

# Methods

## Monitoring progress towards the Millennium Development Goals

### *MDGs for tuberculosis control*

The MDG framework consists of a hierarchy of indicators that measure progress towards “targets”, which are the specific achievements needed to satisfy higher “goals”. Those most directly relevant to TB control are Goal 6 (to combat HIV/AIDS, malaria and other diseases) and Target 8 (to have halted by 2015 and begun to reverse the incidence of malaria and other major diseases, including TB). Among the indicators for Target 8 are two groups that can be used to evaluate the implementation and impact of TB control:

**Indicator 23:** between 1990 and 2015, to halve the prevalence and death rates associated with tuberculosis; and

**Indicator 24:** by 2005, to detect 70% of new smear-positive TB cases arising annually, and to successfully treat 85% of these cases.

The MDG indicators exclude HIV-positive TB patients, mainly to avoid double-counting in death statistics (deaths of HIV-positive people are recorded as AIDS deaths by WHO). However, we routinely calculate all TB indicators with and without HIV-positive TB patient, because TB control programmes need to know both.

This report focuses on the five principal indicators: incidence, prevalence, deaths, case detection and treatment success. The objective of reducing incidence is made explicit by Target 8; the targets for case detection and treatment success have been set by WHO’s World Health Assembly;<sup>3</sup> the targets for prevalence and deaths are based on a resolution of the year 2000 meeting of the Group of Eight (G8) industrialized countries, held in Okinawa, Japan.

### *Data collection and verification*

Every year, WHO requests information from TB control programmes (or rel-

TABLE 1

### Technical elements of the WHO TB control strategy (DOTS)<sup>a</sup>

**MICROSCOPY** Case detection among symptomatic patients self-reporting to health services, using sputum smear microscopy.<sup>b</sup>

**SCC/DOT** Standardized short-course chemotherapy using regimens of 6–8 months for at least all confirmed smear-positive cases. Good case management includes directly observed treatment (DOT) during the intensive phase for all new smear-positive cases, during the continuation phase of regimens containing rifampicin, and during the entirety of a re-treatment regimen.<sup>c</sup>

**DRUG SUPPLY** Establishment and maintenance of a system to supply all essential anti-tuberculosis drugs, and to ensure no interruption in their availability.

**RECORDING AND REPORTING** Establishment and maintenance of a standardized recording and reporting system, allowing assessment of treatment results (see Table 2).

<sup>a</sup> The DOTS strategy comprises five elements in all, including political commitment.

<sup>b</sup> Sputum culture is also used for diagnosis, but direct sputum smear microscopy should still be performed for all suspected cases.

<sup>c</sup> In countries that have consistently documented high treatment success rates, direct observation of treatment may be reserved for a subset of patients, as long as cohort analysis of treatment results is provided to document the outcome of all cases.

evant public health authorities) in 211 countries or territories via a standard data collection form. The latest form was distributed in mid 2004. The section dealing with monitoring and surveillance asked for the following data: TB control strategies implemented up to the end of 2003; TB case notifications in 2003; and treatment outcomes for TB patients registered during 2002, following definitions given in Table 1. The most recent form can be downloaded from [www.who.int/tb](http://www.who.int/tb).

The data collection form is a tool for collecting aggregated national data. The process of national and international reporting is quite distinct from WHO’s recommendations about procedures for recording and reporting data within NTPs. The information gathered from the form includes a core set of data (questions remain more or less the same each year), plus new or timely information (questions may change from year to year). In the latest form, there are new questions about TB/HIV collaboration, about financing (the second year of collection but somewhat expanded), and about the outcomes of re-treatment, for patients who have received two or more courses of anti-TB drugs.

Completed forms are collected and reviewed at all levels of WHO – in WHO

country offices, regional offices and at headquarters – and an acknowledgement form that tabulates all data submitted and shows WHO’s calculations of principal indicators, is sent back to the national correspondent in order to complete any missing responses and to resolve any inconsistencies.

In the WHO European Region only, data collection and verification are performed jointly by the regional office and a WHO collaborating centre, EuroTB (Paris), using a different format. EuroTB subsequently publishes an annual report with additional analyses, using more detailed data for the European Region (see: [www.eurotb.org](http://www.eurotb.org)).

### *High-burden countries and WHO regions*

Much of the data submitted to WHO is shown, country by country, in the annexes of this report. The analysis and interpretation that precedes these annexes focuses on 22 HBCs and the six WHO regions. The 22 HBCs account for approximately 80% of the estimated number of new TB cases (all forms) arising worldwide each year. These countries are the focus of intensified efforts in DOTS expansion (Annex 1). The HBCs are not necessarily those with the highest incidence

TABLE 2

**Definitions of tuberculosis cases and treatment outcomes****A. DEFINITIONS OF TUBERCULOSIS CASES**

**CASE OF TUBERCULOSIS** A case of TB which has been bacteriologically confirmed, or has been diagnosed by a clinician.

**DEFINITE CASE** Patient with positive culture for the *Mycobacterium tuberculosis* complex. In countries where culture is not routinely available a patient with two sputum smears positive for acid-fast bacilli (AFB+) is also considered a definite case.

