) were suffering from diabetes in 2013. In that year, mean diabetes-related expenditure per person with diabetes was US$ 444.

Fig. 54. Diabetes mellitus according to type and prevalence per 100 000 population, Georgia, 2002–2013

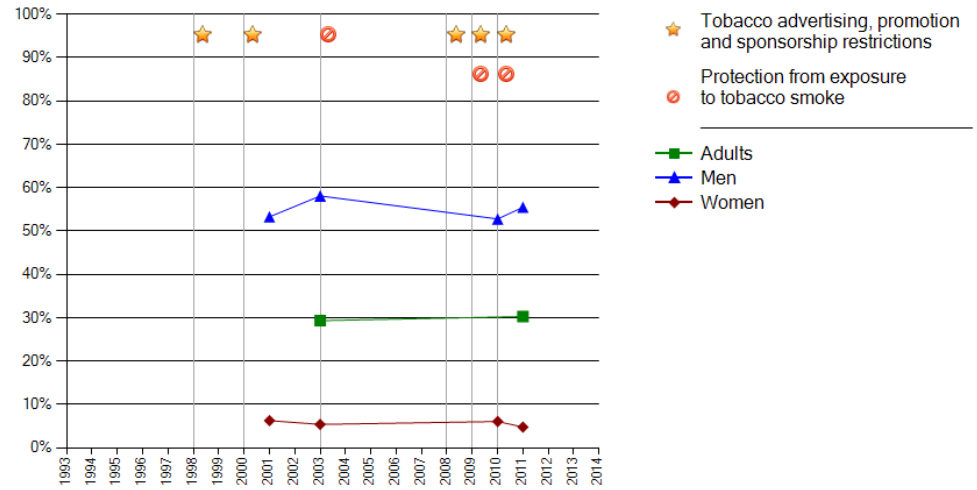


Source: Health care statistical yearbook 2013, Georgia *(31)*

The male *tobacco smoking* rate in Georgia is one of the highest in the world. According to WHO, smoking prevalence was 55.5% among males and 4.8 % among women aged over 15 years *(32)*.

The Law on Tobacco Control, adopted in December 2010, restricts the sale of tobacco products and regulates the packaging of tobacco products. In addition, the Law on Tobacco Advertising adopted in March 1998 (amended in 2008) introduced a ban on tobacco advertising on radio and television and restrictions regarding advertising in printed media and on billboards *(33)*. Even so, there is no evidence of a decline in smoking prevalence (Fig. 55).

Fig. 55. Trends in current tobacco smoking for adults



Source: WHO *(32).*

A recent study exploring the effect of diabetes and smoking on sputum culture conversion among patients with MDR-TB indicated that smoking is one of the independent risk factors for delayed conversion *(34)*. This suggests that, in addition to being a risk factor for contracting TB infection and developing active TB disease, smoking is a risk factor for inefficiency in treatment of MDR-TB.

A multiple cluster indicator survey conducted in 2005 showed that more than half (53.6%) of all households in Georgia were using *solid fuels* for cooking, thus increasing exposure to indoor air pollution *(35)*. The use of solid fuel was much more common in rural households (about 90%) and was strongly associated with household income and education. According to WHO estimates in 2012, the proportion of households that used solid fuel for cooking and heating was 46% *(36)*.

There is no evidence or indication that diabetes and tobacco smoking and alcohol use as risk factors for TB have attenuated; on the contrary, they are probably continuing to fuel the TB epidemic. The proportion of the population exposed to indoor air pollution has, however, fallen.

The relative contributions of key risk factors for TB, which could be considered in prioritizing TB control interventions, are as follows. The population-attributable fraction (PAF) of each of the risk factors was calculated using the formula:

$$PAF = \frac{Prevalence * (RR - 1)}{Prevalence * (RR - 1) + 1}$$

PAF is a statistic used to estimate the proportion of cases that would be prevented if the risk factor were eliminated. The highest PAFs for TB in Georgia are associated with smoking, indoor air pollution, alcohol misuse, diabetes and HIV, in that order (Table 12).

