Key findings of this report

- Data from 189 countries show that progress in global tuberculosis control accelerated somewhat between 1997 and 1998: DOTS programmes reported the biggest annual increment in case finding so far, whilst maintaining high average treatment success rates.
- Forty-five percent of all estimated tuberculosis cases (3.62m/8.08m), and 40% of all smear-positive cases (1.43m/3.57m), were notified to WHO for 1998.
- By the end of 1998, 119 countries had adopted, and reported on, the WHO DOTS strategy for TB control; they include all 22 high-burden countries (which bear 80% of estimated incident cases).
- Forty-three percent of the global population had access to DOTS, double the fraction reported in 1995.
- Twenty-one percent of estimated smear-positive cases were reported under DOTS in 1998, also double the fraction reported in 1995.
- Compared with 1997, an extra 220 000 smear-positive cases were reported by DOTS programmes in 1998, which is faster than the average annual increase since 1994; if programmes could add 250 000 new cases each year, 70% of all (estimated) smear-positive cases would be treated under DOTS by 2005.
- The average treatment success rate was 78% in all DOTS programmes in 1997 (but only 62% in the African Region); it was 82% in the 22 high-burden countries which, collectively, are close to meeting the WHO target of 85%.
- The countries which achieved the biggest improvements in case detection under DOTS whilst maintaining high cure rates were China (83 000 additional smear-positives), South Africa (16 000), India (12 000), Bangladesh (12 000) and the Philippines (11 000).
- Although these five high-burden countries made significant progress in 1997/8, others failed to do so: Indonesia, Pakistan, the Russian Federation and Uganda (among others) all reported low treatment success and/or case detection rates.
- Peru and Viet Nam are still the only two high-burden countries to have met the WHO targets for case detection and treatment success; they can now diversify their TB control programmes by adopting a wider range of impact indicators to quantify, e.g. the decline in incidence, and by addressing special problems in TB control, such as the treatment of multi-drug resistant disease.

Technical Summary

Background and aims

This is the fourth global report on TB control, based on case notifications and treatment outcome data supplied by national control programmes to WHO. It makes use of five consecutive years of data to assess worldwide progress in TB control, focusing on 22 countries that account for 80% of all new cases. The main aim is to assess progress towards meeting WHO targets for case detection (70%) and treatment success (85%).

Methods

A standard data collection form was sent to 211 countries via WHO Regional Offices. Part A of the form requested, from DOTS areas, the number and types of TB cases notified in 1998, plus treatment and retreatment results for smear-positive or culture-positive (mainly Europe) cases registered in 1997. Part B is for areas that have not implemented DOTS; it asks for the same information about notifications and treatment outcomes, but is less demanding of data (e.g. excluding information about cases undergoing retreatment).

Results

189 countries reported to WHO; 119 of these satisfied the technical criteria for DOTS implementation at the end of 1998, including all 22 of the highest-burden countries. 43% of the global population had access to DOTS, double the rate in 1995. The total number of cases notified to WHO for 1998 was 3 617 045, 45% of the estimated global total. The total number of smear-positive (infectious) cases notified was 1 431 413, or 40% of the estimated global total.

The number of new smear-positive TB cases notified (detected) by DOTS programmes was 767 235 in 1998, 21% of estimated global incidence. This detection rate has doubled since 1995. The number of cases reported under DOTS has increased by about 120 000/year on average since 1994, although recruitment accelerated somewhat between 1997 and 1998 (an extra 219 803 cases reported). At the slower average rate of increase in case finding—which is slightly faster than measured last year—70% of cases would be treated in DOTS programmes by 2012. If 250 000 extra cases were recruited each year, DOTS would be available to 70% of cases by 2005. Whilst the smear-positive case detection rate under DOTS has been growing at 3.5%/year since 1994, the overall smear-positive case detection rate has grown at only 1.7%/year. Therefore DOTS programmes are recruiting cases that would have been notified under non-DOTS programmes.

Most DOTS programmes have demonstrated again that they can achieve high treatment success rates. The average for the 1997 cohort was 82% in the 22 high-burden countries (3% less than the target) and 78% globally.

Five high-burden countries significantly expanded case detection, whilst maintaining high treatment success rates. They are China (83 000 additional smear-positives), South Africa (16 000), India (12 000), Bangladesh (12 000) and the Philippines (11 000); the case detection rate accelerated in all except Bangladesh. Indonesia and Thailand improved case detection, but at the expense of lower treatment success. Afghanistan, Pakistan, the Russian Federation and Uganda all reported low treatment success and/or low case detection rates for 1997/8. Peru and Viet Nam are the only two high-burden countries to have met the WHO targets for case detection and treatment success. Four smaller countries have also met the targets: Cuba, Maldives, Oman and the Solomon Islands. A total of 30 reporting

DOTS countries had case detection rates greater than 50% and treatment success rates over 70%.

This report updates information on temporal trends in notifications, but also highlights, for the first time, regional variation in the age and sex distributions of notified cases. The analysis is intended to raise questions (rather than give answers) about how the age and sex of TB cases is influenced by reporting biases, by transmission rate, by TB/HIV co-infection in Africa, by the resurgence of TB in Eastern Europe, and by the decline of TB in industrialized countries.

Conclusion

Progress in global TB control accelerated between 1997 and 1998. DOTS programmes reported the biggest annual increase in case detection so far, whilst maintaining high rates of treatment success. But there are two important caveats. First, whilst the rate of case finding under DOTS appears to have increased, the increase is small. Second, the gains of 1997/8 were made partly by transferring to DOTS programmes cases that would have been notified anyway. Thus, to reach global targets, most countries will have to introduce innovative methods to find and treat cases that are not yet notified. In sum, we can make no firm predictions about whether global targets will be reached by 2005, 2012, earlier, or later.

By the end of 1998, there were still only two high-burden countries that had reached WHO targets for case detection and treatment success, Peru and Viet Nam. With solid national TB control programmes, these two countries now have the potential to diversify by adopting a wider range of impact indicators to quantify, e.g. the decline in incidence, and by addressing special problems in TB control, such as the treatment of multi-drug resistant disease.

Introduction

Following a 1991 World Health Assembly[1] resolution, WHO has urged each National Tuberculosis Control Programme (NTP) to work towards two objectives (the "WHO targets") by the year 2000: (1) to treat successfully 85% of detected smear-positive cases, and (2) to detect 70% of all such cases, by the introduction of an effective approach to TB control.[2]

To assess the magnitude of the global tuberculosis problem, and to measure the achievements of TB control, WHO established a worldwide surveillance and monitoring project in 1995. The global status of TB control and progress towards achieving the WHO targets were reviewed in 1997,[3,4] 1998[5,6] and 1999.[7] The main findings of the last report were:

- By the end of 1997, 85% of all TB cases were living in 102 countries which had adopted the WHO DOTS strategy for control.
- The key to meeting WHO targets lies in expanding case detection in high-burden DOTS countries: in 1997, 83% (2.5 million) of all unnotified TB cases were living in countries which have already shown that they can achieve high treatment success rates by using DOTS.
- The greatest number of cases without access to good treatment was in Asia, especially Bangladesh, India, Indonesia, Pakistan and Philippines.
- The number of new smear-positive TB cases notified by DOTS programmes has increased by an average of 100 000/year since 1994, reaching 16% of all estimated cases in 1997. By adding 250 000 extra cases each year (10% of the unnotified cases living in DOTS countries), the global target of 70% case detection could be reached by 2005.
- DOTS can succeed in a variety of settings: among major endemic countries showing high treatment success (≥70%) and case detection rates (≥50%) were representatives from Africa (Tanzania), Asia (Cambodia, Viet Nam) and Latin America (Peru).
- Marked upward trends in case notification rates from 1980 to 1997 variously reflect failing TB control (Eastern Europe), the impact of HIV (sub-Saharan Africa), and better case finding (China); marked downward trends (Western Europe) represent the direct (chemotherapy against TB) and indirect (general improvements in health) impact of TB control.
- Standardized short-course chemotherapy, promptly delivered, can have a major impact on tuberculosis morbidity and mortality, but this impact has not yet been adequately quantified.

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[1] Forty-Fourth World Health Assembly, Geneva, 6–16 May 1991. Resolutions and decisions. Geneva, Switzerland: World Health Organization 1991. WHA44/1991/REC/1.

[2] World Health Organization. WHO Tuberculosis Programme: *Framework for effective tuberculosis control*. Geneva, Switzerland: World Health Organization 1994. WHO/TB/94.179.

[3] Raviglione MC, Dye C, Schmidt S, Kochi A. Assessment of worldwide tuberculosis control. *Lancet* 1997; 350: 624–29.

[4] World Health Organization. Global Tuberculosis Programme. *Global Tuberculosis Control. WHO Report 1997*. WHO/TB/97.225.

[5] World Health Organization. Global Tuberculosis Programme. *Global Tuberculosis Control. WHO Report 1998*. WHO/TB/98.237.

[6] Netto E, Dye C, Raviglione MR. Progress in global tuberculosis control 1995-6, with emphasis on 22 high-burden countries. *Int J Tuberc Lung Dis* 1999; 3: 310-320.

[7] World Health Organization. *Global Tuberculosis Control. WHO Report 1999*. WHO/CDS/CPC/TB/99.259.

This report is the fourth in the series. It presents data available at 24 January 2000 on case notifications for 1998, treatment results for patients registered in 1997, and the status of DOTS implementation by the end of 1998. This information is supplemented, where possible, with the latest data on progress made by countries during 1999. We compare the new information with those in previous reports (data from 1994 onwards), paying special attention to progress in the 22 highest-burden countries, which account for 80% of all new TB cases. As in past years, the primary aim is to assess progress towards meeting WHO targets for case detection and cure.

Methods

Methods were similar to those described previously[5,6,7] but are nevertheless repeated here in full. An important advance in tuberculosis monitoring and surveillance is the Computerized Information System for Infectious Diseases (CISID), developed during 1999 at WHO's European Regional Office (EURO).

Data collection

In July and August 1999, TB data collection forms (Annex 1) were sent out to 211 countries and territories via the WHO Regional Offices.[8] These forms follow WHO/IUATLD guidelines on recording and reporting, and are accompanied by detailed instructions and definitions. We asked for information on TB control policy as of 31 December 1998, cases reported for 1998, and treatment outcomes among patients registered during 1997. The information about treatment outcome always lags notifications by one year because treatment success is evaluated after a patient has completed treatment, which usually lasts 6–9 months.

The form is divided into two parts (Annex 1). Part A is designed for those countries or areas within countries that have adopted the WHO TB control strategy (DOTS). It asks for, among other things:

- the number and types of TB cases notified: pulmonary (sputum smear-positive—new cases and relapses, sputum smear-negative) and extrapulmonary; new, relapse and retreatment
- age and gender of new smear-positive cases
- treatment results of sputum smear-positive cases (new and retreatment).

During 1999, part A was extended to allow countries (mainly European) the option of defining cases and treatment outcomes on the basis of bacteriological culture, in addition to sputum smears (Annex 1).

Part B is for countries and areas within countries where DOTS has not been implemented, and is less demanding of data. Countries are not asked to provide data on retreatment cases, or to record smear conversions at 2 months.

With these data we can analyse the performance of the NTP according to the type of control strategy used. In particular, data from countries that have adopted DOTS—and have therefore used standard definitions and a standard recording and reporting system—can be assessed separately.

Late reports (received after 24 January 2000) will be used to update the database (Annex 7 contains the updated global profile for 1996/7). Case notifications for all European countries will be supplied later during 2000 by EuroTB (CESES). These may include some adjustments to the numbers of cases; EuroTB data are considered to be definitive and final.

Computer software for TB surveillance

Reports (completed WHO data collection forms) are sent to WHO regional offices, electronically for the most part (email, fax), and entered manually, with two important exceptions: (1) in Europe, for the first time this year, countries could report via the CISID website

[8] Four territories (Guadeloupe, French Guyana, Martinique and La Reunion) which have been listed separately in previous years, are now included with France as overseas departments of that country. The Liechtenstein report, which was listed separately last year, is now included with Switzerland.

of the WHO regoinal office (http://cisid.who.dk/tb), receiving immediate feedback on the regional situation, and (2) in any region, countries may report using WHO software which creates a report to be stored as a data file. In terms of software, an EpiInfo application (TBDATA) has been available for several years as an electronic version of the data collection form in which data are saved as a data file. A second EpiInfo application (EPICENTRE) is designed as a database for national programmes to manage their data from quarterly district reports and to carry out recommended analyses. Among its automated outputs is a report to WHO, saved as a data file. EPICENTRE has been used successfully in Nepal and India, and is being adopted by several other countries in the South-East Asia Region. Each of these tools—the European WHO website (CISID), the electronic version of the data collection form (TBDATA), and the database for TB programmes (EPICENTRE)—improve data transfer efficiency and help to ensure data quality.

Data verification

Each data form submitted by a country was first reviewed in the relevant WHO country and regional office, and then by the Communicable Diseases programme in Geneva. Inconsistencies in the data were followed up with NTP managers, or with other responsible persons in countries.

Data management

Data were stored and managed with Microsoft Access 97. A customised computer program provides:

- *Regional Profiles*, which list data on case notifications and treatment results for each country, and according to the control strategy used (Annex 3)
- *Global Profile*, which lists the same information by region (Annex 2)

A Microsoft Excel 97 program also tabulates the total number of cases notified since 1980. Since 1995, notifications have been stratified by age, gender and type of TB (as for part A of the form, above).