**PULMONARY CASE** A case of TB disease involving the lung parenchyma.

**SMEAR-POSITIVE PULMONARY CASE** At least two initial sputum smear examinations (direct smear microscopy) AFB+; or one sputum examination AFB+ and radiographic abnormalities consistent with active pulmonary tuberculosis as determined by a clinician; or one sputum specimen AFB+ and culture positive for *M. tuberculosis*.

**SMEAR-NEGATIVE PULMONARY CASE** Pulmonary tuberculosis not meeting the above criteria for smear-positive disease. Diagnostic criteria should include: at least three sputum smear examinations negative for AFB; and radiographic abnormalities consistent with active pulmonary TB; and no response to a course of broad-spectrum antibiotics; and decision by a clinician to treat with a full course of anti-tuberculosis therapy; or positive culture but negative AFB sputum examinations.

**EXTRAPULMONARY CASE** Patient with tuberculosis of organs other than the lungs e.g. pleura, lymph nodes, abdomen, genitourinary tract, skin, joints and bones, meninges. Diagnosis should be based on one culture-positive specimen, or histological or strong clinical evidence consistent with active extrapulmonary disease, followed by a decision by a clinician to treat with a full course of anti-tuberculosis chemotherapy. Note: a patient diagnosed with both pulmonary and extrapulmonary tuberculosis should be classified as a case of pulmonary tuberculosis.

**NEW CASE** Patient who has never had treatment for tuberculosis, or who has taken anti-tuberculosis drugs for less than one month.<sup>a</sup>

**RELAPSE CASE** Patient previously declared cured but with a new episode of bacteriologically positive (sputum smear or culture) tuberculosis.<sup>b</sup>

**RE-TREATMENT CASE** Patient previously treated for tuberculosis, undergoing treatment for a new episode of bacteriologically positive tuberculosis.<sup>b</sup>

**B. DEFINITIONS OF TREATMENT OUTCOMES**

(expressed as a percentage of the number registered in the cohort)

**CURED** Initially smear-positive patient who was smear-negative in the last month of treatment, and on at least one previous occasion.<sup>b</sup>

**COMPLETED TREATMENT** Patient who completed treatment but did not meet the criteria for cure or failure.

**DIED** Patient who died for any reason during treatment.

**FAILED** Smear-positive patient who remained smear-positive at five months or later during treatment.

**DEFAULTED** Patient whose treatment was interrupted for two consecutive months or more.

**TRANSFERRED OUT** Patient who transferred to another reporting unit and for whom the treatment outcome is not known.

**SUCCESSFULLY TREATED** Patients who were cured and those that completed treatment.

**COHORT** A group of TB cases diagnosed (and in principal notified and started on treatment) during a specified time period, e.g., the cohort of new smear-positive cases for the calendar year 2003. This group forms the denominator for calculating treatment outcomes. The sum of the above treatment outcomes, plus any cases for which no outcome is recorded (e.g. still on treatment) should equal the number registered. Some countries monitor outcomes among cohorts defined by smear and/or culture, and define cure and failure according to the best laboratory evidence available for each patient.

<sup>a</sup> Cases reported as "history unknown" in the European Region are included as new cases in this report.

<sup>b</sup> In the EuroTB database, bacteriologically positive re-treatment cases for some countries could not be distinguished from other re-treatment cases. For the purposes of this report, where this occurred, all relapse cases were included in the category "relapse", and the remainder of re-treatment cases (after default and after failure) were included as "re-treatment excluding relapse" (applies to countries in the European Region only).

rates per capita; many of the latter are medium-sized African countries with high rates of TB/HIV coinfection.

The WHO regions are the African Region, the Region of the Americas, the Eastern Mediterranean Region, the European Region, the South-East Asia Region and the Western Pacific Region. All essential statistics are summarized for each of these regions and globally. However, to make clear the differences in epidemiological trends within regions, we divide the African Region into countries that have low and high rates of HIV infection (boundary at an estimated infection rate of 4% in adults aged 15–49 years), and include those countries in the Eastern Mediterranean Region which are actually on the African continent (Djibouti, Somalia and Sudan) in the low-HIV Africa group. Furthermore, we distinguish central from eastern Europe (countries of the former Soviet Union plus Bulgaria and Romania), and combine western European countries with the other established market economies. The countries within each of the resulting nine regions are listed in the legend to Figure 6.

**DOTS classification**

DOTS is the internationally recommended approach to TB control. It is not simply a clinical approach to patient management, but rather a strategy for TB control primarily within public health systems. Countries reporting to WHO classify themselves as DOTS or non-DOTS, referring to the elements listed in Table 2. DOTS countries must have officially accepted and adopted the strategy, and must have implemented the essential components of DOTS in at least part of the country (Annex 2). Based on NTP responses to standard questions about policy, and usually on further discussion with the NTP, WHO accepts or revises each country's own determination of its DOTS status.