Table 12. Prevalence and PAF of selected TB risk factors, Georgia, 2013

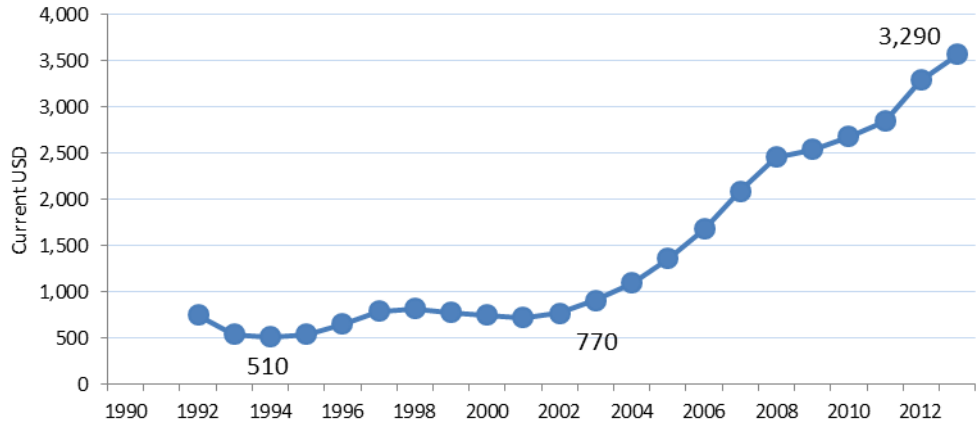
Risk factor	Prevalence of risk factor (%)	Relative risk [a]	PAF in population (%)
HIV (15–49 years)	0.3[b]	26.7	4.7
Diabetes (20–79 years)	3.11[c]	3.1	6.1
Smoking (>15 years)	30.3[d]	2	23.3
Percentage of population using solid fuel	46.0[e]	1.4	15.5
Alcohol misuse	5.3[f]	4.1	14.1

[a] Lönnroth *(37).*
[b] Joint United Nations Programme on HIV/AIDS *(38).*
[c] International Diabetes Federation *(39).*
[d] Tobacco use among 18-64 male and female in Georgia, accessed December 1, 2014 http://www.tobaccoatlas.org/country-data/georgia/.
[e] WHO *(36).*
[f] WHO *(41).*

Gross national income per capita and poverty

Fig. 56 shows changes in gross domestic product per capita from 1992 to 2013. Between 1992 and 2002, gross domestic product per capita was more or less the unchanged. The economy then grew almost exponentially from US$ 770 in 2002 to US$ 3290 per capita in 2013. Economic growth may have an important effect on such TB determinants as overcrowding, education, nutrition and health care-seeking behaviour and thus contribute to reduce the transmission of infection and the risk of progression of infection to disease.

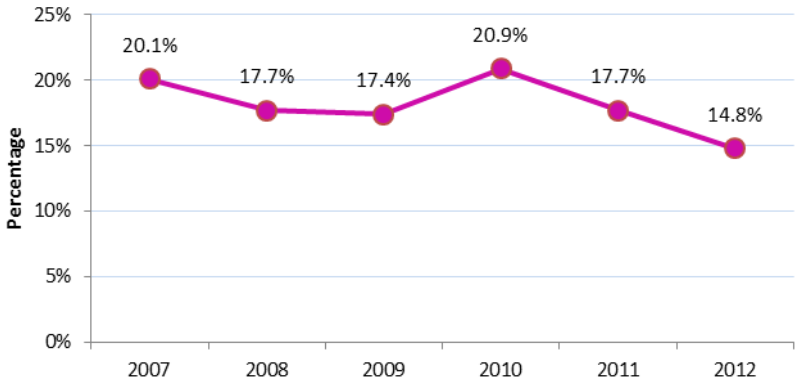
Fig. 56. Gross national income per capita (current US$), Georgia, 1990–2013



Source: World Bank *(42).*

Not everyone, however, benefited equally from the rapid economic growth as the proportion of the population living under the poverty line despite this growth remained stable between 2007 and 2010, and only after 2010 was some decrease observed (Fig. 57).