Data analysis

Categorization of countries

A qualitative (or semi-quantitative) categorization of progress in TB control is shown in Figure 1, with definitions in Table 1. A country was considered as implementing the DOTS strategy if, by 31 December 1998, it:

- Had a national TB control policy based on WHO recommendations. This requires (1) a national TB manual, or a document issued by the government or an authorised scientific body, including policy recommendations endorsed by WHO, and (2) that a "WHO standard" training

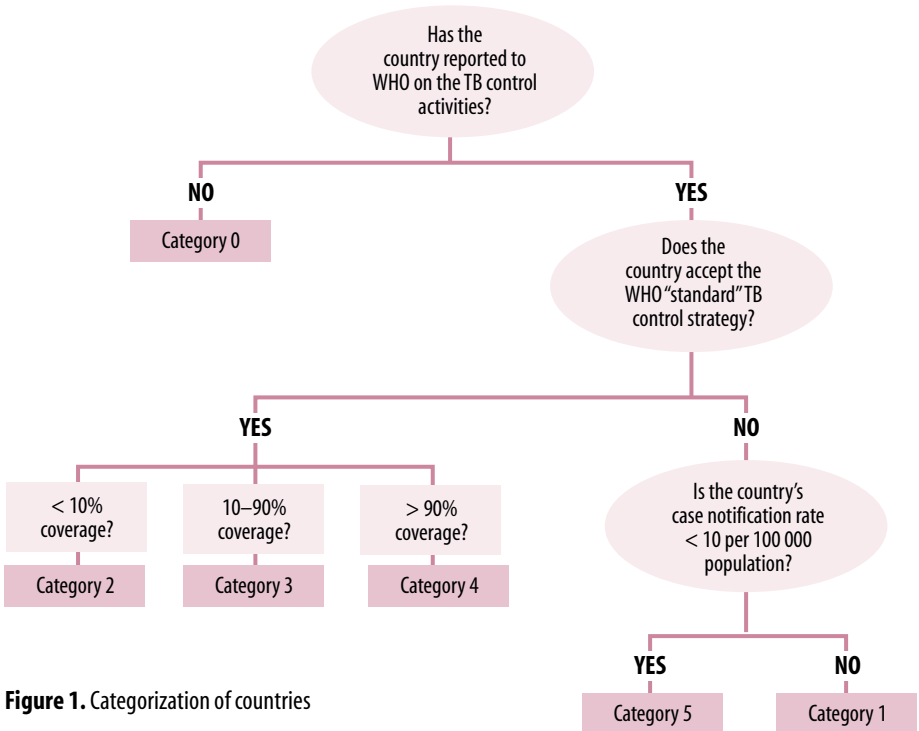


Figure 1. Categorization of countries

Table 1. Categorization of countries

Category	Definition
0	Countries not reporting to WHO.
1	Countries **not** implementing the DOTS strategy and having a case notification rate of **over** 10 cases per 100 000 population.
2	Countries implementing the DOTS strategy in less than 10% of the total population (**pilot phase**).
3	Countries implementing the DOTS strategy in 10 to 90% of the total population (**expansion phase**).
4	Countries implementing the DOTS strategy in over 90% of the total population (**routine implementation**).
5	Countries **not** implementing the DOTS strategy but having a case notification rate of **less** than 10 cases per 100 000 population (low incidence).

Table 2. Technical elements of the WHO TB control strategy (DOTS)

Microscopy	Case detection among symptomatic patients self-reporting to health services, utilising sputum smear microscopy;
SCC/DOT	Administration of standardised short-course chemotherapy (SCC) to at least all confirmed sputum smear-positive cases under proper case management conditions (Directly Observed Therapy—DOT—during at least the intensive phase of treatment);
Drug Supply	Establishment of a system of regular drug supply of all essential anti-tuberculosis drugs to ensure no interruption in their availability;
Recording and Reporting	Establishment and maintenance of a standardised recording and reporting system, allowing assessment of treatment results (see Table 5).

* In countries which can afford sputum culture, culture can be used for diagnosis, but direct sputum smear microscopy should still be performed for all suspected cases.[9]

** In industrialized countries achieving high treatment success rates, Directly Observed Therapy 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.

course on management of tuberculosis control programmes has been carried out within the past two years. Alternatively, there should be available training materials endorsed by WHO or IUATLD, and which contain the essential elements of DOTS.

➤ Complied with all of the DOTS strategy's technical elements (Table 2), and reported to WHO on notifications and treatment outcomes from DOTS areas.

If DOTS was implemented only in some districts (or equivalent administrative units) on the initiative of local authorities, but the policy was endorsed by national authorities, the country was classified as a DOTS country. If a country reported that DOTS was newly implemented during 1998, and that the results of cohort analysis were therefore not yet available, it was classified as a DOTS country, provided 1998 case notifications from DOTS areas were available.

This system of categorization provides a first impression of each country's progress in TB control. However, WHO targets are expressed more stringently in terms of treatment success and the case detection rate. TB control should ensure high treatment success before expanding case finding. 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 country-wide coverage. Case detection and treatment success rates are defined and measured as described in the following section.

Table 3. Definitions of TB cases

New smear-positive pulmonary	TB in a patient with at least two initial sputum smear examinations (direct smear microscopy) positive for acid fast bacilli (AFB+); or TB in a patient with one sputum examination AFB+ and radiographic abnormalities consistent with active pulmonary TB as determined by the treating medical officer; or TB in a patient with one sputum specimen AFB+ and culture positive for AFB.
New smear-negative pulmonary	TB in a patient with symptoms suggestive of TB and at least three sputum smear examinations negative for AFB, and with radiographic abnormalities consistent with active pulmonary TB determined by a medical officer followed by a decision to treat the patient with a full course of anti-tuberculosis therapy; or diagnosis based on positive culture but negative AFB sputum examinations.
Extrapulmonary	Patient with tuberculosis of organs other than the lungs
Retreatment	Failures, treatment interrupted (defaulters), and relapses (see box 'Definitions of treatment outcomes').
Relapse	Patient previously declared cured and diagnosed with sputum smear-positive tuberculosis

[9] Rieder HL, Watson JL, Raviglione MC et al. Surveillance of tuberculosis in Europe. *Eur Respir J* 1996; 9: 1097–1104.

Case detection

Based on the data provided on parts A and B of the form, we made separate assessments of TB programmes in DOTS and non-DOTS areas. 1998 case notifications distinguished between all types of TB and sputum smear-positive cases (or culture-positive cases, in some countries). Table 3 contains the standard case definitions. As an indicator of each NTP's ability to detect and identify smear-positive cases we calculated the proportion of new sputum smear-positive cases out of all new pulmonary cases (expected value 55–70%).

Case notifications represent only a fraction of the true number of cases arising in a country because of incomplete coverage by health services, inaccurate diagnosis, or deficient recording and reporting. The estimated case detection rate is defined as:

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

though we also make reference to the detection rate of all forms of TB. A stricter measure of case finding is the fraction of all incident smear-positive cases which are detected (and potentially treated) by DOTS programmes:

$$\text{DOTS detection rate (\%)} = \frac{\text{annual new smear positive notifications (under DOTS)}}{\text{estimated annual new smear positive incidence (country)}}$$

"Case detection rate" (CDR) and "DOTS detection rate" (DDR) are identical when a country has 100% DOTS coverage. The denominators for 1998 case detection rates are 1997 estimates of the smear-positive incidence rate,[10] re-scaled with 1998 population sizes[11] (Map 1, Annex 4). The denominators for 1995–97 were back-calculated from 1997 estimates, allowing for changes in total population size, but not for any changes in the incidence rate. Many of these incidence estimates were obtained by making an independent assessment of the case detection rate. In such instances, the above formulae do not provide new estimates of the case detection rate; they merely return us, by circular reasoning, to our original assumption. Some caution is therefore needed when assessing changes in the case detection rate, especially for countries in which HIV has been responsible for a rise in case notifications (Map 2, Annex 4). It is equally important to remember that the incidence estimates for each country are subject to error: for high-burden countries, the difference between lower and upper estimates of incidence is typically twofold.[10] Estimated incidence rates for the 22 highest-burden countries in 1998 are in Table 4. Incidence estimates are available for all countries, including those not reporting to WHO.

Treatment success and cure rate

To assess the quality of treatment programmes for new infectious cases, we first determined what fraction of registered cases was evaluated for outcome. All registered cases should be evaluated. Second, we compiled the six standard, mutually exclusive outcomes of treatment in Table 5. "Treatment success" (TS) is defined as the proportion of patients who were cured plus the proportion who completed treatment. These figures are reported, where possible, as percentages of all registered cases, so that the six possible outcomes plus the fraction of cases not evaluated sum to 100%. In some instances, countries state the number of patients registered for treatment, but give no outcomes. When this happens, we report no result, rather than zero treatment success (see Table 13). In other instances, the number of registered cases is less than the number evaluated; then we use the number

[10] Dye C, Scheele S, Dolin P, Pathania V, Raviglione MC. Global burden of tuberculosis: estimated incidence, prevalence and mortality by country. *JAMA* 1999; 282, 677-686.

[11] Population data used in this report come from UN Population Division, *World Population Prospects*, 1998 revision.

Table 4. Estimated incidence of TB: 22 high-burden countries, 1998

		Number estimated				
		All cases		Smear-positive cases		
Country (ranked by burden)	Population x 1000	Thousands	rate/100 000	Thousands	rate/100 000	Cumulative incidence (%)
1 India	982 223	1 828	186.1	818	83.3	23
2 China	1 255 698	1 414	112.6	636	50.7	40
3 Indonesia	206 338	591	286.6	266	128.7	47
4 Bangladesh	124 774	305	244.7	137	110.1	51
5 Pakistan	148 166	268	181	120	81.3	55
6 Nigeria	106 409	259	243.4	113	106.1	58
7 Philippines (the)	72 944	224	306.7	101	137.9	61
8 South Africa	39 357	172	437.9	70	177.3	63
9 Ethiopia	59 649	160	268.6	67	112.8	65
10 Viet Nam	77 562	147	189.3	66	85.2	66
11 Russian Federation (the)	147 434	156	105.7	70	47.5	68
12 Democratic Republic of the Congo (the)	49 139	130	263.7	55	112.1	70
13 Brazil	165 851	124	74.7	55	33.3	71
14 United Republic of Tanzania (the)	32 102	99	308.6	41	127.5	73
15 Kenya	29 008	86	296.8	35	121.7	74
16 Thailand	60 300	85	140.9	37	62	75
17 Myanmar	44 497	81	181.9	36	81.9	76
18 Afghanistan	21 354	75	353.1	34	158.9	77
19 Uganda	20 554	68	332.3	27	132.9	78
20 Peru	24 797	66	265	29	118.7	78
21 Zimbabwe	11 377	64	560.1	25	215.6	79
22 Cambodia	10 716	58	540.5	26	241.6	80
total, 22 high-burden countries	3 690 248	6 461	175.1	2 866	77.7	80
Global total	**5 898 152**	**8 083**	**137**	**3 574**	**60.6**	**100**

Table 5. Definitions of treatment outcomes

Cured	Initially smear-positive patient who had a negative sputum smear or after treatment completion, and on at least one previous occasion*.
Completed treatment	Sputum smear-positive patient who had negative sputum smear results at the end of the initial phase of treatment, with no or only one negative sputum smear result in the continuation phase and none at the end of treatment.
Died	Patient who died during treatment, irrespective of cause.
Failure	Smear-positive patient who remained or became smear-positive again at least 5 months after the start of treatment.
Interrupted treatment (defaulted)	Patient who did not collect drugs for 2 months or more at any time after registration.
Transferred out	Patient who was transferred to another reporting unit and his/her treatment results are not known.
Treatment success	The sum of the percentage of cases cured and that of cases who completed treatment.

* Some European countries define cure in terms of culture conversion, rather than sputum smear conversion[12]

evaluated as the denominator for treatment success. Although these treatment outcomes are expressed as percentages, they are usually referred to as 'rates'. Data describing the outcome of retreatment were collected only from DOTS areas because the definitions of 'failure' and 'relapse' require data on smear conversion (Tables 3 and 5).

To assess the capacity of each NTP to retain patients and to maintain consistent records between years, we also compared the number of cases registered for treatment in 1997 (reported in 1998) with the number of cases notified as smear-positive in 1997 (reported in 1997). These numbers should be the same.

[12] Veen J, Raviglione MC, Rieder HL et al. Standardized tuberculosis treatment outcome monitoring in Europe. *Eur Respir J* 1998; 12: 505–510.