**DOTS coverage**

Coverage in any country is defined as the percentage of the national population living in areas where health services have adopted DOTS. "Areas" are the lowest administrative or management units in the country –

townships, districts, counties, etc. If an area (with its one or more health facilities) is considered by the NTP to be a DOTS area in 2003, then all the cases registered and reported by the NTP in that area are considered DOTS cases, and the population living within the boundaries of that area counts towards the national DOTS coverage. In some cases, treatment providers who are not following DOTS guidelines (for example private practitioners, or public health services outside the NTP such as those within prisons) notify cases to the NTP. These cases are considered non-DOTS cases, even if they are notified from within DOTS areas. However, when certain groups of patients treated by DOTS services receive special regimens or management (for example nomads placed on long-course treatment), these are considered as DOTS cases. Where possible, additional information about these special groups of patients is provided in the country notes in Annex 2.

Coverage is a crude indicator, which is easy to calculate, and which is most useful during the early stages of DOTS expansion. As a measure of patient access to diagnosis and treatment under DOTS, coverage is an approximation, and usually an overestimate. Where countries are able to provide more precise information about access to DOTS services this information is reported in the country notes of Annex 2. The case detection rate (defined below) is more precise, but also more demanding of data.

#### *Estimating TB incidence, prevalence and death rates*

Estimates of incidence, prevalence and deaths are based on a consultative and analytical process; they are revised annually to reflect new information gathered through surveillance and from special studies, such as prevalence surveys. The details of estimation are described elsewhere.<sup>5,6</sup> In brief, estimates of incidence (number of new cases per year) for each country are derived by one or more of four approaches, depending on the available data:

- (1) 
$$\text{incidence} = \frac{\text{case notifications}}{\text{proportion of cases detected}}$$
- (2) 
$$\text{incidence} = \frac{\text{prevalence}}{\text{duration of condition}}$$
- (3) 
$$\text{incidence} = \text{annual risk of infection} \times \text{Stýblo coefficient}$$
- (4) 
$$\text{incidence} = \frac{\text{deaths}}{\text{proportion of incident cases that die}}$$

The “Stýblo coefficient” in equation (3) is taken to be a constant, with an empirically derived value in the range 40–60, relating risk of infection (%) to the incidence of smear-positive cases (per 100 000 per year). Given two of the quantities in any of these equations, we can calculate the third, and any of these formulae can be rearranged to estimate incidence, prevalence and death rates. The available data differ from country to country but include case notifications and death records (from routine surveillance and vital registration), and measures of the prevalence of infection and disease (from population-based surveys).

For each country, estimates of incidence for each year in the period 1995–2003 are made as follows. We first select a reference year for which we have a best estimate of incidence; this may be the year in which a survey was carried out, or the year in which incidence was first estimated. We then use the series of case notifications (all forms of TB) to determine how incidence changed before and after that reference year. The time series of estimated incidence rates is constructed from the notification series in two ways: if the rate of change of incidence is roughly constant through time, we fit exponential trends to the notifications; if the rate of change varies (eastern Europe, central Europe and high-HIV Africa), we use a three-year moving average of the notification rates. If the notifications for any country are considered to be an unreliable guide to trend (e.g. because reporting effort is known to have changed), we apply the aggregated trend for all other countries with reliable data from the same epidemiological region. For China, exceptionally, we have used an assessment of the trend in incidence

based on risk of infection derived from tuberculin surveys. For those countries that have no reliable data from which to assess trends in incidence (e.g. for countries such as Iraq, for which data are hard to interpret, and which are atypical within their own regions), we assume incidence is stable. Further details are available at [www.who.int/tb](http://www.who.int/tb).

For countries that have not yet measured HIV infection rates in TB patients directly, an indirect estimate can be obtained from the incidence rate ratio (IRR, the TB incidence rate in HIV-infected people divided by the incidence rate in HIV-uninfected people), as described elsewhere.<sup>6</sup> The prevalence of MDR-TB among previously untreated TB patients has also been estimated in a separate exercise,<sup>7</sup> supplemented with data from more recent surveys.<sup>8</sup>

Estimates of incidence form the denominator of the case detection rate. Trends in incidence are determined by underlying epidemiological processes, modified by control programmes. The impact of control on prevalence is determined by the trend in incidence, and by the estimated

<sup>5</sup> Dye C et al. Global burden of tuberculosis: estimated incidence, prevalence and mortality by country. *Journal of the American Medical Association*, 1999, 282: 677–686.

<sup>6</sup> Corbett EL et al. The growing burden of tuberculosis: global trends and interactions with the HIV epidemic. *Archives of Internal Medicine*, 2003, 163:1009–1021.

<sup>7</sup> Dye C et al. Worldwide incidence of multidrug-resistant tuberculosis. *Journal of Infectious Diseases*, 2002, 185:1197–1202.