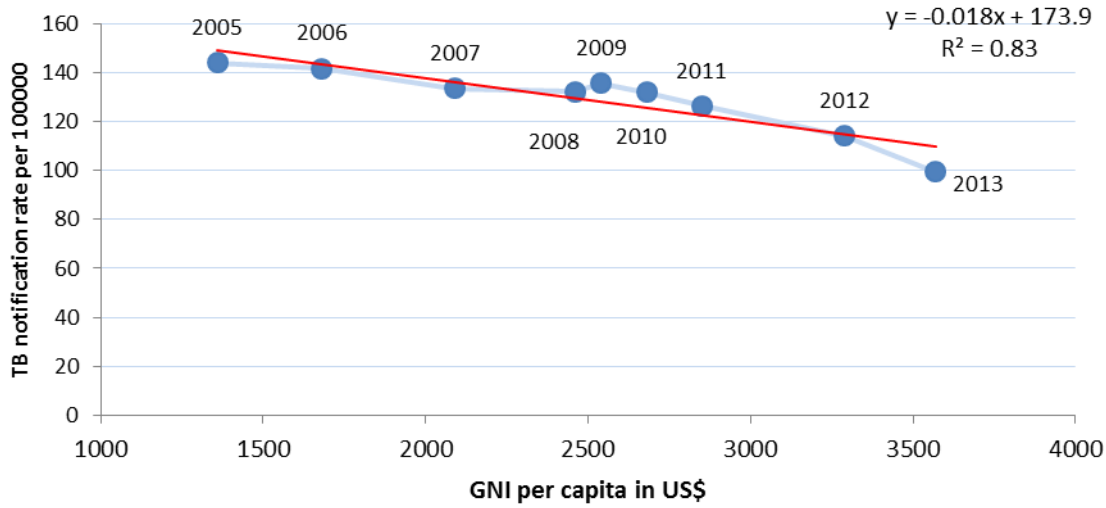
Fig. 57. Population living under poverty line (%), Georgia, 2007–2012



Source: World Bank *(43)*.

The increase in gross national income is correlated with the decrease in TB notifications (Pearson's R^2=0.83, indicating that 83% of variability in notifications is explained with the fitted model). The linear regression analysis suggests that an increase in gross national income per capita by each US$ 100 is associated with a decrease in the TB notification rate of 1.8% (Fig. 58). Thus, the improvement in social conditions among the population due to economic development might be an important contributory factor to the observed decrease in TB notifications.

Fig. 58. Relationship between gross national income per capita (US$) and TB notification rate (all forms), Georgia, 2003–2013 (fitted with linear regression line)



Data sources: World Bank and Global TB database

Source: World Bank database http://data.worldbank.org/, WHO Global TB database *(7)*.

Poor socioeconomic status is a known risk factor not only for TB infection and progression of infection to active TB, but also for poor treatment outcome. A recent study conducted in Georgia indicated that lower household income was an independent risk factor for unfavourable TB treatment outcome *(44)*.

Coverage of financial protection for health care costs

Health care financing is predominantly financed by out-of-pocket payments. In 2013, 64.7% of total health expenditure was covered by such payments *(45)*, although it is known that they are highly regressive as poorer households pay a greater proportion of their income for health services than richer households. This suggests that many people might not have access to health care, including TB services. In recent years there has been a slight decrease in such payments (Fig. 59).

Fig. 59. Out-of-pocket expenditure as a percentage of total health expenditure, Georgia, 2000–2012

Source: WHO Global health expenditure database *(45)*.