Results

Global and regional progress in TB control

Countries reporting to WHO

By 24 January 2000, 189 (90%) of 211 countries reported case notifications for 1998 and/or treatment outcomes for patients registered in 1997, seven more than last year. Ninety-eight percent of the global population lives in these countries (Annexes 2 and 3). All countries with population sizes of more than 50 million reported to WHO. We received reports from all 22 high-burden countries, and from all countries in the Eastern Mediterranean and South-

Table 6a. List of countries adopting and implementing DOTS, 1998

Category 2 (13 countries)	**Category 3** (40 countries)	**Category 4** (66 countries)	
Brazil	Afghanistan	Andorra	Mongolia
Burundi	Angola	Benin	Morocco
Dominica	Argentina	Bhutan	Mozambique
Haiti	Armenia	Botswana	Namibia
Honduras	**Australia**	Burkina Faso	Netherlands (the)
India	Azerbaijan	Cambodia	Nicaragua
Kazakhstan	Bangladesh	Chile	Norway
Pakistan	*Bolivia*	China, Macao SAR	Oman
Panama	**Bosnia and Herzegovina**	**Colombia**	Peru
Papua New Guinea	Cameroon	Congo (the)	Portugal
Poland	China	Côte d'Ivoire	Puerto Rico
Russian Federation (the)	*Cook Islands*	Cuba	Qatar
Uzbekistan	Democratic Republic of the Congo (the)	**Cyprus**	Republic of Korea (the)
	Ecuador	Czech Republic (the)	**Romania**
	Egypt	Djibouti	Rwanda
	El Salvador	Equatorial Guinea	**Saint Kitts and Nevis**
	Eritrea	Fiji	**Saint Vincent and the Grenadines**
	Ethiopia	French Polynesia	Senegal
	Ghana	Georgia	Seychelles
	Indonesia	Guatemala	Sierra Leone
	Iran (Islamic Republic of)	Guinea	Slovakia
	Iraq	Israel	Slovenia
	Italy	Jamaica	Solomon Islands
	Lao People's Democratic Republic (the)	Jordan	Sri Lanka
	Liberia	Kenya	Togo
	Mali	Kiribati	Tonga
	Marshall Islands (the)	Kyrgyzstan	Uganda
	Mexico	Latvia	United Republic of Tanzania (the)
	Myanmar	Madagascar	United States of America (the)
	Nepal	Malawi	Uruguay
	Niger (the)	Maldives	Venezuela
	Nigeria	Malta	Viet Nam
	Philippines (the)	Mauritius	**Zimbabwe**
	Saint Lucia		
	Somalia		
	South Africa		
	Sudan (the)		
	Syrian Arab Republic (the)		
	Thailand		
	Yemen		

Bold: countries which implemented DOTS in 1998

Italics: countries which moved one or more categories down since 1997 due to re-evaluation of coverage

Underline: countries which moved one or more categories up since 1997

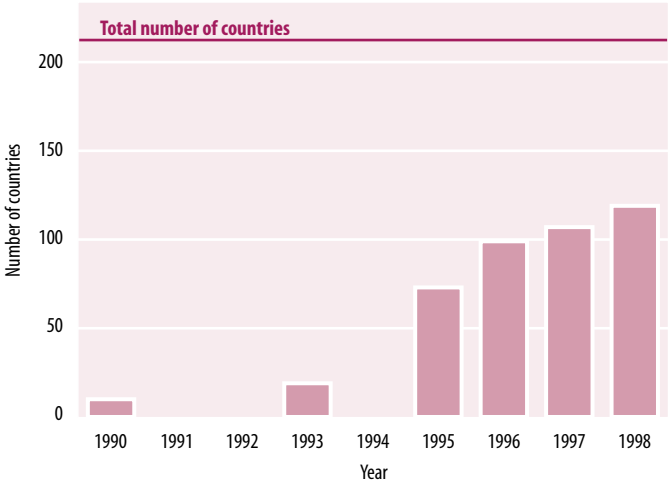
Table 6b. List of countries not implementing DOTS or not reporting to WHO, 1998

Category 0 (22 countries)	**Category 1** (55 countries)		**Category 5** (15 countries)
American Samoa	Albania	Kuwait	British Virgin Islands
Anguilla	Algeria	Lebanon	Cayman Islands
Antigua and Barbuda	Austria	Libyan Arab Jamahiriya (the)	Grenada
Bermuda	Bahamas (the)	Lithuania	Iceland
Brunei Darussalam	Bahrain	Luxembourg	Monaco
Canada	Barbados	Malaysia	Montserrat
Comoros (the)	Belarus	Micronesia (Federated States of)	Netherlands Antilles
France	Belgium	Paraguay	New Zealand
Gambia (the)	Belize	Republic of Moldova (the)	Niue
Guam	Bulgaria	Samoa	Northern Mariana Islands
Guinea-Bissau	Cape Verde	Saudi Arabia	San Marino
Lesotho	Central African Republic (the)	Singapore	Sweden
Mauritania	Chad	Spain	Turks and Caicos Islands
Nauru	China, Hong Kong SAR	Suriname	Tuvalu
New Caledonia	Costa Rica	Switzerland	United States Virgin Islands
Palau	Croatia	Tajikistan	
Sao Tome and Principe	Democratic People's Republic of Korea (the)	The former Yugoslav Republic of Macedonia	
St. Helena	Denmark	Trinidad and Tobago	
Swaziland	Dominican Republic (the)	Tunisia	
Tokelau	Estonia	Turkey	
Wallis and Futuna Islands	Finland	Turkmenistan	
Zambia	Gabon	Ukraine	
	Germany	United Arab Emirates (the)	**Bold:** countries which reported in 1997 but not in 1998 (4 countries which submitted DOTS reports in 1997, 5 countries which submitted non-DOTS reports in 1997)
	Greece	United Kingdom (the)	
	Guyana	Vanuatu	
	Hungary	West Bank and Gaza	
	Ireland	Yugoslavia	
	Japan		

East Asia Regions (Tables 6a and 6b). Twenty-two countries did not report, 21 of which were in Africa, the Americas and the Western Pacific Region. In terms of TB burden, the most important omission was Zambia. All industrialized countries reported, except France (the only missing European country) and Canada.

Six countries (India, Malawi, Nepal, Seychelles, Uganda and Venezuela) submitted reports using TBDATA or EPI-CENTRE. Eight European countries submitted data via the CISID website (Belgium, Denmark, Finland, Iceland, Latvia, Norway, The Netherlands and Slovakia). Twelve DOTS countries and 16 non-DOTS countries in Europe identified TB cases based on bacteriological culture, in addition to the results of sputum smear examinations.

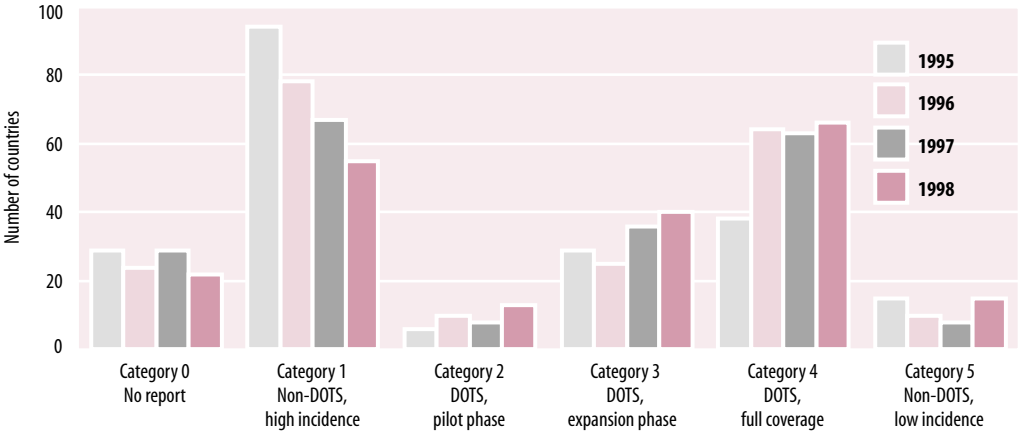
Figure 2. Number of countries which have adopted DOTS, 1990–98



Categorization of countries, 1995–98

The number of countries using DOTS has been increasing since 1990, reaching 119 (56%) in 1998 (Figure 2, Table 6a). Four countries classified as DOTS based on 1997 data did not report this year, whereas 16 countries were classified as DOTS for the first time in 1998. Of the 211 countries and territories, 66 (31%) had implemented DOTS in over 90% of the country (category 4; Figures 3 and 4, Annexes 2 and 3, Map 3 in Annex 4). Thirteen countries were in the DOTS pilot phase (category 2), and 40 were in the ex-

Figure 3. Changes in the categorization of countries, 1995–98, according to the scheme in Figure 1



pansion phase (category 3). Since 1995, countries have been moving out of category 1 and into categories 2 to 4 (DOTS).

By the end of 1998, 43% of the global population was living in countries, or parts of countries, which had adopted DOTS (categories 2–4). Reported DOTS population coverage was greatest in the Western Pacific (58%), African (61%) and American Regions (59%) in 1998, and relatively low in the other three regions (Figure 5, Table 7, Annex 2). Table 8 tabulates DOTS coverage for the 22 high-burden countries from 1995 to 1998 (see also Annex 3).

Sixteen countries implemented DOTS for the first time in 1998 (Table 6a). Five achieved low coverage (< 10%, Category 2): Brazil, Kazakhstan, Panama, Poland and Uzbekistan. Four achieved moderate coverage (10-90%, Category 3): Australia, Bosnia and Herzegovina, Iraq and the Marshall Islands. The remaining six reached high coverage (> 90%), including Colombia, Cyprus, Romania and Zimbabwe. Mexico, Sudan and Thailand moved up to category 3 in 1998. According to reports, nine countries moved up to category 4 from categories 2 or 3, including Burkina Faso, Cambodia, Mongolia, Mozambique, Sierra Leone and Togo. Four countries that had implemented DOTS by 1997 failed to provide data for 1998: American Samoa, the Gambia, Lesotho and Palau (Table 6b).

Figure 4. Proportions of countries with different levels of DOTS coverage, 1998

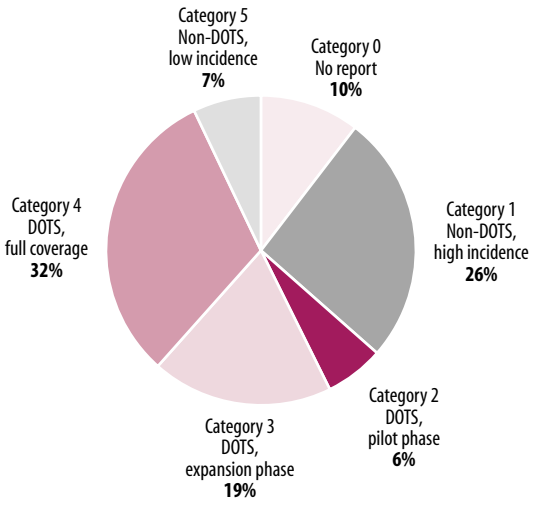


Figure 5. DOTS population coverage by WHO Region, 1998.
Each bar shows the population of the region, and the lower portion of the bar shows the population covered by DOTS. The number above each bar is the percentage of the population covered.
AFR: African Region; EMR: Eastern Mediterranean Region; EUR: European Region; SEAR: South-East Asia Region; WPR: Western Pacific Region

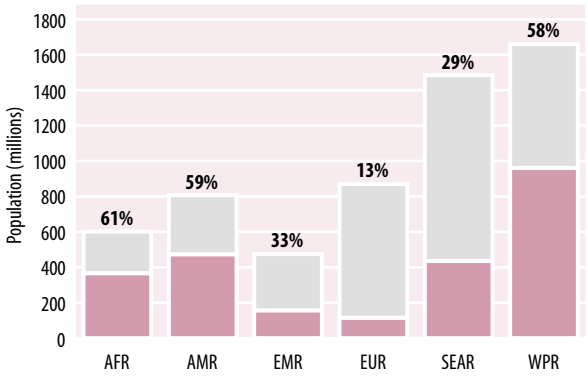


Table 7. Summary of notifications by WHO Region, 1998

		% of pop	Notifications		New ss+ notifs	ss+ % of all pulmonary
			Number	%		
AFR	DOTS	61.0	495 736	76.6	249 692	63.4
	non-DOTS	36.1	151 106	23.4	86 181	71.9
	no report	2.9				
	Total		**646 842**		**335 873**	
AMR	DOTS	58.7	116 816	49.2	71 044	74.8
	non-DOTS	37.5	120 630	50.8	58 950	60.5
	no report	3.8				
	Total		**237 446**		**129 994**	
EMR	DOTS	33.1	79 133	33.7	41 298	76.4
	non-DOTS	66.9	155 909	66.3	33 584	25.5
	no report					
	Total		**235 042**		**74 882**	
EUR	DOTS	13.3	53 662	15.3	18 957	48.0
	non-DOTS	80.0	297 859	84.7	92 414	36.2
	no report	6.7				
	Total		**351 521**		**111 371**	
SEAR	DOTS	29.3	168 844	12.9	103 498	69.1
	non-DOTS	70.7	1 138 331	87.1	284 450	26.7
	no report					
	Total		**1 307 175**		**387 948**	
WPR	DOTS	57.9	495 903	59.1	282 746	61.8
	non-DOTS	42.0	343 116	40.9	108 599	35.9
	no report					
	Total		**839 019**		**391 345**	
Global	DOTS	42.6	1 410 094	39	767 235	64.5
	non-DOTS	55.6	2 206 951	61	664 178	33.7
	no report	1.8				
	Total		**3 617 045**		**1 431 413**	

Percent of population: the regional non-DOTS population includes the non-DOTS portion of DOTS countries and the entire population of non-DOTS reporting countries.

Table 8. Progress in DOTS implementation: 22 high-burden countries, 1995–98

		Percent of population covered by DOTS services			
		1995	1996	1997	1998
1	India	1	2	2	9
2	China	49	60	64	64
3	Indonesia	6	14	28	80
4	Bangladesh	41	65	80	90
5	Pakistan	2	8		8
6	Nigeria	47	30	40	45
7	Philippines (the)	4	2	15	17
8	South Africa			13	22
9	Ethiopia	39	39	48	64
10	Viet Nam	50	95	93	96
11	Russian Federation (the)		2	2	5
12	Democratic Republic of the Congo (the)	47	51	60	60
13	Brazil				3
14	United Republic of Tanzania (the)	98	100	100	100
15	Kenya	15	100	100	100
16	Thailand		1	4	32
17	Myanmar		59	60	60
18	Afghanistan			12	11
19	Uganda			100	100
20	Peru	100	100	100	100
21	Zimbabwe				100
22	Cambodia	60	80	88	100
	all high-burden countries	25	32	36	43
	all other countries	19	32	35	42
	Global	**22**	**32**	**35**	**43**

Case notifications, 1995–98

The 189 countries reporting to WHO notified a total of 3 617 045 cases (61 per 100 000 population), of which 1 431 413 (40%) were sputum smear-positive (Table 7). These totals compare with 3 368 879 and 1 292 884 for 1997. The total number of notified cases was 7% higher in 1998, and the number of smear-positive cases was 11% higher.

Among all cases reported for 1998, 1 410 094 (39%) originated in DOTS areas (Table 7, Annex 2), a 42% increase on 1997. Among smear-positive cases, 767 235 (54%) were reported from DOTS areas, 40% higher than in 1997. The African (18%), South-East Asia (36%) and Western Pacific Regions (23%) together accounted for 77% of all notified cases and 78% of sputum smear-positive cases (Figure 6).