<sup>8</sup> *Anti-tuberculosis drug resistance in the world. Report No.3*. WHO/IUATLD Global Project on Anti-Tuberculosis Drug Resistance Surveillance. Geneva, World Health Organization, 2004 (WHO/HTM/TB/2004.343).

reduction in the duration of the condition, e.g. smear-positive disease. The impact of control on deaths is determined by the trend in incidence, and by the estimated reduction in case fatality (proportion of incident cases that ever die from TB).<sup>5,6</sup>

Where population sizes are needed to calculate TB indicators, we use the latest revision of estimates provided by the United Nations Population Division,<sup>9</sup> even though these estimates sometimes differ from those made by the countries themselves (some of which are based on more recent census data). The estimates of some TB indicators, such as the case detection rate, are derived from data and calculations that use only rates per capita, and discrepancies in population sizes do not affect these indicators. Where rates per capita are used as a basis for calculating numbers of TB cases, these discrepancies sometimes do make a difference. Some examples of important differences are given in the country notes in Annex 2.

#### Case detection rate

Smear-positive cases are the focus of DOTS programmes because they are the principal sources of infection to others, because sputum smear microscopy is a highly-specific (if somewhat insensitive) method of diagnosis, and because patients with smear-positive disease typically suffer higher rates of morbidity and mortality than smear-negative patients. As a measure of the quality of diagnosis, we calculate the proportion of new sputum smear-positive cases out of all new pulmonary cases, which has an expected value of 65–80% in areas with negligible HIV prevalence.<sup>10</sup> However, this report presents the numbers of all TB cases notified, smear-positive and smear-negative pulmonary cases, in addition to those in whom extrapulmonary disease is diagnosed.

The term “case detection”, as used here, means that TB is diagnosed (correctly or incorrectly) in a patient, and is reported within the national surveillance system, and then to WHO. The case detection rate is calculated as the ratio of the number of notified smear-positive cases to the number of new smear-positive cases esti-

mated for that year. Detection is presented in two ways – as the case detection rate (countrywide) and as the DOTS case detection rate (by DOTS programmes):

$$(5) \quad \text{case detection rate} = \frac{\text{annual new smear-positive notifications (country)}}{\text{estimated annual new smear-positive incidence (country)}}$$

$$(6) \quad \text{DOTS case detection rate} = \frac{\text{annual new smear-positive notifications (DOTS)}}{\text{estimated annual new smear-positive incidence (country)}}$$

The case detection rate and the DOTS case detection rate are identical when a country reports only from DOTS areas. This generally happens when DOTS coverage is 100% but, in some countries where DOTS is implemented in only part of the country, no TB notifications are received from the non-DOTS areas. Furthermore, in some countries where DOTS coverage is 100%, patients may choose to seek treatment from non-DOTS providers, who in some cases notify TB cases to the national authorities.

Both of the above definitions of the case detection rate refer to smear-positive cases, although we also present the detection rate for all forms of TB. The detection rate of all forms is similarly presented in two ways: detection by DOTS programmes, and detection countrywide.

Although these indices are termed “rates”, they are actually ratios. The number of cases notified is usually smaller than estimated incidence because of incomplete coverage by health services, under-diagnosis, or deficient recording and reporting. However, the calculated detection rate can exceed 100% if case-finding has been intense in an area that has a backlog of chronic cases, if there has been over-reporting (e.g. double-counting) or over-diagnosis, or if estimates of incidence are too low. If the expected number of cases per year is very low (especially if it is less than one), the case detection rate can vary markedly from year to year due to chance. Whenever this index comes close to or exceeds 100%, we attempt to investigate, as part of the joint planning and evaluation process with NTPs, which of these explanations is correct.

The ratio of the DOTS case detec-

tion rate to coverage estimates the case detection rate within DOTS areas (as distinct from the case detection rate nationwide), assuming that the TB incidence rate is homogene-

ous across counties, districts, provinces, or other administrative units. Ideally, this ratio would have a value of 70% or more as DOTS coverage increases within any country. Where the value of this indicator is much lower, it is clear that the DOTS programme has been poorly implemented, at least in some parts of the designated DOTS area. Changes in the value of this ratio through time are a measure of changes in the quality of TB control, after the DOTS programme has been established.

#### Treatment success

Treatment success in DOTS programmes is the percentage of new smear-positive patients that are cured (negative on sputum smear examination), plus the percentage that complete a course of treatment, without bacteriological confirmation of cure (Table 2).<sup>11</sup> Cure and completion are among the six mutually exclusive outcomes.<sup>12</sup> The sum of cases assigned to these outcomes, plus any additional cases registered but not assigned to

<sup>9</sup> *World population prospects – the 2002 revision*. New York, United Nations Population Division, 2003.

<sup>10</sup> *Tuberculosis handbook*. Geneva, World Health Organization, 1998 (WHO/TB/98.253).

<sup>11</sup> TB control programmes should ensure high treatment success before expanding case detection. The reason is that a proportion of patients given less than a fully-curative course of treatment remain chronically infectious, and continue to spread TB. Thus DOTS programmes must be shown to achieve high cure rates in pilot projects before attempting countrywide coverage.