Demographic changes

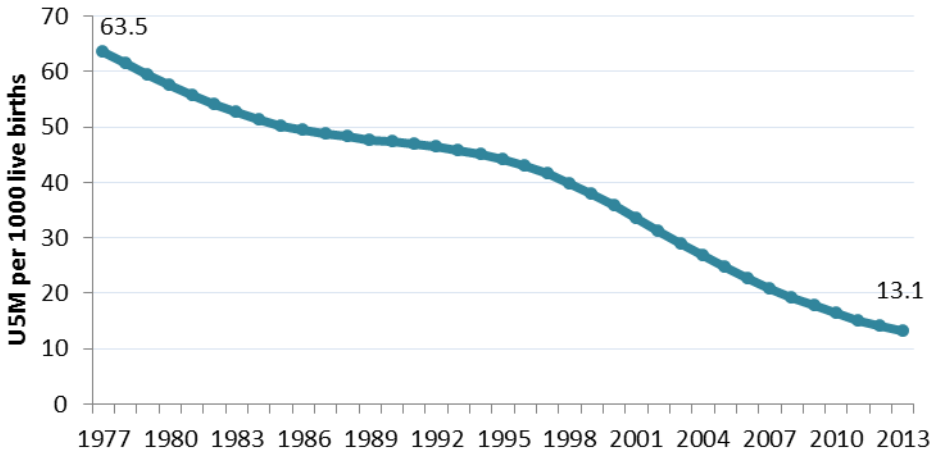
Fig. 60 shows the age pyramids in 1990, 2000 and 2013, indicating rapid changes in size and structure of the population. Each pyramid represents the distribution of the population by age and sex. Within the recent 23 years, from 1990 to 2013, the population fell from 5.5 million to 4.4. In addition, there is a marked ageing of the population: in 1990 the proportion of children aged under 15 years was 24.6% versus 17.9 in 2013, while the relative proportion of the old population increased from 9.3% in 1990 to 15.7% in 2013, indicating that the population is ageing. Such changes in the population structure are expected to drive the TB epidemic upward as TB is less common in children and with the ageing of the population TB prevalence and incidence are expected to be much higher. In 2013 the population pyramid sex distribution of children aged under 15 years becomes skewed because of the growing practice of sex-selective abortions *(46)*, which might affect the TB epidemic if this practice continues.

Fig. 60. Population structure (thousands), Georgia, 1990, 2000 and 2013

Under-five mortality

Under-five mortality is commonly used as a proxy indicator of overall population health and could, therefore, serve to assess progress in the general population's health and access to health services. Fig. 61 represents the time trend in under-five mortality in Georgia since 1977. Between 1977 and 2013 it steadily declined by an average annual decline of 4.3%. The year-on-year change was especially high in 2006–2007, exceeding 8%, and much lower after 2001–2002 (-0.8%).

Fig. 61. Trends in under-5 mortality rates per 1000 live births, Georgia, 1977–2013

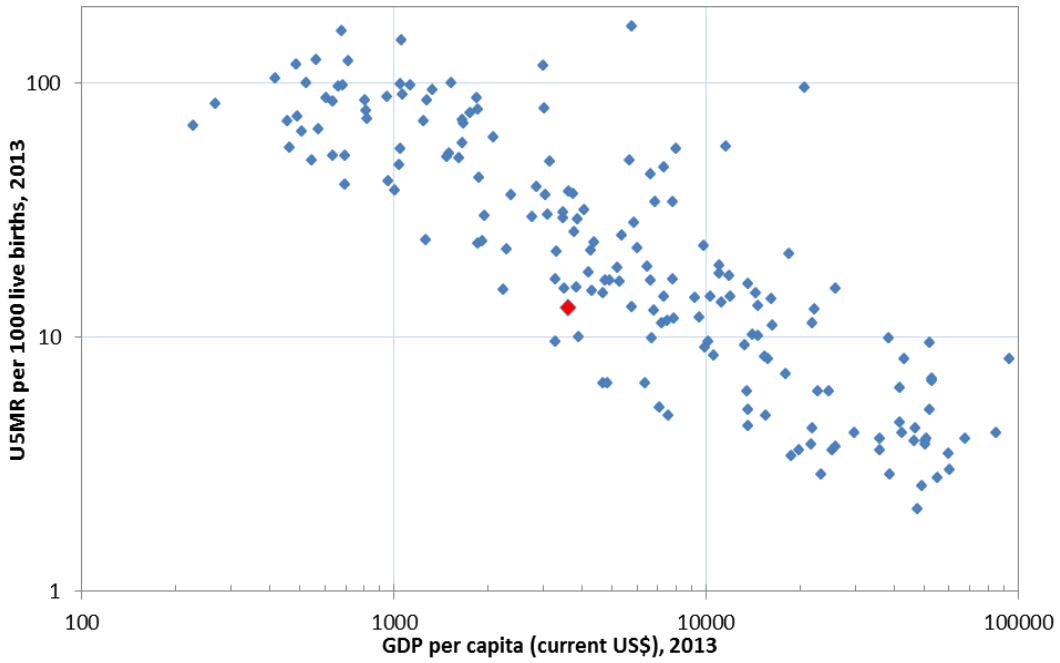


Source: World Bank *(47)*.