In DOTS areas, 54% of all cases were smear-positive (45–60% expected), compared with 30% in other areas. Sixty-five percent of new pulmonary cases were sputum smear-positive in DOTS areas (55–70% expected), compared with 34% elsewhere (Tables 7 and 9). These figures are almost identical to those for 1997.

The annual increments in smear-positive cases detected by DOTS programmes between the five years 1994 to 1998 were: 127 850, 116 462, 54 658 and 219 803; that is, an average of 129 693 extra cases each year. The annual increments in all cases detected by DOTS programmes between 1995 and 1998 were 191 504, 104 329 and 418 034. Thus, last year's increases in smear-positive and all cases are the biggest recorded so far.

As shown in last year's report, the global notification rate has remained more or less stable since 1980, but for some deviations due mainly to re-evaluations of case numbers in India and Indonesia, and to missing data from Pakistan (Figure 7). Figure 8 updates information on regional variation in epidemic trajectories, highlighting temporal trends by expressing notification rates relative to an arbitrary standard of 100 in 1990 (thereby eliminating much of the absolute difference between countries). To recap, the standardized rate for 12 countries in Western Europe shows a steady average decline of 4%/year (Figure 8a). The rate for 11 countries in Eastern Europe also shows the same decline of 4%/year until 1990, but has been rising at 10%/year since 1992 (Figure 8b). In 14 countries of the African Region, notifications were more or less stable from 1980 to 1988, but have increased at 10%/year since then (Figure 8c), the same rate as Eastern Europe. Notifications from 11 Latin American countries have been in continuous, gentle decline of 2%/year since 1980 (Figure 8d). In a selection of Asian countries, the notification rate has increased slowly at 1–2%/year over the period 1980-98 (Figure 8e; Indonesia reported an extraordinarily large number of cases in 1991; these data were therefore excluded).

Figure 9 shows the distribution of smear-positive case notifications by age and sex, arranging groups of countries (approximately) according to the average age of cases. The peak notification rate was in age class 15–24 years in the three highest incidence countries of Latin America (Figure 9a). By contrast, the highest notification rate was in people over 65 years in the lower incidence

Figure 6. Proportions of all notified cases, and smear-positive cases, by WHO Region, 1998

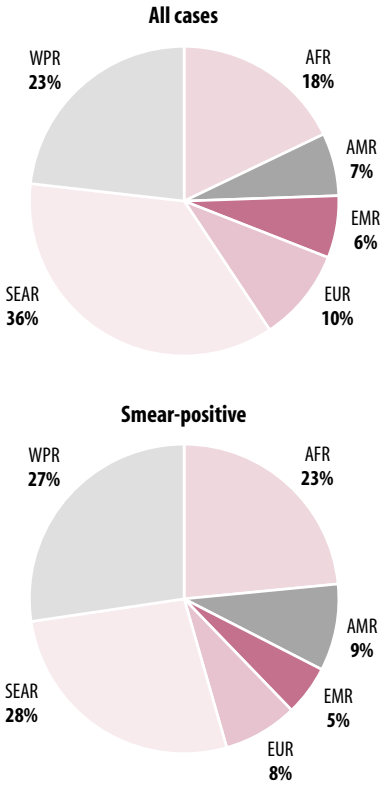


Figure 7. Global trend in case notification rate, 1980–98

countries of Latin America (Figure 9f; note change of scale on y-axis), in most countries of the Western Pacific Region (Figure 9g), and in industrialized countries (Figure 9h). Other groupings of countries lie between these extremes. For African countries with high rates of HIV infection (Figure 9b), incidence was maximum in age class 25–34 years for women and 35–44 years for men. Eastern European countries (Figure 9c) showed the greatest discrepancy between men and women. The male:female ratio for age class 45–54 years exceeded 6, the highest for these eight groups of countries. The notification rate for men was at a maximum in this age class, but the peak rate for women was at a much younger age (25–34 years). For countries in the Eastern Mediterranean (Figure 9d) and South-East Asia Regions (Figure 9e), the notification rate was highest at age 55–64 years, but the rates for ages 25–54 years were not much lower.

Figure 8. Trend in case notification rates for selected countries in different regions, 1980–98. (a) Western Europe, (b) Eastern Europe, (c) Sub-Saharan Africa, (d) Latin America, (e) South Asia. To highlight trends in notifications within regions, the rates for all countries have been expressed relative to an arbitrary standard of 100 in 1990: error bars are 95% CL on the standardized rates. Countries selected in each region are those which have provided consistent notification data 1980–98.

Figure 9. Incidence rates by age and sex for different regions, 1998. (a) High incidence countries in Latin America, (b) Sub-Saharan Africa, (c) Eastern Europe, (d) Eastern Mediterranean Region (e) South-East Asia Region, (f) Latin American (excluding high incidence countries) (g) Western Pacific Region (excluding industrialized countries), (h) Industrialized countries. Thick line–males; thin line–females; dotted line–ratio of incidence rate in males to incidence rate in females

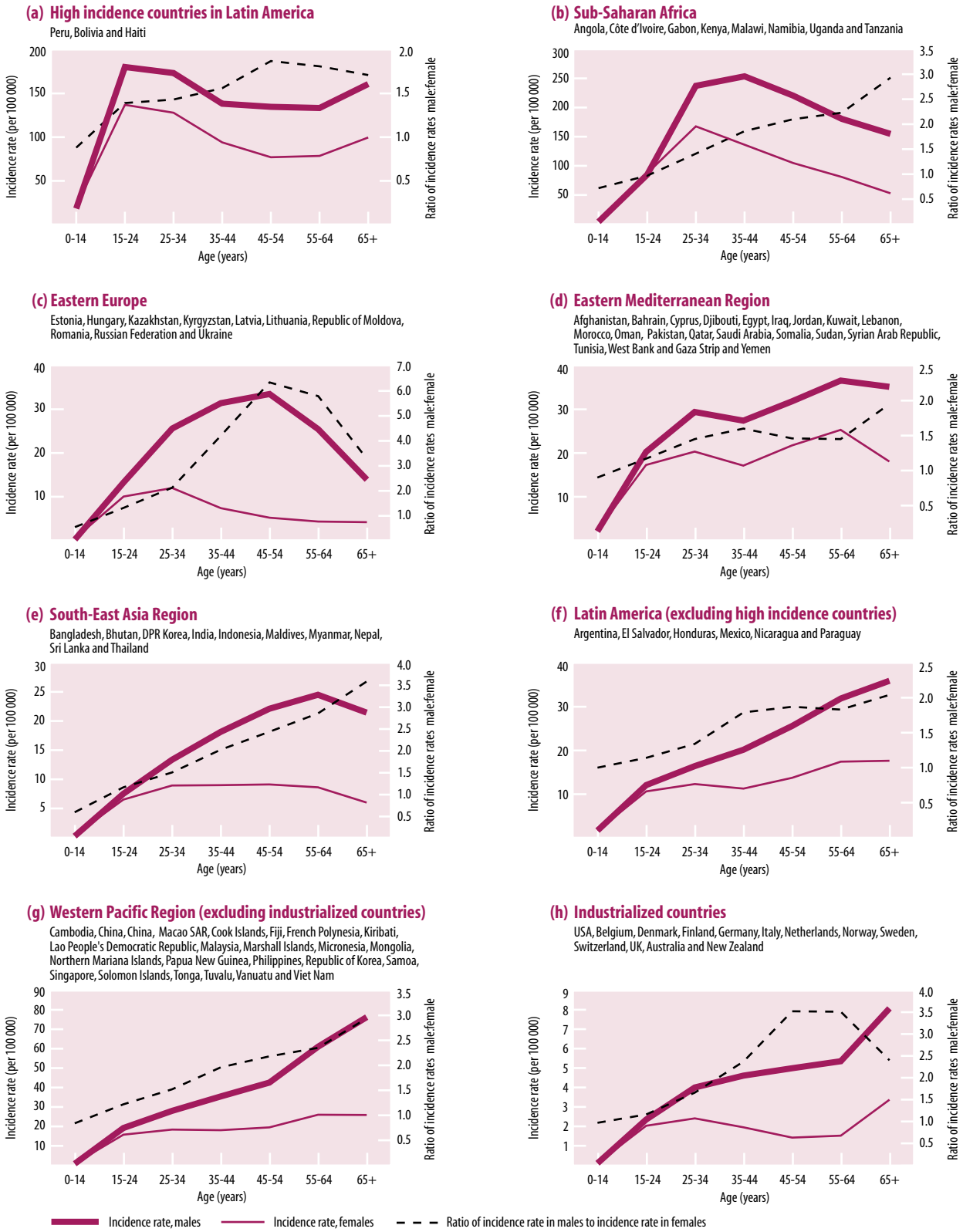


Table 9. Case notifications: 22 high-burden countries, 1998

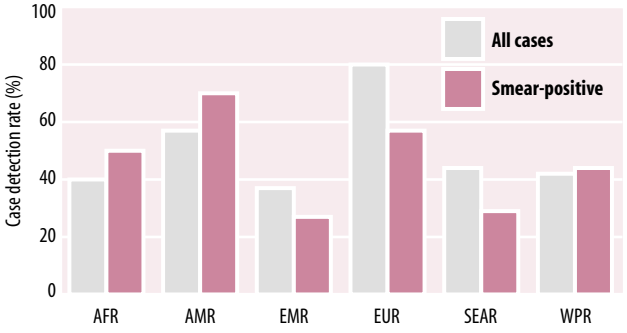
		Number notified					
		All cases		Smear-positive		New ss+ / New pulmonary cases (%)*	
	Country (ranked by burden)	non-DOTS	DOTS	non-DOTS	DOTS	non-DOTS	DOTS
1	India	1 100 364	29 674	271 645	12 421	26	52
2	China	120 814	336 535	23 172	191 290	20	60
3	Indonesia		40 497		32 280		83
4	Bangladesh	19 395	52 861	4 517	33 220	26	68
5	Pakistan	80 104	9 495	10 829	4 145	14	54
6	Nigeria		20 249		13 161		71
7	Philippines (the)	141 580	18 286	61 371	10 292	49	60
8	South Africa	106 294	22 121	66 047	16 246	75	89
9	Ethiopia		69 472		18 864		40
10	Viet Nam	2 850	84 599	1 726	53 147	74	76
11	Russian Federation (the)	119 663	1 771	41 536	683	38	48
12	Democratic Republic of the Congo (the)		58 869		33 419		78
13	Brazil	80 062	4 132	36 588	2 221	59	62
14	United Republic of Tanzania (the)		51 231		23 726		58
15	Kenya		48 936		24 029		58
16	Thailand		15 850		7 962		56
17	Myanmar		14 756		10 089		82
18	Afghanistan		3 084		1 833		79
19	Uganda		29 228		18 222		73
20	Peru		43 723		27 707		83
21	Zimbabwe		47 277		14 492		36
22	Cambodia		16 946		13 865		95
	total, 22 high-burden countries	1 771 126	1 019 592	517 431	563 314	32	64
	total, all other countries	435 825	390 502	146 747	203 921	43	67
	Global	**2 206 951**	**1 410 094**	**664 178**	**767 235**	**34**	**65**

* Expected perrcentage of new smear-positive to new pulmonary cases is 55–70%.

Case detection rate, 1995–98

The 3 617 045 cases of tuberculosis (all forms) notified in 1998 represent 45% of the 8.08 million estimated cases; the total of 1 431 413 new smear-positives is 40% of 3.57 million estimated cases (Tables 4 and 7). Seventeen percent of all estimated cases, and 21% of estimated smear-positive cases, were detected under DOTS. The detection rate of smear-positive cases within DOTS programmes has been rising faster (from 10% to 21%, 1995-98) than the overall smear-positive detection rate (34 to 40%; Table 10).

Figure 10. Detection rates of smear-positive and all TB cases by WHO Region, 1998



Case detection rates in 1998 were lowest in the Eastern Mediterranean Region and highest in Europe and the Americas (Figure 10, Annexes 2, 3, 4.3). European, South-East Asian and Eastern Mediterranean countries notified relatively few smear-positive cases compared with all forms of TB (Figure 10).

Treatment results, 1994–97 cohorts

In DOTS areas, the number of new sputum smear-positive cases notified in 1997 was 579 623. According to 1998 reports, 615 803 cases were registered for treatment in 1997, i.e. 6% more than expected (Annex 5 lists notified and registered cases for 1997 by country). This discrepancy is due mostly to inconsistencies in reports from China and the Philippines. Of the registered cases, 93% were evaluated for treatment outcome (Tables 11a and 12, Annex 2). Seventy-two percent of the registered cases were cured and a further 6% completed treatment (without demonstrating cure), a treatment success rate of 78%. Eighty-four percent of evaluated cases were treated successfully under DOTS.

Table 10. Detection of new smear-positive cases: 22 high-burden countries, by control strategy, 1995–98

		Percent of the country's estimated new smear-positive cases detected by							
		DOTS programmes				Whole country			
	Country (ranked by burden)	1995	1996	1997	1998	1995	1996	1997	1998
1	India	0.3	0.8	1	1.5	34	36.8	34	34.7
2	China	14.6	22	23.5	30.1	21.8	27	29.9	33.7
3	Indonesia	1.4	4.6	7.4	12.2	12.6	*	*	*
4	Bangladesh	7	14.8	19.2	24.2	15.7	22.3	24.5	27.5
5	Pakistan	1	1.6	—	3.4	2.3	*	—	12.4
6	Nigeria	9.1	14.7	10.2	11.7	*	*	*	*
7	Philippines (the)	0.4	0.5	3.2	10.2	100.3	89.8	84.6	71.2
8	South Africa	—	—	6	23.3	2.1	55.3	80	117.9
9	Ethiopia	14.7	20.7	24.3	28	*	24.7	*	*
10	Viet Nam	29.9	59	76.9	80.4	59.9	76.5	82.5	83.1
11	Russian Federation (the)	—	0.4	0.9	1	53.2	60.5	60	60.3
12	Democratic Republic of the Congo (the)	37.4	46	46.8	60.7	39.5	*	*	*
13	Brazil	—	—	—	4	84.8	82.8	79.9	70.4
14	United Republic of Tanzania (the)	52.3	54.9	55	58	*	*	*	*
15	Kenya	42.1	50.1	55	68.1	*	*	*	*
16	Thailand	—	0.3	5.1	21.3	55.6	46.3	35.7	*
17	Myanmar	—	24.9	25.1	27.7	25	27.5	27	*
18	Afghanistan	—	—	1.9	5.4	—	—	*	*
19	Uganda	—	—	65	66.7	54.3	58.6	*	*
20	Peru	114.9	94.3	95	94.1	*	*	*	*
21	Zimbabwe	—	—	—	59.1	38.7	50.5	60	*
22	Cambodia	46	39	50.1	53.6	*	48.8	*	*
	all high-burden countries	8.8	12.7	14.9	19.7	30.7	34.2	34.8	37.7
	Global	**10.6**	**14.4**	**16.5**	**21.5**	**34.4**	**37.6**	**37.8**	**40**

— not available; * no additional data beyond DOTS report.