<sup>12</sup> *Treatment of tuberculosis: Guidelines for national programmes*. Third edition. Geneva, World Health Organization, 2003 (WHO/CDS/TB/2003.313).

an outcome, adds up to 100% of cases registered (i.e. the treatment cohort).

We also compare the number of new smear-positive cases registered for treatment (for this report, in 2002) with the number of cases notified as smear-positive (also in 2002). All notified cases should be registered for treatment, and the numbers notified and registered should therefore be the same (discrepancies arise e.g. when subnational reports are not received at national level). If the number registered for treatment is not provided we take, as the denominator for treatment outcomes, the number notified for that cohort year. If the sum of the six outcome categories is greater than the number registered (or the number notified), we use this sum as the denominator.

Because the number of patients presenting for a second or subsequent course of treatment, and the outcome of further treatment, are indicative of NTP performance and levels of drug resistance, we have begun to compile these data in this report. We present the numbers of patients registered for re-treatment, and the outcomes of re-treatment, for each of three registration types: re-treatment after relapse, failure or default. However, some countries do not yet compile data on cases registered for re-treatment after failure and default separately at national level. Furthermore, some countries do not have outcome data for each of these re-treatment case types.

The assessment of outcomes for a given calendar year always lags notifications by one year to ensure that all patients registered during that calendar year have completed treatment. A DOTS country must report treatment outcomes, unless it is newly-classified as DOTS, in which case it would take an additional year to report outcomes from the first cohort of patients treated.

#### *Overview of data in annexes*

Annex 1 presents data on epidemiology and surveillance, and planning and financing for each of the 22 HBCs. Data on policy and strategy are collected for both DOTS and non-DOTS areas separately.

Annex 2 contains the estimates needed to evaluate MDG Target 8 and indicators 23 and 24. These data include case detection and treatment success rates to monitor DOTS implementation, and incidence, prevalence and death rates to monitor the impact of TB control.

These data are presented, for each of the six WHO regions, as follows:

- TB control policies for each country, stating which technical components of the DOTS strategy have been implemented;
- incidence, prevalence and death rates for 1990 (MDG reference year) and 2003;
- case notifications, detection rates, and DOTS coverage: nationally, and separately for DOTS and non-DOTS programmes. Notifications include new pulmonary cases (smear-positive, smear-negative and laboratory-confirmed), new extra-pulmonary and re-treatment cases;
- treatment outcomes for 2002 cohorts: both the new smear-positive and the re-treatment cohorts from DOTS programmes (relapse, re-treatment after default and re-treatment after failure are presented separately where possible, as well as all re-treatment cases combined), and the new smear-positive treatment outcomes (where available) from non-DOTS programmes;
- new smear-positive notification rates by age and sex for the whole country;
- new smear-positive notifications (numbers) by age and sex, from DOTS and non-DOTS programmes;
- notification rates and numbers since 1980, for all forms of TB;
- notification rates and numbers since 1995, for new smear-positive cases;
- country notes: remarks that may help to explain data reported by selected countries (e.g. additional breakdown of cases of interest, late-reported data, reasons for incomplete data, discrepancies in estimated population sizes).

The data in Annex 2 are available as Excel spreadsheets from [www.who.int/tb](http://www.who.int/tb).

### **Planning and DOTS implementation**

The information on strategic planning analysed and presented in this report reflects activities from July 2003 to June 2004. Country plans and activities are monitored through several mechanisms, including direct discussion with NTP managers, analysis of a questionnaire on planning and implementation sent by WHO to all HBCs during 2004 (available from [www.who.int/tb](http://www.who.int/tb)), collaboration with international technical agencies, monitoring missions, comprehensive programme reviews, GFATM applications, regional NTP managers' meetings, and the annual meeting of the DOTS Expansion Working Group (DEWG) of the Stop TB Partnership. In writing this report, WHO staff worked with NTP managers of the 22 HBCs to:

- assess national TB control activities planned and carried out during 2004, focusing on activities to improve political commitment, expand access to DOTS, strengthen diagnosis, improve treatment outcomes, ensure adequate staffing, and improve programme monitoring and supervision;
- update the country profiles to summarize progress made by the end of 2004 in implementing, or scaling up, national plans for DOTS expansion;
- analyse constraints to reaching the targets for detection and treatment success;
- review and revise the list of partners operating in, or on behalf of, each country;
- assess levels of drug resistance and activities planned to address MDR-TB, including mechanisms of drug-resistance surveillance, MDR-TB diagnosis and treatment policies, and the availability of second-line drugs;
- determine the status of collaborative TB/HIV activities;

- determine the status of additional strategies to expand DOTS, and to involve community and health-care providers not currently participating in the provision of DOTS.

#### *Planning activities carried out in 2003*

In preparation for the 5th DEWG meeting (Paris, France, 27–28 October 2004), NTP managers for the 22 HBCs were asked to summarize what activities had been planned for implementation during 2003, which of those activities were implemented, which were not and why, and what corrective actions were taken so that these activities could be implemented in 2004. The information from these DEWG summary tables, supplemented with additional information provided by NTP managers and by WHO staff, is incorporated into the country profiles (Annex 1).