Compared to other countries with similar incomes, under-five mortality in Georgia was lower in 2013 than would be expected from the size of the economy expressed in gross domestic product

per capita, suggesting a comparatively better performance of the health system (as measured through the under-five mortality indicator) (Fig. 62).

Fig. 62. Scatterplot of the under-five mortality rate against gross domestic product per capita, Georgia, 2013



Note. Each blue dot represents a country pair of data points. Georgia is shown in red.
World bank database http://data.worldbank.org/

Key findings

- TB funding fluctuated sharply in recent years without any clear trend over time. Funding from both domestic sources and donors varied year on year, although no gap was reported in the funding of TB control.
- The number of diagnostic laboratory services decreased about three times. The total number of microscopy laboratories is four times less than recommended by the Stop TB partnership target of at least one microscopy laboratory per 100 000 population.
- Active case-finding in the civilian population was unchanged over the last 5 years, from 2009 to 2013 and the yield of TB among TB contacts had slightly increased.
- The proportion of successfully treated patients improved markedly among new cases (65% in 2002 to 81% in 2011) and previously treated cases (from 38% in 2002 to 61% in 2011).
- The rate of estimated MDR-TB cases among notified new TB patients per 100 000 population in recent five years [2009-2013] had decreased by an average of 3.4% annually.
- Since 2009, universal MDR treatment coverage has been achieved, although only one in two MDR-TB cases is successfully treated.
- The proportion of HIV-positive patients among those tested in recent five years [2009-2013] was stable, ranging between 2.0% and 2.6%. HIV testing coverage was below what it should be: only in recent reporting year [2013] did it increase from 40% [2012] to 62%

[2013]. Coverage with ART and CPT among TB/HIV coinfected patients improved from 55% in 2009 to 89% in 2013, although it is unlikely that HIV/TB collaborative activities could make any substantial impact on TB epidemiology.

- The prison population more than halved in the last two years [2012-2013]. In addition, the rate of TB fell from 5.4% to 2.3%, notably affecting the overall TB burden.
- Gross national income per capita has increased exponentially since 2002 due to economic growth.
- Health care is still predominantly financed by out-of-pocket payments. There is a little improvement in financial protection for health care costs.
- Changes in the age structure are resulting in ageing of the population with a concomitant increase in the TB burden.

Conclusions

- From 2005 to 2013, the average annual rate of decrease in the notification rate of all TB cases was 5.4%. The observed decline in notifications could be attributed to a true decrease in TB incidence in the population, a decrease in TB case detection or a combination of both.
- The main factors related to the NTP that are expected to drive the TB epidemic downwards are an increase in the treatment success rate among new and previously treated cases and universal access to DST and MDR-TB treatment.
- Among the external factors that are expected to drive the TB epidemic downwards are: economic growth (increase of gross domestic product per capita), strengthening of the health system (reducing under-five mortality), reduction in the prison population and overcrowding in prisons, an increase in ART coverage among people living with HIV and a decrease in the proportion of population using solid fuel. These factors should have the effect of reducing TB transmission and the vulnerability of the population and increasing protection and prevention in the health system.
- Despite the rising trends in ART and CPT coverage among HIV/TB coinfected patients, the overall effect of these interventions on the TB epidemic is probably limited because of the low levels of HIV testing and ART/CPT coverage until recent years and the low absolute number of HIV/TB cases.
- External factors that are expected to drive the TB epidemic upward are: ageing of the population, increase of HIV prevalence in general population, increase in diabetes prevalence and late detection of HIV cases.
- The sharp reduction in laboratory diagnostic services could be a contributory factor for the decline in notification. The decreasing trend in the age-specific notification rate among the young age groups, however, as well as the more or less consistent declining trend across all geographic areas disaggregated by type, sex and site of disease supports the hypothesis of a true decline in TB incidence.

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