The discrepancy between cases notified in 1997 (748 068), and reported in 1998 as having been registered for treatment (533 267), was bigger in non-DOTS areas. Many fewer cases were registered than notified in China, the Philippines and Thailand. Outside DOTS areas a smaller proportion of registered cases (47%) was evaluated for treatment outcome. Twenty-two percent of registered cases were cured and 16% completed treatment, using either short-course chemotherapy or another regimen, a treatment success rate of 38% of registered cases (Tables 11b and 12, Annex 2). Seventy-nine percent of evaluated cases were reported to be successfully treated outside DOTS programmes.

Among the WHO regions, the documented treatment success rates under DOTS

Figure 11. Treatment success by WHO Region, 1997

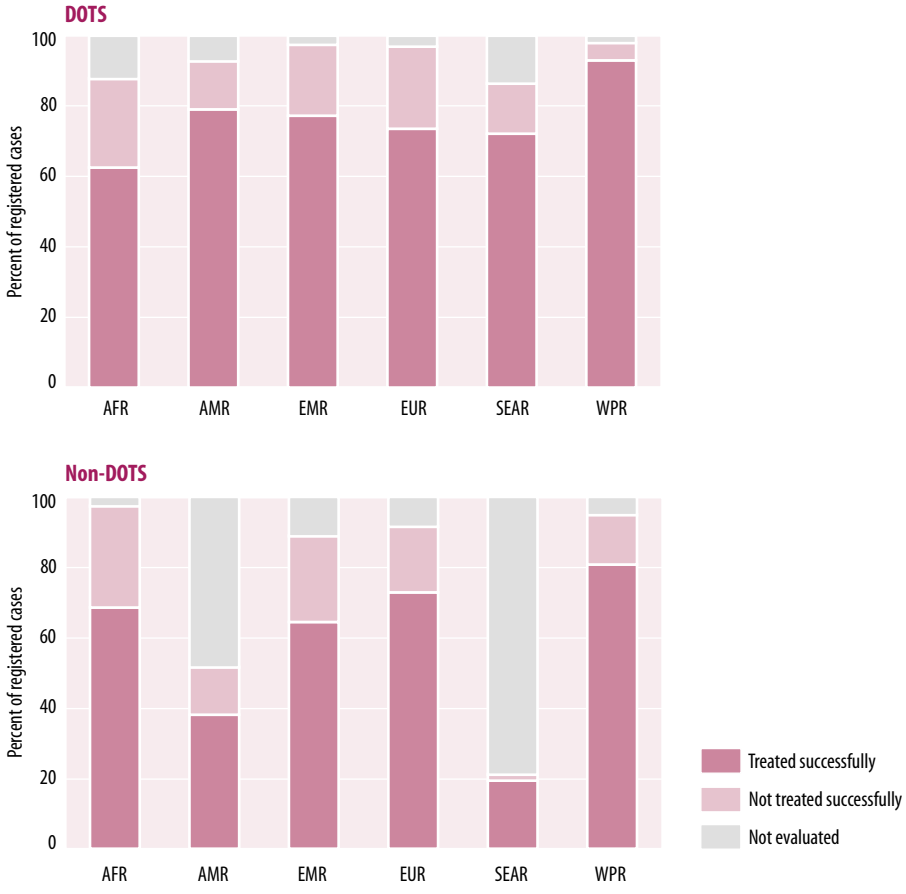


Table 11a. Treatment outcomes for smear-positive cases: 22 high-burden countries: DOTS strategy, 1997 cohort*

	Country (ranked by burden)	Notified	Registered*	Regst'd (%)	Treatment outcomes (%)* Cured	Completed treatment*	Died	Failed	Defaulted	Trans-ferred	Not eval'd	Treatment success* (%)	% est* cases successfully treated under DOTS
1	India	7 708	7 689	99.8	80.4	1.4	3.5	3.4	8.7	2.5	0.1	81.8@	0.8
2	China	147 905	166 279	112.4	96.3	0	1.3	1	0.6	0.3	0.5	96.3@	25.4
3	Indonesia	19 492	21 355	109.6	46.7	7.8	1.1	1	1.7	0.5	41.2	54.5	4.4
4	Bangladesh	25 871	26 374	101.9	72.9	5.6	4.8	1.4	10.1	2.6	2.7	78.4	15.3
5	Pakistan		2 805		52.4	15	3.4	1.2	25.7	2.2	0	67.4	1.6
6	Nigeria	11 235	11 253	100.2	60.4	12.6	6.9	2.7	14.9	2.4	0	73	7.4
7	Philippines (the)	3 190	4 085	128.1	79.7	3.2	2.8	2.9	6.7	4	0.8	82.8@	3.4
8	South Africa	4 146	4 146	100	68.2	4.9	4.9	3	10.9	6.9	1.1	73.2	4.4
9	Ethiopia	15 957	11 592	72.6	61.2	10.4	6.6	1	11.7	4.7	4.4	71.7	12.6
10	Viet Nam	50 016	50 016	100	81.9	3	2.7	1.1	2.1	2.1	7.1	84.9@	65.3
11	Russian Federation (the)	660	661	100.2	66.4	1.1	9.7	7.9	8.2	2.4	4.4	67.5	0.6
12	Democratic Republic of the Congo	25 183	25 183	100	52.2	11.5	4.8	1	8	7.9	14.5	63.7	29.8
13	Brazil												0
14	United Republic of Tanzania (the)	22 010	22 064	100.2	71.2	5.5	9	0.6	6.2	4.7	2.8	76.7	42.3
15	Kenya	19 040	19 040	100	52.9	12.2	4.8	0.5	7.4	6.7	15.5	65.1	35.8
16	Thailand	1 873	1 059	56.5	59.8	2.4	4.9	1.7	8.2	4.3	18.7	62.1	1.8
17	Myanmar	9 014	9 232	102.4	72.9	8.9	4.6	1.2	9.8	2.6	0	81.8@	21
18	Afghanistan	618	2 001	323.8	39.3	5.4	1.6	1.1	8.2	0.9	43.4	44.7	2.7
19	Uganda	17 268	17 500	101.3	19.7	20	6.1	0.4	14.2	4.9	34.7	39.7	26.1
20	Peru	27 498	24 428	88.8	88	1.8	2.3	1.3	3.6	0.6	2.6	89.8@	75.8
21	Zimbabwe												0
22	Cambodia	12 686	12 278	96.8	86.2	4.5	2.2	0.4	2.5	0.6	3.7	90.7@	44
	Global (DOTS)	**579 623**	**615 803**	**106.2**	**72**	**6.4**	**3.8**	**1.4**	**6.4**	**3**	**7.1**	**78.3**	**13.7**

* Cohort: cases diagnosed during 1997 and treated/followed-up through 1998. Treatment outcomes divided by number registered (or by number evaluated, if greater). Completed treatment: clinically cured but without lab-confirmation. Treatment success: cured plus completed. @=treatment success ≥80%. Est: estimated (as opposed to notified or registered).

Table 11b. Treatment outcomes for smear-positive cases: 22 high-burden countries: non-DOTS strategy, 1997 cohort*

	Country (ranked by burden)	Notified	Registered	Regst'd (%)	Treatment outcomes (%)* Cured	Completed treatment*	Died	Failed	Defaulted	Trans-ferred	Not eval'd	Treatment success* (%)
1	India	265 811	285 794	107.5	0	16.6	0	0	0	0	83.4	16.6
2	China	40 625	23 010	56.6	84.3	0	1.6	7.1	4.2	1.7	1	84.3@
3	Indonesia											
4	Bangladesh	7 246	7 410	102.3	42.8	11.4	0.5	0.7	37.1	7.4	0.1	54.3
5	Pakistan											
6	Nigeria											
7	Philippines (the)	80 163	23 396	29.2	69.9	6.9	1.1	1.1	7.8	3.6	9.7	76.8
8	South Africa	50 854	50 854	100	55.9	11.6	6.7	2.3	17.3	2.5	3.6	67.4
9	Ethiopia											
10	Viet Nam	3 631	3 631	100	78.3	8.1	3.1	2.5	5.1	1.6	1.3	86.4@
11	Russian Federation (the)	41 434										
12	Democratic Republic of the Congo		814		46.6	0	23.2	10.8	2.2	13.5	3.7	69.8
13	Brazil	43 490	43 490	100	0	26.9	2	0.3	5.2	1.4	64.2	26.9
14	United Republic of Tanzania (the)											
15	Kenya											
16	Thailand	11 341	2 638	23.3	52.9	3.7	6	1.4	8.8	3.6	23.5	56.6
17	Myanmar	681										
18	Afghanistan											
19	Uganda											
20	Peru											
21	Zimbabwe	14 512	12 410	85.5	51.3	17.5	10.2	0.2	8.2	12.7	0	68.8
22	Cambodia											
	Global (non-DOTS)	**748 068**	**533 267**	**71.3**	**21.9**	**15.5**	**1.8**	**1**	**5.3**	**1.6**	**52.8**	**37.5**

* Cohort: cases diagnosed during 1997 and treated/followed-up through 1998. Treatment outcomes divided by number registered (or by number evaluated, if greater). Completed treatment: clinically cured but without lab-confirmation. Treatment success: cured plus completed. @=treatment success ≥80%.

Table 12. Treatment outcomes for smear-positive cases, by WHO Region and strategy, 1997 cohort*

WHO region/strategy		Notified	Registered	Regst'd (%)	Treatment outcomes (%)* Cured	Completed treatment*	Died	Failed	Defaulted	Trans-ferred	Not eval'd	Treatment success* (%)	% est* cases successfully treated under DOTS
AFR	DOTS	197 519	185 863	94.1	51	11.4	6.5	1.4	11.8	5.7	12.3	62.4	17.5
	non-DOTS	77 869	78 270	100.5	56.3	12.2	7.1	1.8	15.6	4.5	2.7	68.4	
AMR	DOTS	55 090	64 120	116.4	72.7	6.2	4.2	1.2	6	2.3	7.3	78.9	27.7
	non-DOTS	86 458	68 504	79.2	12.5	25.5	2.8	0.5	7.7	2.6	48.4	38	
EMR	DOTS	25 269	36 251	143.5	64.6	12.5	2.9	1.8	10.6	4.9	2.6	77.1	10.2
	non-DOTS	27 811	23 456	84.3	51.2	13.1	1.8	3.8	14.6	4.3	11.2	64.3	
EUR	DOTS	5 284	15 276	289.1	56.3	17	5	6.7	10	1.8	3.1	73.4	5.7
	non-DOTS	108 303	7 329	6.8	62.5	10.1	3.9	8.2	5.3	1.5	8.5	72.7	
SEAR	DOTS	70 145	71 475	101.9	65.8	6.2	3.4	1.4	7.3	2.2	13.6	72	3.9
	non-DOTS	298 079	304 995	102.3	2.9	16.4	0.1	0.1	1.3	0.3	78.8	19.3	
WPR	DOTS	226 316	242 818	107.3	91.7	1.1	1.7	1.1	1.2	1.1	2.1	92.8@	25.6
	non-DOTS	149 548	50 713	33.9	76.6	4	1.6	4	6	2.6	5.2	80.6@	
Global	DOTS	579 623	615 803	106.2	72	6.4	3.8	1.4	5.7	3	7.1	78.3	13.7
	non-DOTS	748 068	533 267	71.3	21.9	15.5	1.8	1	4.7	1.6	52.8	37.5	

* Cohort: cases diagnosed during 1997 and treated/followed-up through 1998. Treatment outcomes divided by number registered (or by number evaluated, if greater). Completed treatment: clinically cured but without lab-confirmation. Treatment success: cured plus completed. @=treatment success ≥80%. Est: estimated (as opposed to notified or registered).