#### *Update of country profiles*

Country profiles (Annex 1) were updated by incorporating information from the following sources: summary tables prepared for the 5th DEWG; country posters presented by the 22 HBCs at the DEWG meeting; questionnaires submitted by the 22 HBCs; and consultations with, and reviews of, the country profiles by NTP staff and collaborating technical agencies.

#### *Constraints and remedial actions*

Following the previous analysis of constraints to DOTS expansion and remedial actions proposed,<sup>13</sup> this year's report provides an update. Constraints and remedial actions were assessed with information provided at the DEWG meeting, and through personal communications with NTP managers and staff. Special attention was devoted to constraints related to laboratory services and human resources.

#### *Partnerships and coordination*

The list of donors and collaborating organizations was updated in consultation with NTP managers, WHO regional and country offices and partners. Major technical agencies, along with financial partners, are listed in each country profile. The coordination of these numerous agencies is vital for the efficient use of limited

resources within countries, and is facilitated through a formal coordination mechanism, such as the national interagency coordinating committee (NICC).

#### *Management of drug resistance*

Data on the prevalence of drug resistance are collected through the WHO/IUATLD Global Project on Anti-tuberculosis Drug Resistance Surveillance (DRS), which began in 1994, and which published its third report in 2004.<sup>8</sup> Profiles of the 22 HBCs contain estimates of the national prevalence of MDR-TB among previously untreated TB patients based on survey data for those countries participating in the WHO/IUATLD project. For those countries that have not carried out surveys, figures given in the country profiles are estimates.

WHO develops global policy on the management of MDR-TB and facilitates access to second-line drugs through the Green Light Committee (GLC).<sup>14</sup> As part of this process, and under the continuous monitoring of the GLC, several DOTS-Plus pilot projects are evaluating the feasibility and cost-effectiveness of using second-line drugs for managing MDR-TB in countries with limited resources. Projects approved by the GLC have access to quality-assured, second-line drugs at reduced prices and benefit from technical support and external monitoring. This report summarizes the number and status of GLC-approved DOTS-Plus projects that had been established by 2004.

#### *Collaborative TB/HIV activities*

WHO has published an interim policy on collaborative TB/HIV activities<sup>15</sup> that outlines the methods and benefits of collaboration between HIV and TB programmes. Three main areas of collaboration are recommended. First, organizational structures should be set up to plan and manage collaborative TB/HIV activities. Second, people infected with HIV should be screened for TB, treated if they have active disease, and offered isoniazid preventive therapy as needed. Third, TB patients should be offered voluntary counselling and testing for HIV infection (VCT); if positive, they should be offered co-

trimoxazole preventive therapy and, wherever possible, ART. WHO has also developed a guide for monitoring and evaluating collaborative TB/HIV activities that defines indicators for each of the key activities recommended in the interim policy.<sup>16</sup>

To investigate progress in implementing the recommended collaborative TB/HIV activities, countries were asked, via the standard WHO data collection form, to report on the extent to which TB patients were tested for HIV, assessed for ART and provided with ART during 2003. A supplementary questionnaire (available at [www.who.int/tb](http://www.who.int/tb)) was sent to the 41 countries that have the highest incidence rates of TB with HIV coinfection. This questionnaire asked specifically about policy developments between 2002 and 2003. The data obtained from both forms were reviewed at WHO regional offices and headquarters, and any inconsistencies or missing data were discussed with the national correspondent before being included in the analysis.

#### *Additional strategies for DOTS expansion*

This report covers three areas:

- PPM initiatives that aim to bring a greater diversity of health-care providers into DOTS programmes, promoting the essential package of patient care and improving reporting and monitoring procedures;
- community participation that improves access to care and fosters a patient-centered approach to the management of TB. While the type and scope of community involve-

<sup>13</sup> *Global tuberculosis control: surveillance, planning, financing. WHO report 2004.* Geneva, World Health Organization (WHO/HTM/TB/2004.331).

<sup>14</sup> Gupta R et al. Increasing transparency in partnerships for health – introducing the Green Light Committee. *Tropical Medicine and International Health*, 2002, 7:970–976.

<sup>15</sup> *Interim policy on collaborative TB/HIV activities.* Geneva, World Health Organization, 2004 (WHO/HTM/TB/2004.330; WHO/HTM/HIV/2004.1).

<sup>16</sup> *A guide to monitoring and evaluation for collaborative TB/HIV activities.* Geneva, World Health Organization, 2004 (WHO/HTM/TB/2004.342; WHO/HIV/2004.09).

ment depends upon location and context, many HBCs regard civil society as an essential partner in providing support to patients and their families;

- the feasibility of implementing the Practical Approach to Lung Health (PAL), which several countries are examining, and assessing its potential impact on TB case detection and on the rationalization of drug prescriptions.

In addition to the findings presented in this report, further details of PPM, TB/HIV, PAL and other projects can be found at [www.who.int/tb](http://www.who.int/tb).

