

Results

Progress towards the Millennium Development Goals

Countries reporting to WHO

By the end of 2004, 199 (94%) of 211 countries and territories reported case notifications for 2003 and/or treatment outcomes for patients registered in 2002. These countries include 99% of the world's population. WHO received reports from all 22 HBCs.

Case notifications and incidence

The 199 countries reporting to WHO in 2003 notified 4.4 million new and relapse cases, of which 1.9 million (44%) were new sputum smear-

positive (Table 3; Figure 1). Among these notifications, 3.7 million were from DOTS areas, including 1.8 million smear-positives. A total of 17.1 million cases, and 8.6 million smear-positives, were notified by DOTS programmes between 1995 and 2003. Based on surveillance and survey data, we estimate that there were 8.8 million new cases of TB in 2003 (140 per 100 000), including 3.9 million (62 per 100 000) smear-positive cases (Table 4; Figure 2).

The African Region (24%), South-East Asia Region (35%), and Western Pacific Region (22%) together ac-

counted for 82% of all notified cases and similar proportions of new smear-positive cases. Because DOTS emphasizes diagnosis by sputum smear microscopy, 47% of all new and relapse cases were smear-positive (45–60% expected) in DOTS areas, compared with 29% elsewhere. Similarly, 58% of new pulmonary cases were smear-positive under DOTS (55–70% expected), compared with 35% elsewhere (Table 3).

The ranking of countries by number of incident TB cases has drawn attention to the 22 HBCs, but the magnitude of the TB burden in individual