Table 13. Treatment success for smear-positive cases: 22 high-burden countries, 1994–97 cohorts

		DOTS programmes				Whole country			
	Country (ranked by burden)	**1994**	**1995**	**1996**	**1997**	**1994**	**1995**	**1996**	**1997**
1	India	83.2	78.8	79.0	81.8	*	24.7	20.0	16.6
2	China	94.0	95.8	96.2	96.3	86.0	85.1	86.9	84.3
3	Indonesia	94.3	90.7	81.4	54.5	*	*	*	*
4	Bangladesh	73.0	71.4	72.4	78.4	*	*	45.6	54.3
5	Pakistan	73.8	70.4	—	67.4	64.7	*	—	*
6	Nigeria	65.1	49.1	31.5	73.0	*	*	*	*
7	Philippines (the)	80.4	—	82.4	82.8	87.5	60.0	34.2	76.8
8	South Africa	—	—	69.4	73.2	78.2	57.9	60.5	67.4
9	Ethiopia	74.0	60.6	73.4	71.7	*	*	63.4	*
10	Viet Nam	90.5	91.3	90.2	84.9	*	85.3	86.4	86.4
11	Russian Federation (the)	—	64.8	62.3	67.5	—	*	56.7	*
12	Democratic Republic of the Congo (the)	71.5	79.8	48.0	63.7	78.8	68.9	66.9	69.8
13	Brazil	—	—	—	—	69.6	16.9	20.3	26.9
14	United Republic of Tanzania (the)	79.8	73.5	76.2	76.7	*	*	*	*
15	Kenya	73.3	74.7	76.7	65.1	*	*	*	*
16	Thailand	—	—	77.8	62.1	58.2	63.6	*	56.6
17	Myanmar	—	66.0	79.1	81.8	77.4	77.5	76.2	*
18	Afghanistan	—	—	—	44.7	—	—	—	*
19	Uganda	—	—	33.0	39.7	—	43.7	*	*
20	Peru	81.4	83.4	88.6	89.8	*	*	*	*
21	Zimbabwe	—	—	—	—	51.7	53.3	32.1	68.8
22	Cambodia	84.3	90.8	93.8	90.7	*	*	*	*
	all high burden countries	87.0	85.5	79.5	82.2	83.2	54.1	51.3	57.1
	Global	**76.9**	**78.6**	**76.9**	**78.3**	**74.7**	**57.0**	**53.6**	**59.4**

Cohort: see notes for Tables 11a-b. — not available; * no additional data beyond DOTS report

Table 14. Re-treatment outcomes in DOTS programmes: 22 high-burden countries, 1997 cohort*

	Country (ranked by burden)	Registered	Evaluated	Regst'd (%)	Treatment outcomes (%)* Cured	Completed treatment*	Died	Failed	Defaulted	Trans-ferred	Not eval'd	Treatment success* (%)
1	India	2 306	2 209	95.8	62.2	3	7.4	5.6	14.7	2.9	4.2	65.2
2	China											
3	Indonesia											
4	Bangladesh	1 131	844	74.6	53.5	4.2	3.1	2.2	8.1	3.5	25.4	57.6
5	Pakistan	537	537	100	37.4	19.2	8.2	5.4	25.3	4.5	0	56.6
6	Nigeria											
7	Philippines (the)	276	111	40.2	23.6	2.5	1.8	6.5	1.8	4	59.8	26.1
8	South Africa	533	513	96.2	63.4	4.7	5.6	3.2	11.4	7.9	3.8	68.1
9	Ethiopia	784	784	100	52.2	17.1	8.3	4	13.3	5.2	0	69.3
10	Viet Nam	4 866	4 500	92.5	74.4	5.2	3.8	4.1	2.4	2.6	7.5	79.6
11	Russian Federation (the)											
12	Democratic Republic of the Congo (the)	2 771	1 810	65.3	40.4	5.7	4.9	1.5	4.8	8	34.7	46.1
13	Brazil											
14	United Republic of Tanzania (the)		2 095		60.8	14.1	13.8	1.1	6.4	3.8	0	74.9
15	Kenya	1 386	991	71.5	47.5	7.1	6.1	0.6	5.8	4.3	28.5	54.7
16	Thailand	238	194	81.5	52.9	2.1	7.6	4.6	10.5	3.8	18.5	55
17	Myanmar	1 745	1 745	100	60.7	13.5	6.2	3.7	11.3	4.5	0	74.2
18	Afghanistan											
19	Uganda	1 136	1 136	100	31.6	26.3	10.4	1.2	23.6	6.9	0	57.9
20	Peru											
21	Zimbabwe											
22	Cambodia	650	639	98.3	85.1	5.4	3.8	1.2	2.5	0.3	1.7	90.5@
	Global total	**36 380**	**34 353**		**53**	**11.4**	**6.1**	**3.4**	**9.6**	**4**	**12.5**	**64.4**

* Cohort: cases starting retreatment during 1997 and followed-up during 1998. Treatment outcomes divided by number registered (or by number evaluated, if greater).
Completed treatment: clinically cured but without lab-confirmation. Treatment success: cured plus completed. @=treatment success ≥80%.

varied from 62% in the African Region to over 90% in the Western Pacific Region (Figure 11, Table 12). Africa's low success rate is due in part to a low cure rate (51%), and in part to high proportions of cases that interrupted treatment (6%), that died (7%), that were lost during transfer (6%), or were not evaluated (12%). The success rate in Africa was higher for the 1997 cohort than for the 1996 cohort (58%) as a result of both an improved cure rate, and decreased proportions that interrupted treatment or were not evaluated. A comparison of treatment results for three consecutive cohorts (1995–97) shows that the overall success rates have remained approximately stable at 77–79% under DOTS, and 54–60% world-wide (Table 13).[13]

In DOTS areas, 36 380 cases registered for retreatment in 1997, half as many as in 1996. This fall is due to the fact that China did not provide retreatment reports for 1997. Fifty-three percent were cured and 11% completed treatment, a retreatment success rate of 64% (Table 14, Annex 2).

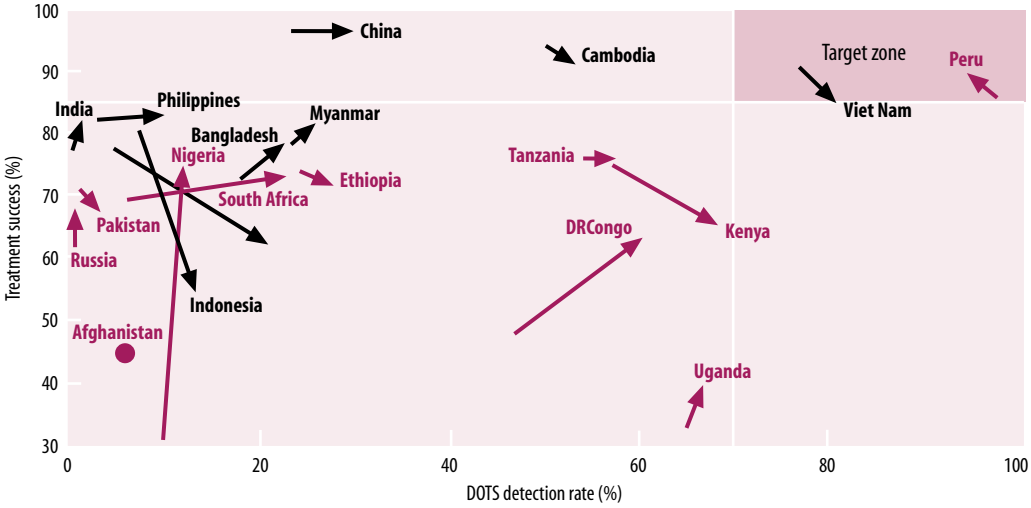
Progress in TB control in 22 high-burden countries

Figure 12, and Tables 10–12, give an overview of progress towards meeting WHO targets for 20 of the 22 high-burden countries (excluding Brazil and Zimbabwe, for which no data on treatment success are yet available). The essential elements of progress in the high-burden countries are as follows. These notes, which include some recent information from local WHO staff, should be read in conjunction with another recent report on the status of tuberculosis control in these countries.[14]

[13] The average treatment success rate for whole countries was relatively high in 1994, mainly because India registered 144 058 cases in non-DOTS areas without providing treatment outcomes; these data were excluded.

[14] World Health Organization. *Status of Tuberculosis in the 22 High-Burden Countries, 1999*. WHO/CDS/TB/99.271.

Figure 12. DOTS progress in high-burden countries, 1997–98. Treatment success refers to cohorts of patients registered in 1996 or 1997, and evaluated, respectively, by the end of 1997 or 1998. DOTS detection rate is the fraction of estimated cases notified under DOTS in 1997-98. Arrows mark progress in countries that supplied notification and cohort data for at least two years. For Pakistan, the start of the arrow is for cases notified in 1996 rather than 1997. Afghanistan (circle) has provided notification data for 1998 and treatment outcome data for patients registered in 1997 only. Countries should enter the graph at top left, and proceed rightwards to the target zone. Countries from AFR, AMR and EMR are shown in pink, those from SEAR and WPR are shown in black.



1. India

Between 1993 and 1997, India's DOTS programme reported high treatment success near or above 80%, but by 1998 the proportion of smear-positive cases detected under DOTS was only 1.5%. India's DOTS programme underwent large-scale expansion in the last quarter of 1998 and now covers approximately 20% of the country (200 million people). More than 140 000 patients were treated in 1999, including over 50 000 new smear-positive patients (6% of estimated in the country and approximately 54% of those in DOTS areas). The cure rate in 1998 remained above 80%, and would have been higher but for a default rate of 9%. Coverage is expected to reach 250 million by the end of 2000 and more than 450 million by the end of 2002.

2. China

The existing DOTS programme includes both the Infectious Endemic Disease Control (IEDC) and Ministry of Health Projects, covering 50% and 14% of the population, respectively. Although these population coverage rates did not increase in 1998, the total number of cases reported under DOTS increased by one third (from 253 904 cases in 1997 to 336 535 cases in 1998). The cure rate has remained over 90%, and we estimate that more than 1 in 4 infectious TB cases is now successfully treated under DOTS. It has recently been estimated[15] that the Chinese DOTS programme is preventing at least 30,000 (26 000–59 000) TB deaths each year. Outside DOTS areas, many fewer cases were registered for treatment than notified, and the treatment success was reported to be lower (84%). The two key issues now facing China are the need for new funds to sustain the DOTS programme when World Bank-supported IEDC Project finishes in 2001, and the need for additional funds to expand DOTS to the entire country.

[15] Dye C, Zhao F, Scheele S, Williams B. Evaluating the impact of tuberculosis control: number of deaths prevented by short-course chemotherapy in China. *Int J Epidemiol* 2000; 29: in press.

3. Indonesia

Reported DOTS population coverage expanded dramatically from 28% in 1997 to 80% by the end of 1998, but the detected fraction of incident cases increased from only 7.4% to 12.2%. The treatment success among cases that were evaluated was 93% in the 1997 cohort, but failure to evaluate 41% of registered cases pushed the overall treatment success down to 55%. Failure to evaluate has been a growing problem since 1995, though steps to rectify it were taken in 1999. In 1997, the reported DOTS population coverage was four times the case detection rate under DOTS; coverage in 1998 was seven times the detection rate. Thus case finding is not sufficiently intensive within areas purportedly covered by DOTS. As for 1997 notifications, a relatively high fraction (83%) of new pulmonary cases was smear-positive, outside the expected range of 55–70%. This raises questions about the fate of smear-negative cases. No report was received for non-DOTS areas in 1998.

4. Bangladesh

Bangladesh reported 90% DOTS coverage in 1998, and 95% in 1999 (40% in collaboration with NGOs). An estimated 24% of smear-positive cases were detected under DOTS in 1998, more than a threefold increase over the 1995 detection rate. The big difference between population coverage and detection rate persists because many patients continue to seek treatment from non-DOTS programmes in specialized TB institutions (clinics and hospitals), and perhaps the private sector. The treatment success rate has been consistently greater than 70% since 1994, and rose to 78% in 1997 cohort. However, this is still lower than the WHO target of 85%, mainly because the default rate in 1997 (10%) was as high as in 1996. An estimated 15% of all smear-positive cases were successfully treated under DOTS in 1997. Treatment outside the DOTS programme is characterised by a very high default rate (37%), which explains the low treatment success rate of 54%.

5. Pakistan

DOTS population coverage was 8% in 1998, the same as in 1996 (no report was provided for 1997). The case detection rate under DOTS was therefore also low (3.4%). Just 2802 smear-positive patients were registered in the 1997 cohort. Treatment success was 68%, and only 53% were "cured" (demonstrated smear conversion at 5 months). More than 1 in 4 patients defaulted from treatment, the highest fraction in any of the high-burden countries. Only 2% of smear-positive cases were successfully treated under DOTS in 1997. These data indicate, in short, that Pakistan has a poor National TB Control Programme.

6. Nigeria

Both DOTS population coverage (45% in 1998) and the case detection rate (12% in 1998) have remained stable and low since 1996. Changes in the treatment success between 1996 and 1997 show some positive and some negative signs. The main indication of progress is that 100% of registered cases were reportedly evaluated in 1997, as compared with 44% the previous year. However, the default rate doubled from 8% to 15% between 1996 and 1997. The net result was a treatment success of 73%, well below the WHO target. No data were provided for non-DOTS areas of the country in 1997.

7. The Philippines

The population covered by DOTS was still low (17%) in 1998, but the programme has expanded rapidly since then. Preliminary data indicate that coverage reached 40% by the end of 1999. The case detection rate under DOTS was 10% in 1998, three times that in 1997 (3%). The number of new, pulmonary smear-positive cases reported for the country as a whole was more than 70% of the estimated total. Sixty percent of new pulmonary cases were smear-positive in 1998, within the expected range of 55–70%. Cases registered for DOTS treatment in 1997 outnumbered notifications (recorded the previous year), but the reverse was true in non-DOTS areas. Defects therefore remain in the system of recording

and reporting. Treatment success exceeded 80% 1996 and 1997 (83%) cohorts, with a high rate of smear-conversion (79% in 1996 and 77% in 1997). The re-treatment success rate was very low in 1997 cohort (27%) because a high fraction of registered patients was not evaluated (60%). The main obstacle to better cure appears to be the default rate, which was 7% among new cases in the 1997 cohort.

8. South Africa

The total number of cases notified in 1998 exceeded the estimated total; it is not clear whether the estimate is wrong, or whether there are errors in defining and reporting cases. The same problem reappears in the indicators used to measure DOTS progress, which has been rapid since 1996: the estimated case detection rate under DOTS (23%) in 1998 was a little bigger than DOTS population coverage (22%). The fraction of new pulmonary cases reported to be smear-positive was 89%, higher than expected, and much higher than reported for 1997. Treatment success rates in DOTS (73%) and non-DOTS areas (67%) were both low due to high default rates. Despite high rates of HIV infection, estimated to be 45% among TB cases in 1997, the DOTS cohort death rate was under 5%.