### Financing DOTS expansion

The financial analysis in this series of annual reports on global TB control has evolved and improved since being introduced in 2002.<sup>17</sup> The main developments in this year's report are: (a) to place greater emphasis on the presentation and analysis of trends, with each HBC profile including budget and cost data for four years; and (b) to provide a more complete analysis of data for countries other than the HBCs. The report has eight objectives:

- for each HBC, and for all HBCs combined, to present trends in total NTP budgets and expenditures for the period 2002–2005, with breakdowns by funding source and line item;
- for each HBC and for all HBCs combined, to present trends in total TB control costs<sup>18</sup> for the period 2002–2005, with breakdowns by funding source and line item;
- for each HBC and for all HBCs combined, to assess trends in NTP budgets and total TB control costs, giving particular attention to where progress has been made and where major funding gaps persist;
- for each HBC, to estimate and compare per patient costs, budgets and available funding for the period 2002–2005 and per patient expenditures for 2002 and 2003;
- for HBCs, to assess the relationship between gross national income (GNI) per capita and (a) per

patient costs and (b) the fraction of funds contributed by the government;

- for HBCs, to assess whether projected budgets and available funding will be sufficient to achieve the global targets for case detection and treatment success;
- to assess the contribution of the GFATM to funding for TB control;
- for countries other than the HBCs, to quantify NTP budgets and funding gaps in 2004 and 2005.

### Data collection

We collected data from five main sources: NTPs, the WHO-CHOICE web site,<sup>19</sup> costing guidelines developed for the “Disease Control Priorities in Developing Countries” project (DCPP),<sup>20</sup> GFATM proposals and databases, and previous WHO reports in this series. In 2004, data were collected directly from countries by means of a two-page questionnaire included in the standard WHO data collection form. NTP managers were asked to complete three tables. The first two tables required a summary of the NTP budget for fiscal years 2004 and 2005 in US\$, broken down by line item and funding source (including a column for funding gaps). The third table requested NTP expenditure data for 2003, broken down by line item and source of funding. The form also requested information about dedicated TB control infrastructure and the way in which general health infrastructure is used for TB control – for example, the number of dedicated TB beds that exist, the number of outpatient visits that patients need to make to a health facility during treatment and the average number of days for which patients are hospitalized. We also asked for an estimate of the number of patients that would be treated in 2004 and 2005. We used the WHO-CHOICE web site to identify the average costs, in international dollars (I\$), of a hospital bed-day and an outpatient clinic visit in every country. The costing guidelines for the DCPP and the WHO-CHOICE web site were used to identify the purchasing power parity (PPP) exchange rates re-

quired for conversion of I\$ costs to costs in US\$ (for consistency with budget and expenditure data reported on the data collection form).

### Data entry and analysis

*High-burden countries.* Data entry and analysis focused on the 22 HBCs. We created a standardized spreadsheet, with one worksheet for each country. Additional worksheets were included for summary analyses and for the data required as inputs to the analyses in each country worksheet (e.g. notification data, unit costs for bed-days and outpatient clinic visits, and the typical number of outpatient clinic visits and days in hospital for different types of patient during treatment). For each country worksheet, seven tables were created. These were:

- NTP budget by source of funding for each year 2002–2005, with the funding sources defined according to the 2004 data collection form i.e. government (excluding loans), loans, grants (excluding GFATM), GFATM and budget gap;
- NTP budget by line item for each year 2002–2005, with the line items defined according to the 2004 data collection form i.e. first-line drugs, second-line drugs, dedicated NTP staff, initiatives to increase case detection and cure rates, collaborative TB/HIV activities, buildings/equipment and other;
- NTP expenditures by source of funding for 2002 and 2003, with funding sources as defined for NTP budgets;
- NTP expenditures by line item for 2002 and 2003, with line items defined as for NTP budgets;

<sup>17</sup> *Global tuberculosis control: surveillance, planning, financing. WHO report 2002.* Geneva, World Health Organization, 2002 (WHO/CDS/TB/2002.295).

<sup>18</sup> i.e. including costs not reflected in NTP budget data.

<sup>19</sup> [www3.who.int/whosis/cea/prices/unit](http://www3.who.int/whosis/cea/prices/unit).

<sup>20</sup> *DCPP guidelines for authors*, pp. 74–77, (available at [www.fic.nih.gov/dcpp/authorguide.pdf](http://www.fic.nih.gov/dcpp/authorguide.pdf), accessed 11 January 2005).

- total TB control costs by funding source for each year 2002–2005, with funding sources defined as for NTP budgets;
- total TB control costs by line item for each year 2002–2005, with the line items defined as NTP budget items, hospitalization and clinic visits;
- per patient costs, NTP budget, available funding, expenditures and budget for first-line drugs.