TABLE 3
Case notifications, 2003

| | ALL NEW AND RELAPSE CASES | | NEW SMEAR-POSITIVE | | NEW SMEAR-NEGATIVE OR SMEAR UNKNOWN | | NEW EXTRAPULMONARY | | RE-TREATMENT CASES EXCLUDING RELAPSE | | OTHER ^a | | % OF NEW PULMONARY CASES SMEAR POSITIVE ^b | |
|------------------------------|---------------------------|----------------|--------------------|----------------|-------------------------------------|----------------|--------------------|---------------|--------------------------------------|---------------|--------------------|---------------|--|-----------|
| | DOTS | NON-DOTS | DOTS | NON-DOTS | DOTS | NON-DOTS | DOTS | NON-DOTS | DOTS | NON-DOTS | DOTS | NON-DOTS | DOTS | NON-DOTS |
| 1 India | 836 768 | 236 297 | 372 088 | 61 183 | 305 921 | 153 503 | 112 064 | 20 189 | 102 542 | 13 247 | – | – | 55 | 29 |
| 2 China | 553 677 | 62 191 | 257 287 | 10 127 | 206 493 | 42 312 | 27 804 | 2 964 | 64 887 | 2 822 | – | – | 55 | 19 |
| 3 Indonesia | 178 260 | – | 92 566 | – | 77 561 | – | 4 047 | – | – | – | – | – | 54 | – |
| 4 Nigeria | 44 184 | – | 28 173 | – | 13 276 | – | 1 525 | – | 2 151 | – | 261 | – | 68 | – |
| 5 Bangladesh | 88 156 | – | 53 618 | – | 24 913 | – | 7 120 | – | – | – | – | – | 68 | – |
| 6 Pakistan | 73 100 | – | 20 962 | – | 34 447 | – | 12 874 | – | 3 184 | – | – | – | 38 | – |
| 7 Ethiopia | 117 600 | – | 39 698 | – | 35 141 | – | 40 883 | – | 676 | – | – | – | 53 | – |
| 8 South Africa | 227 278 | 42 | 116 331 | 33 | 56 535 | 5 | 37 682 | 4 | 28 094 | 8 | – | – | 67 | 87 |
| 9 Philippines | 134 375 | – | 72 670 | – | 55 942 | – | 1 693 | – | – | – | – | – | 57 | – |
| 10 Kenya | 91 522 | – | 38 158 | – | 37 135 | – | 13 403 | – | 1 127 | – | 2 661 | – | 51 | – |
| 11 DR Congo | 84 687 | – | 53 578 | – | 9 352 | – | 18 357 | – | 1 641 | – | 387 | – | 85 | – |
| 12 Russian Federation | 21 064 | 102 977 | 6 322 | 22 546 | 12 780 | 72 252 | 1 016 | 3 648 | – | 22 512 | 851 | 4 840 | 33 | 24 |
| 13 Viet Nam | 92 741 | – | 55 937 | – | 16 791 | – | 14 564 | – | 680 | – | – | – | 77 | – |
| 14 UR Tanzania | 61 579 | – | 24 899 | – | 21 911 | – | 12 959 | – | 378 | – | 2 708 | – | 53 | – |
| 15 Brazil | 16 560 | 63 554 | 9 061 | 30 877 | 4 795 | 18 727 | 1 503 | 9 081 | 799 | 3 663 | 1 256 | 2 690 | 65 | 62 |
| 16 Uganda | 41 805 | – | 20 320 | – | 16 612 | – | 3 249 | – | – | – | 1 096 | – | 55 | – |
| 17 Thailand | 54 504 | – | 28 459 | – | 17 596 | – | 6 756 | – | – | – | – | – | 62 | – |
| 18 Mozambique | 28 602 | – | 16 138 | – | 7 847 | – | 3 441 | – | 505 | – | – | – | 67 | – |
| 19 Zimbabwe | 53 183 | – | 14 488 | – | 28 246 | – | 8 916 | – | – | – | 3 934 | – | 34 | – |
| 20 Myanmar | 75 744 | – | 27 448 | – | 26 006 | – | 17 796 | – | 2 451 | – | – | – | 51 | – |
| 21 Afghanistan | 13 808 | – | 6 510 | – | 3 440 | – | 3 254 | – | 141 | – | – | – | 65 | – |
| 22 Cambodia | 28 216 | – | 18 923 | – | 4 307 | – | 4 232 | – | 79 | – | 91 | – | 81 | – |
| High-burden countries | 2 917 413 | 465 061 | 1 373 634 | 124 766 | 1 017 047 | 286 799 | 355 138 | 35 886 | 209 335 | 42 252 | 13 245 | 7 530 | 57 | 30 |
| AFR | 1 061 882 | 10 789 | 503 217 | 6 947 | 319 715 | 2 513 | 193 812 | 1 013 | 39 548 | 403 | 19 902 | – | 61 | 73 |
| AMR | 142 409 | 85 142 | 82 479 | 43 324 | 31 761 | 24 210 | 19 936 | 11 835 | 4 208 | 4 259 | 5 909 | 3 154 | 72 | 64 |
| EMR | 206 160 | 3 781 | 80 822 | 191 | 63 703 | 2 099 | 51 417 | 1 488 | 4 015 | – | 178 | – | 56 | 8 |
| EUR | 142 760 | 195 883 | 44 673 | 50 839 | 64 716 | 96 592 | 16 547 | 12 085 | 7 334 | 25 316 | 22 292 | 54 198 | 41 | 34 |
| SEAR | 1 314 983 | 240 402 | 610 079 | 62 799 | 481 487 | 155 219 | 160 093 | 20 772 | 107 746 | 13 408 | 9 845 | 583 | 56 | 29 |
| WPR | 879 827 | 108 100 | 431 396 | 23 336 | 313 113 | 63 566 | 59 422 | 11 084 | 66 352 | 3 563 | 3 262 | 3 746 | 58 | 27 |
| Global | 3 748 021 | 644 097 | 1 752 666 | 187 436 | 1 274 495 | 344 199 | 501 227 | 58 277 | 229 203 | 46 949 | 61 388 | 61 681 | 58 | 35 |

– Indicates not applicable or not available.

^a Cases not included elsewhere in table.