9. Ethiopia

About half the country was covered by DOTS at the end of 1998, the same as in 1997. However, the case detection under DOTS has continued to increase, doubling from 15% in 1995 to 28% in 1998. As cautioned in last year's report, the rise in case detection might be due to improved coverage, but it might also be driven, at least in part, by the HIV epidemic. Treatment success did not change between 1996 and 1997 (72%), because the default rate remained high (12%). No report was received for non-DOTS areas in 1998. It is therefore unclear from these data how much progress in TB control Ethiopia made between 1997 and 1998.

10. Viet Nam

Having reached WHO targets in 1997, Viet Nam has maintained high rates of DOTS coverage (96%), case detection (80%) and treatment success (85%). An estimated 65% of all smear-positive cases were successfully treated under DOTS in 1997, second only to Peru among the 22 highest burden countries. Treatment success was also high in non-DOTS areas (86%). The fraction of cases reported to be smear-positive (76%) under DOTS was somewhat higher than would be expected among the entire population of new pulmonary cases. Viet Nam must now look for epidemiological impact using a wider range of indicators, assessing, for example, whether incidence and prevalence are now declining, and quantifying the number of deaths averted. A prevalence survey will be carried out this year.

11. Russian Federation

DOTS coverage approximately doubled between 1997 and 1998, rising from 2% to 5%. However, only 1.5% of all notified cases, and 1.0% of all cases, were reported under DOTS. Treatment success was again low in the 1997 cohort (68%), as in the 1996 cohort, because of high death (10%), failure (8%) and default rates (8%). The same was true for patients on retreatment regimens. No treatment results were provided for non-DOTS areas of the country. Though progress has been very slow during the 1990's, Russia is now planning, in collaboration with WHO, the World Bank and other agencies, a major expansion of DOTS coverage. Control efforts in this country will need to confront the considerable problem of multi-drug resistant TB (MDR-TB).

12. The Democratic Republic of the Congo

As in South Africa, DOTS coverage (60%) was reported to be about the same as the DOTS detection rate (61%). There are several possible explanations: the incidence rate has been

underestimated, the notification rate is exaggerated (e.g. because cases from non-DOTS areas are included), or DOTS areas of the country suffer relatively high incidence rates. With present data, we cannot say which applies. Treatment success was low (64%) because 15% of registered cases were not evaluated, 8% defaulted, and because the fate of the 8% of patients that "transferred out" was unknown. No data were provided for non-DOTS areas of the country.

13. Brazil

In 1998, the Brazilian National Health Board declared tuberculosis a priority health problem. In the same year, DOTS was implemented in the central west region of the country. Although the programme in this area is apparently very effective (treatment outcome data are not yet available), it detected only 4% of estimated smear-positive cases in 1998. By contrast, the case detection rate for the whole country was 70%. Non-DOTS areas reported a treatment success rate of 27% in 1997, because 64% were not evaluated. The success rate among those evaluated was 75%. The critical issue for Brazil is to successfully expand the DOTS programme to other parts of the country. Tuberculosis control programmes fall under the aegis of state governments that are independent of the federal government (which supports DOTS). The use of DOTS has been encouraged under a plan wherein states are reimbursed for smear examinations and are paid for each tuberculosis patient cured (with final negative smear conversion). In addition to the current disease surveillance system, an information system to collect and report data on the status of the implementation of DOTS in states throughout the country is urgently needed.

14. The United Republic of Tanzania

DOTS coverage remains officially 100%, but the detection rate under DOTS has stayed in the range 50-60% since 1995. Assuming that the estimated TB incidence rate is correct, the National TB Control Programme is missing 15 000–20 000 new smear-positive cases each year. Treatment success has also remained between 75% and 80%, with smear-conversion demonstrated for most patients that complete treatment. Treatment success has been low partly due to the 8-9% death rate in 1994–97 cohorts (14% under retreatment in 1997), which in turn could be explained by the high rate of HIV infection among TB patients (estimated at 37% in 1997). Forty-two percent of all (estimated) smear-positive cases were successfully treated under DOTS in 1997, about the same as in 1996.

15. Kenya

All cases are reported under DOTS, and the case detection rate increased to 68% of estimated cases in 1998. As we have previously remarked (see paragraph 9 on Ethiopia), the apparent improvement in case detection could be explained by the rise in incidence due to HIV. Treatment success fell sharply between 1996 and 1997 (from 77% down to 65%), because 16% of registered cases were not evaluated, 7% defaulted and 7% transferred out. The death rate among cases evaluated was under 5%, but we do not know how many unevaluated cases died. Kenya appears to have understated its treatment outcomes for 1997: among the 16% of cases for which there were no treatment results, 10% (1913) were nomads, and 85% of these were successfully treated. Adding these results to those in Table 11a, and excluding 1032 patients receiving a standard rather than a short-course regimen, gives an overall success rate of 78% instead of 65%.

16. Thailand

Thailand began to implement DOTS in October 1996. Coverage rose to 32% at the end of 1998 (and 40% in 1999), with a detection rate of 21%. By the middle of 1999, all provinces in the country had demonstration districts and 40% of all districts had implemented the new control policy. The rapid expansion led to difficulties in case monitoring in some areas. Some reports received in the central unit have been incomplete, and the number of

cases registered in 1997 was significantly lower than the number notified for that year. Treatment outcomes for 19% of cases registered in 1997 were unknown. While this is clearly the main reason for the low overall success rate of 62%, another contributing factor was the relatively high default rate of 8%. Failure to evaluate cases under treatment, and a high default rate, also explain the low non-DOTS treatment success of 57%. A strong focus on quality control, and especially on the accuracy of reporting, dominates the current activities of the National TB Control Programme.

17. Myanmar

DOTS coverage remained at about 60% between 1996 and 1998, but is now reported to be somewhat higher at 64%. Case detection under DOTS has been similarly steady at 25–28%. Treatment success jumped from 66% to 79% between 1995 and 1996, and reached 82% in 1997. The main loss was through defaulting, both among new and retreatment cases (10%). No report was received for non-DOTS areas. Myanmar has a good-quality DOTS programme, which is in need of investment for further expansion.

18. Afghanistan

Despite civil conflict, Afghanistan retained its DOTS status in 1998 by reporting from the 11% of the population covered. About 5% of the estimated smear-positive cases were notified. Cohort data show, first, a major discrepancy between the number of cases notified for 1997 (618) and the number registered for treatment (2001). The treatment success was 45%, mainly because 43% were not evaluated, and 8% defaulted. In sum, Afghanistan made little progress in TB control between 1997 and 1998.

19. Uganda

The NTP achieved full country coverage with the DOTS strategy in 1996. Routine support and supervision showed that TB control services were available, but not easily accessible, to the mostly rural population. Uganda reported a case detection rate of 67% in 1998, but treatment success (40%) was the lowest of all 22 the high-burden countries. The two main problems were failure to evaluate newly-registered cases (35% of outcomes unknown), and defaulting (14%). The default rate was even higher among cases being retreated (24%). The high death rate of retreatment cases (10%) might be a consequence of interrupted treatment, or linked to HIV co-infection. The NTP began to address these problems in 1998–99 by testing a community DOTS programme based on the observation of treatment by volunteers in rural villages. At the end of 1999, the NTP had completed follow-up of the cohort from the first demonstration district, with strikingly improved results. All patients had 8 months supervision by community volunteers and all were evaluated at the end of treatment. Treatment success was 87%, the death rate was 12%, and the transfer rate was just 1%. Treatment interruption and failures were nil. Preliminary data from other two demonstration districts are equally promising. The new approach to DOTS implementation, based on community involvement, has been adopted by the Ministry of Health and will be expanded all over Uganda during the next 2–3 years.

20. Peru

Peru had reached the WHO targets by 1995, and has continued to maintain its performance. In terms of nationwide case finding and cure, Peru is still the most successful DOTS country among the top 22. The estimated case detection rate was 94% in 1998. Of all cases notified in 1997, 89% were registered for treatment. Among registered cases, 90% were treated successfully. Given these very strong results, we expect to see TB incidence in decline. The number of notified cases peaked at 52 552 in 1992, and fell to 41 739 in 1996, but has increased again over the past two years. The number of sputum smears examined increased from 466 000 in 1992 to 1.4 million in 1997. The decline in notifications from 1992 to 1996 is therefore not due to any reduced effort in case finding, and it may reflect a

genuine fall in the incidence rate. However, that cannot be proven with the data supplied for this report. Peru is the first NTP in the world to address systematically the problem of multi-drug resistant TB (MDR-TB) through an innovative scheme of referral to a special unit responding to the NTP manager. The high rate of case detection in Peru allows the programme to treat MDR-TB cases, via this mechanism, countrywide.

21. Zimbabwe

DOTS pilot projects began only during 1998, and yet Zimbabwe reported 100% DOTS coverage for that year. In fact, DOTS was implemented only in five districts during 1998, and plans exist to expand to all 58 districts by 2002. The 14 492 smear-positive cases notified in 1998 represent 59% of all estimated cases. The non-DOTS treatment success for 1997 was 69%, with high death (10%) and default rates (8%).

22. Cambodia

DOTS was introduced in 1994 and coverage reached all 23 provinces by 1998. The NTP doubled its treatment capacity from less than 10 000 TB patients in 1991 to nearly 20,000 in 1999. Some 12 686 smear-positive cases were notified in 1998, 54% of the estimated total, an increase of 4% over 1997. Cambodia has the highest case notification rate for new sputum smear-positive cases in the Western Pacific Region with 121 per 100 000 in 1998. Eighty-five percent of the treated patients are pulmonary positive, 4% are pulmonary negative and 6% are extra-pulmonary. Treatment success has been maintained above 85% since 1995, and reached 91% in 1997. The principal concern of the programme at present is the rapidly increasing case-load of TB patients related to HIV/AIDS epidemic. The prevalence of HIV infection is the highest in the Region (4% among 15–49 age group population or 200 000 cases in 1999), and 20% of TB patients are expected to be HIV positive in year 2000.

Progress in TB control in all DOTS countries

Of 91 DOTS countries for which data were submitted, 60 (66%) had treatment success rates over 70% (Figure 13, Annex 6). Among these 60 countries, 30 had DOTS detection rates above 50%, including Botswana, Chile, Morocco and Venezuela (Figure 14). These countries appear to have reached or are close to reaching WHO targets, but together account for only 8% of all incident TB cases. Of 71 countries that provided data from two consecutive cohorts, 62% showed higher treatment success rates during 1996–97. About half (34/71) improved DOTS detection by more than 1% whilst maintaining treatment success above 70%. Annex 6 tabulates case detection and treatment success rates by country for 1995 to 1998.

Figure 13. DOTS status in 1998. Estimated DOTS detection rate in 1998 and treatment success in 1997 for 90 countries reporting to WHO during 1998. The remaining DOTS countries have adopted the strategy too recently to provide data on treatment outcomes.

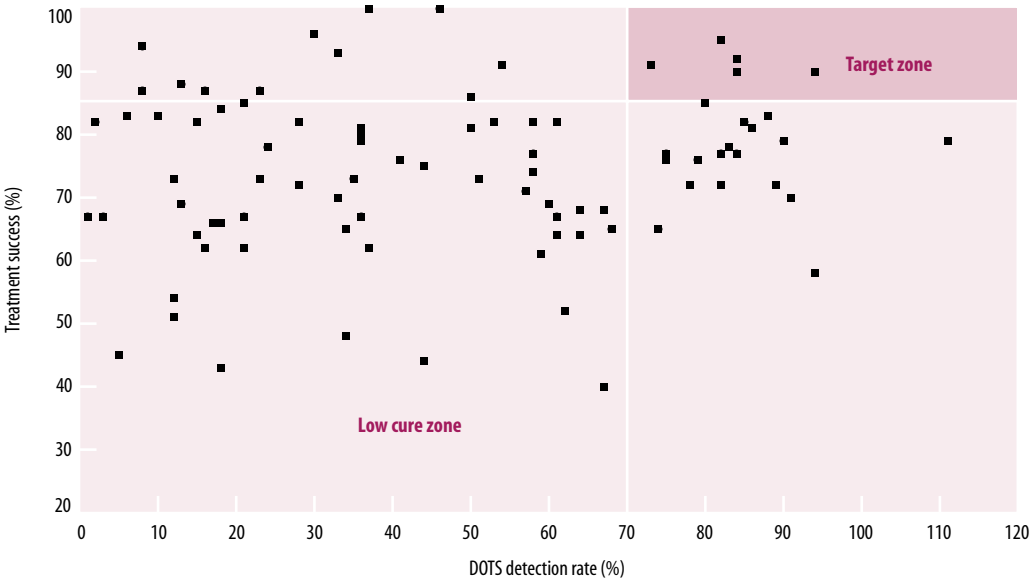
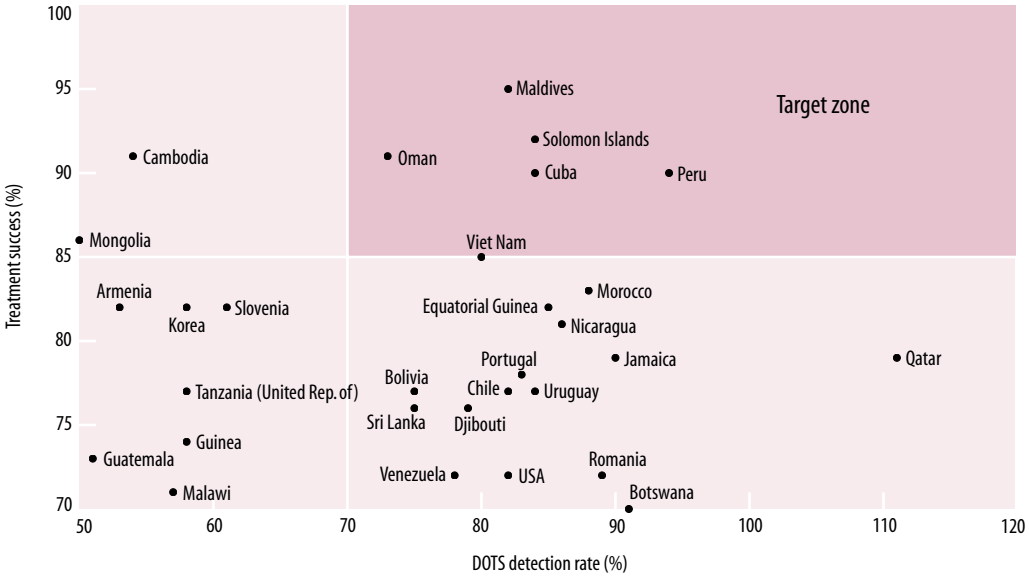