Budget data for 2004 and 2005 were taken from the 2004 data collection form. Budget data for 2002 and 2003 were taken from the 2002 and 2004 annual reports, respectively. Expenditure data for 2002 and 2003 were based on the 2003 and 2004 data collection forms, respectively. Total TB control costs were estimated by adding costs for hospitalization and outpatient clinic visits to either NTP expenditures (for 2002 and 2003) or NTP budgets (for 2004 and 2005).<sup>21</sup> Expenditures were used in preference to budgets for 2002 and 2003 because they reflect actual costs, whereas budgets can be higher than actual expenditures (for example, when large budgetary funding gaps exist or the NTP does not spend all the available funding). When expenditures are known for 2004 and 2005, they will be used instead of budget data to calculate, retrospectively, the total cost of TB control in these years. For some HBCs, expenditures were not available for 2002 and 2003. When this was the case, we estimated expenditures based on available funding, which was calculated as the total budget minus the funding gap.

The cost of outpatient clinic visits was estimated in three steps. First, we converted I\$ prices for clinic visits reported on the WHO-CHOICE web site into US\$ prices using the DCP exchange rates. Second, we multiplied the average number of visits required per patient (estimated on the WHO data collection form) by the average cost (in US\$) per clinic visit, to give the cost per patient treated. Third, we multiplied the cost per patient treated by the number of patients notified (for 2002 or 2003) or the number of pa-

tients that the NTP projects will be treated (for 2004 and 2005). The cost of hospitalization was generally calculated in the same way, replacing the unit cost of a clinic visit with the unit cost of a bed-day. The procedure differed for eight countries that have dedicated TB beds, and where the total cost of these beds is higher than implied by multiplying bed-days per patient by the number of patients treated (this applied to Brazil, Cambodia, India, Nigeria, the Russian Federation, the United Republic of Tanzania, Viet Nam and Zimbabwe). We assumed that all clinic visits and hospitalization are funded by the government.

Per patient costs, budgets, available funding and expenditures were calculated by dividing the relevant total by the number of cases notified (for 2002 and 2003) and the number of patients that the NTP projects will be treated (for 2004 and 2005). Since the total costs of TB control for 2002 and 2003 were based on expenditure data, it is possible for the total TB control cost per patient treated to be less than the NTP budget per patient treated when the funding gap is large or there is an important budgetary under-spend. In addition, for 2002 and 2003, the expenditure per patient was sometimes higher than the available funding per patient. This can occur when some of the NTP budget funding gap is closed following the reporting of budget data to WHO.

All data are reported in nominal prices (i.e. they have not been adjusted for inflation) rather than constant prices (i.e. all data are adjusted to a common year of prices) for two reasons. First, this avoids adjustment of values reported in the 2002–2004 reports in this series, which makes it easier for country staff to review the data for previous years. Second, the adjustment will make only a limited difference to the numbers reported (about 5% to 2002 values and less for other years). However, as data are collected for an increasing number of years, presentation of data in constant prices will be necessary.

Following data entry, text on data sources and assumptions were added. Where there were questions

about the data, these were discussed with NTP staff and the appropriate WHO regional and country office. These discussions were used to produce a final set of charts. Four of these charts appear in the profiles for each country at Annex 1: NTP budget by funding source, NTP budget by line item, total TB control costs by line item, and per patient costs, budgets, available funding, expenditures and budget for first-line drugs. These charts were selected because they illustrate the most important trends in financing, while other data are referred to in the text. A full set of charts and data is available upon request. In some instances, the review process led to revisions to data included in previous annual reports. For this reason, figures sometimes differ from those reported in the 2002, 2003 and 2004 reports.

Finally, we compared the total costs of TB control with total government health expenditures to estimate the percentage of total government health expenditures used for TB control. Total government health expenditures were estimated by multiplying the government health expenditure per capita in US\$ (as estimated in the WHO national health accounts database)<sup>22</sup> by population size. We also explored the association between GNI per capita in 2003 and (a) government contributions to total NTP budgets and TB control costs, and (b) the cost per patient treated. Data on GNI per capita were taken from *World development indicators 2004*.<sup>23</sup>

*Other countries.* The data provided by countries other than the HBCs were less complete, and as a consequence our analyses to date are more superficial. We used the data provided on the 2004 data collection form to assess NTP budgets by region, and com-

<sup>21</sup> The exception was South Africa, because no data on hospitalization and clinic visits, or on NTP budgets, were provided in the data collection form. Costs were therefore estimated based on recent costing studies, as described in previous WHO reports in this series.

<sup>22</sup> [www.who.int/nha/country/en/](http://www.who.int/nha/country/en/).

<sup>23</sup> [www.worldbank.org/data/wdi2004/](http://www.worldbank.org/data/wdi2004/).

pared these with the budgets reported by the HBCs. Only countries that submitted complete data of sufficient quality (e.g. subtotals and totals were consistent by both line item and funding source) were used.

#### *GFATM contribution to TB control*

We assessed GFATM funding for both HBCs and other countries, as announced after the first four rounds of funding. We assessed total approved funding at the end of 2004, how the amounts in signed grant agreements compared with those in the original proposals, disbursements to the end of 2004, the time taken between approval of a proposal and the signature of grant agreements, and the time taken between the signing of the grant agreement and the first disbursement of funds.