Figure 14. Magnified view of Figure 14, showing 30 countries that reported treatment success rates over 70% and estimated DOTS detection rates over 50%



Discussion

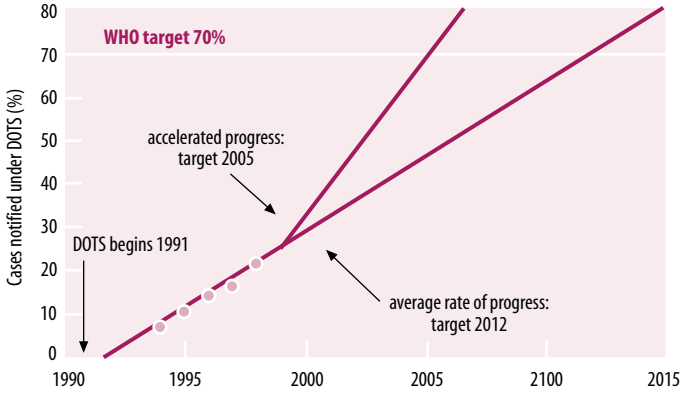
Global and regional progress in TB control

Progress in controlling tuberculosis accelerated somewhat during 1997–98. DOTS programmes reported the biggest annual increase in case detection so far, whilst maintaining a high average rate of treatment success.

The number of reporting DOTS countries increased from 102 in 1997 to 119 in 1998. Between 1997 and 1998, the shift continued away from categories 0 (no report) and 1 (non-DOTS), and towards categories 2 (pilot phase), 3 (expansion) and 4 (full coverage). The net increase in DOTS population coverage was 8%, up to 43%, and coverage has doubled since 1995. The fraction of all estimated cases reported climbed another increment from 38% to 40% (it was 34% in 1995). The fraction of all smear-positive cases treated under DOTS exceeded 20% for the first time in 1998, and has also doubled since 1995.

Compared with 1997, nearly quarter of a million (219 803) additional smear-positive cases (and nearly half a million more TB cases in total) were reported by DOTS programmes in 1998. This is the biggest recorded annual increment, although it followed a slower rate of improvement between 1996 and 1997 (Figure 15). If the average rate of increase is maintained, adding about 120 000 cases/year, 70% of cases would be detected under DOTS by year 2012. More optimistically, if programmes can add 250 000 cases annually, 70% case detection would be achieved by 2005. As reported for 1997, the greatest potential for improving case finding was in the South-East Asia Region, which had the highest incidence of TB cases, but a relatively low detection rate, especially of smear-positive cases (29%).

Figure 15. Progress towards the 70% case detection target. Points mark the number of smear-positive cases notified under DOTS 1994–1998, expressed as a percentage of all estimated cases (1997). The solid line through these points indicates the current average annual increment of about 120 000 new cases, which intersects the target in year 2012; the steeper line represents a higher annual increment of 250 000 cases, and reaches the 70% target by 2005.



DOTS programmes have made these gains, in part, by claiming a proportion of cases from non-DOTS programmes, but this is recommended procedure. Because over 600 000 infectious cases were reported outside DOTS areas in 1998, it is conceivable that the same progress could be made under passive case detection for the next 2–3 years. Thereafter, a different strategy will be needed for finding cases that would not otherwise have been reported (either because they were treated but not notified, or because they were not treated).

The case detection rate accelerated under DOTS whilst the average treatment success rate remained high in the 1997 cohort. All regions, except Africa, had rates over 70%, and the global average (weighted by population size) under DOTS was 78%. Combining case detection and treatment success, an estimated 14% of all smear-positive cases were cured under DOTS in 1997, up from 10% in 1996. The average re-treatment success rate (64%) was much lower than reported for 1996, largely because China provided no data.

Other new data in this report reinforce two familiar themes in global TB control. First, diagnosis and treatment appear to be better under DOTS: 65% of new pulmonary cases were sputum smear-positive (55–70% expected), compared with 34% elsewhere. Treatment success was also higher under DOTS (78% vs 38%), mainly because a greater fraction of

registered cases was evaluated (94% vs 48%). The treatment success rates among evaluated cases were similar in DOTS and non-DOTS areas (85% and 79%), though cohort data from non-DOTS programmes are generally less trustworthy. In the African Region, the treatment success rate was low under DOTS (62%), but not as low as in 1996. As is often remarked, the elevated death rate (6%) is almost certainly linked to high HIV infection rates among TB patients, estimated to be 33% in 1997. HIV-related deaths are an obstacle to reaching the target cure rate in Africa, but treatment success was low in 1997 mainly because 12% of cases were not evaluated.

Second, whilst notification data need to be examined critically, several groups of countries show clear trends. TB incidence has been falling in Western Europe and Latin America since 1980, though the direct contribution of TB control to this decline is unclear. The decline in Western Europe has been steady at 4%/year since 1980, despite the growing number of cases among non-nationals.[7] Eastern Europe has suffered a sharp rise in tuberculosis since 1992. The rate of increase has been the same as that in sub-Saharan Africa, which in that setting is almost certainly due to the spread of HIV.

This is the first of our reports to highlight regional variations in the age and sex distribution of notified smear-positive cases. These data represent TB epidemiology, distorted by reporting biases, both of which need to be understood so as to improve TB control. A full analysis of the data presented in Figure 9 is beyond the scope of this report. Nonetheless, a preliminary comparison of patterns at least serves to generate hypotheses that could be tested with further data.

Two clear results are that more cases are reported in men than women, and the male/female ratio increases with age everywhere. The consistency of these patterns suggests that they represent epidemiological phenomena, and are not purely artefactual. Figure 9a–h orders groups of countries roughly according to the age at which the notification rate peaks, and this ranking is clearly related to present and past transmission and incidence rates. Bolivia, Haiti and Peru have the highest estimated TB incidence rates in Latin America,[14] and thus the earliest ages of infection and breakdown to disease. In contrast, industrialized countries now have low incidence rates, and most cases occur in older people who were infected years ago when transmission rates were higher. Prior to the mid-1980s, the average age of TB cases in Africa may have been increasing as the transmission rate slowly declined. HIV is probably reversing this trend by increasing the breakdown rate to TB in young, co-infected adults. African women with TB are younger than men with TB; women typically acquire HIV infection at younger ages, and this may be part of the explanation. The gap between men and women was greatest in Eastern Europe, where there has also been a resurgence of TB. The hypothesis to be tested here is that the notification rate has increased most sharply among men aged 35–54 years.

Progress in TB control in 22 high-burden countries

Based on 1998 estimates of case detection and treatment outcomes for the 1997 cohort, we have re-graded the top 22 countries as in Table 15. Six countries made sufficient progress to be reclassified with higher rank (bold, underlined). Data from 3 countries showed signs of deteriorating control, and moved to a lower rank (underlined). On balance, TB control in the high-burden countries in 1998 was better than in 1997, as indicated by higher DOTS coverage (43%), better case detection (20% of estimated smear-positive cases), and a marginally higher treatment success rate (82%). The large increment in the number of smear-positive cases reported under DOTS is explained mainly by improvements in China, South Africa, India, Bangladesh and the Philippines. Case detection rates accelerated in all these countries, except Bangladesh. Given the enormous populations of these countries, even a small percentage increase in case detection (as shown by the short arrows in Figure 12) means a large increase in the number of cases detected.

As in the previous report, the top performing countries (treatment success ≥70%, DOTS detection rate ≥50%) included representatives from Africa (Tanzania), Asia (Cambodia, Viet Nam) and Latin America (Peru). The central problem facing Tanzania and Cambodia is to maintain high-quality programmes, despite the spread of HIV. Kenya has slipped out of the

top rank since 1997 because treatment success fell to 65%, apparently due to a reporting error. The real treatment success appears to be 78%.

Peru and Viet Nam maintained case detection and treatment success rates above WHO targets between 1997 and 1998. Both programmes now have firm foundations upon which to diversify TB control. Peru has already begun to address the special problem of drug resistant and multi-drug resistant TB. Both countries should consider introducing additional indicators of impact to determine, for example, whether there has been a fall in incidence attributable to the control programme, and whether it is possible to quantify the number of deaths averted, as has been done in China.[15]

Table 15. Progress in DOTS implementation: top 22 countries, 1996–98

	DOTS			
		High treatment success (≥ 70%)		
Non-DOTS or incomplete data	Low treatment success (< 70%)	Low case detection** (< 10%)	Intermediate case detection (10–49%)	High case detection (≥ 50%)
Brazil* Zimbabwe*	**Afghanistan** **Congo, D.R.** Indonesia Kenya Uganda **Pakistan** Russian Federation Thailand	India	Bangladesh China Ethiopia, F.D.R. Myanmar **Nigeria** **Philippines** **South Africa**	Cambodia Peru Viet Nam Tanzania

* Implementing DOTS but data not yet available

** DOTS detection rate: patients found and treated through DOTS programmes.

Underline: countries which have moved down one or more categories since 1997.

Underline bold: countries which moved one or more categories up since 1997.

The seven countries in the second rank have high treatment success rates (> 70%) with intermediate rates of case detection (DDR 10–49%), and now include Nigeria, the Philippines and South Africa. Nigeria's main achievement has been to evaluate all registered smear-positive cases for treatment outcome. The Philippines has maintained high treatment success whilst expanding case detection, reporting an additional 11 000 smear-positive cases in 1998. South Africa has improved both treatment success and case detection. The challenges to the other members of this group are well-known. Thus, patients in Bangladesh are encouraged to seek treatment from health facilities delivering DOTS close to their homes, rather than at specialized TB institutions that do not provide DOTS. There are signs that this is now happening—Bangladesh reported 12 000 additional smear-positive cases under DOTS in 1998. China reported the biggest increase in cases notified under DOTS during 1998, an extra 83 000 smear-postive cases, as compared with 1997. Though China must maintain and improve on its success in the 13 DOTS provinces, it must also extend DOTS to the other half of the country.

India is the sole remaining country with high treatment success and low national case detection rate (third rank). The persistently low case detection rate belies progress made since 1997. India reported an extra 12 000 smear-positive cases under DOTS in 1998, and improved treatment success in the 1997 cohort. DOTS should reach one quarter of the country by the end of 2000, and 35% of all smear-positive cases are now reported countrywide. India could therefore have moved up at least one rank by the time year 2000 notifications are reported to WHO. This would have a huge impact on the global case detection rate.

The Russian Federation and Uganda remain among the high-burden countries with low treatment success (fourth rank). The case detection rate in Uganda was higher than in Tanzania, a top-ranking country. However, treatment outcomes remained poor in 1997 because a high proportion of cases defaulted or were not evaluated. Even among patients that were treated successfully, about half did not have cure confirmed by smear examination. Russia continues to report low treatment success and low case detection; based on available information, drug resistance appears to be a partial explanation for low cure. Indonesia, Kenya and Thailand have moved down to this group because treatment success rates fell below 70% between 1996 and 1997. The benign explanation is that all three programmes failed to follow up all registered cases. In the three sets of cohort data, more than 70% of evaluated cases were successfully treated, though it is possible that the evaluated cases were a biased sample. Afghanistan, the Democratic Republic of the Congo and Pakistan moved up into this category by virtue of providing data to WHO; all three countries failed to report on treatment outcomes for 1996.[7]

The lowest rank in Table 15 is occupied by Brazil and Zimbabwe, both countries that

began to implement DOTS in 1998. Significantly, no high-burden country failed to provide WHO with data for this report, and none is actively promoting a system of TB control that is incompatible with DOTS. This underscores the principal conclusion of last year's report: the central problem in global TB control is to expand DOTS coverage in high-burden countries, where 95% of TB patients live. All of these countries have now accepted that the DOTS system embodies, for most patients, best practice in TB control.

Developments in tuberculosis monitoring and surveillance

An important limitation of our present global surveillance system is that it presents information with a delay of 1–2 years: in the year 2000, we are reporting on cases notified during 1998, and on treatment outcomes for patients registered in 1997. The advantages of rapid, accurate reporting are obvious: we could be more confident that case detection in countries such as India is accelerating, we could better assess whether the growth in Russian case notifications is at last beginning to slow, and we could more easily judge whether the excellent control programmes in Peru and Viet Nam are now forcing down incidence.

Three initiatives in 1999 began to address the problem of reporting delays. WHO's Eastern Mediterranean Office has introduced quarterly reporting from countries by fax. The European Office has developed the CISID system of reporting data through the Internet. The American Office now has on site the Access software developed at WHO Geneva for compiling notifications and treatment outcomes. Full details are available from the relevant Regional Offices. With these, and other similar developments, it should be possible to report aggregate case notifications and treatment outcomes (once evaluated) with a delay of only 3–6 months.

There are, however, some aspects of surveillance that are beyond the compass of the present system of recording and reporting. The current method of (mostly) quarterly reporting from districts cannot alert countries or regions to local outbreaks of, for example, multi-drug resistant TB. This will require a network of laboratories equipped and quality-controlled for drug-susceptibility testing. Some European countries already have a system for reporting laboratory diagnostic results to a central, national office.[9] Euro TB (CESES) are now working on a Europe-wide extension of this network.