^b Expected percentage of new pulmonary cases that are smear-positive is 65–80%.

FIGURE 1
Tuberculosis notification rates, 2003

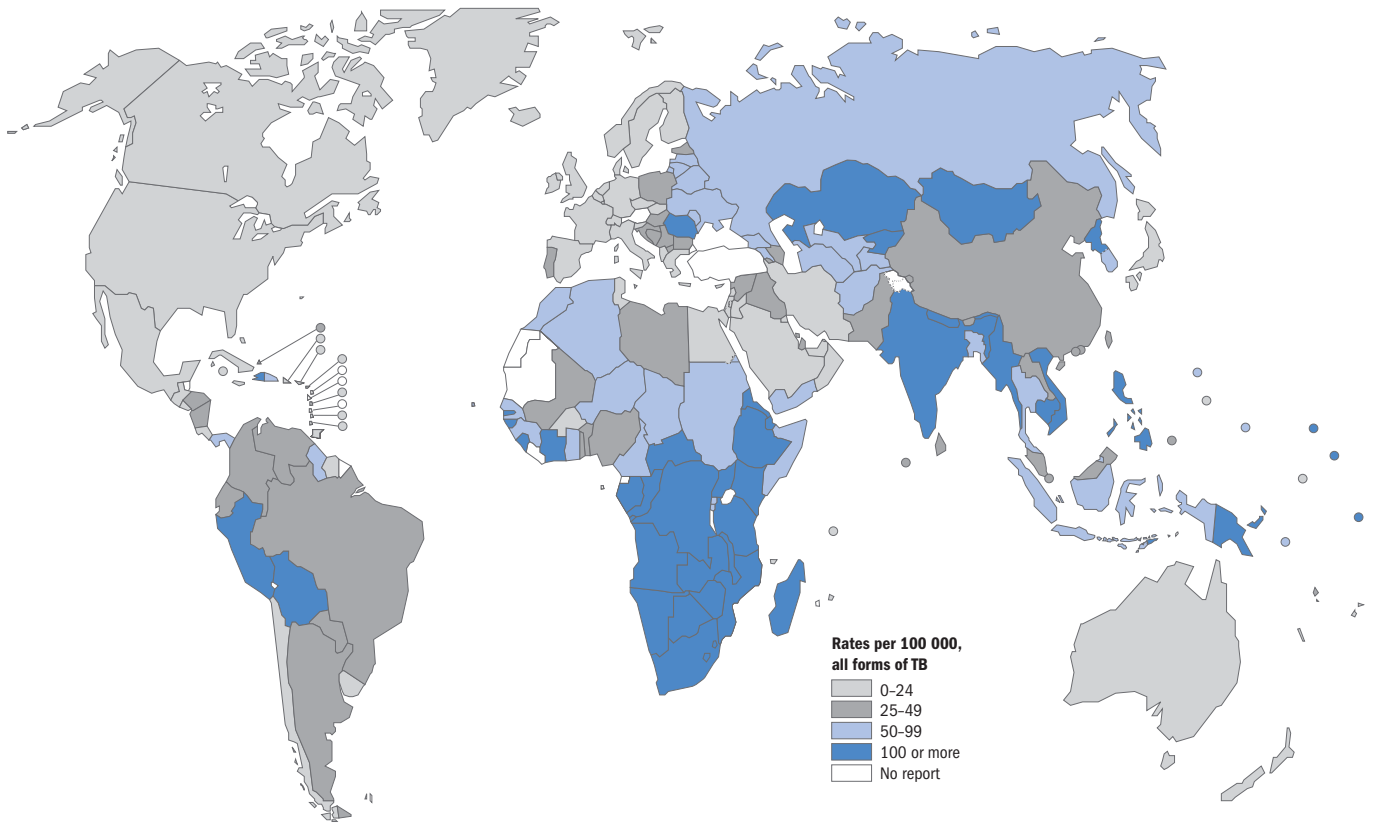


FIGURE 2
Estimated TB incidence rates, 2003

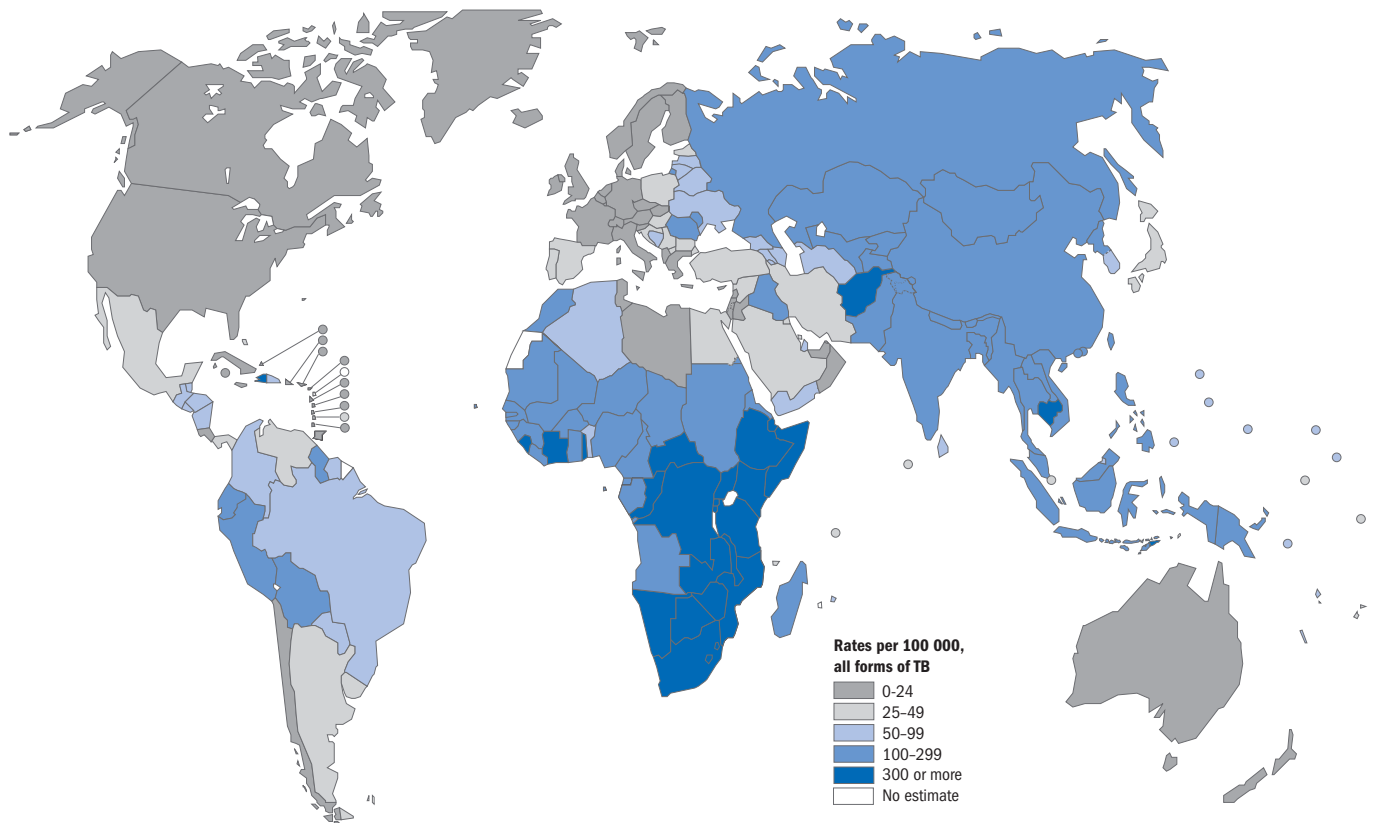
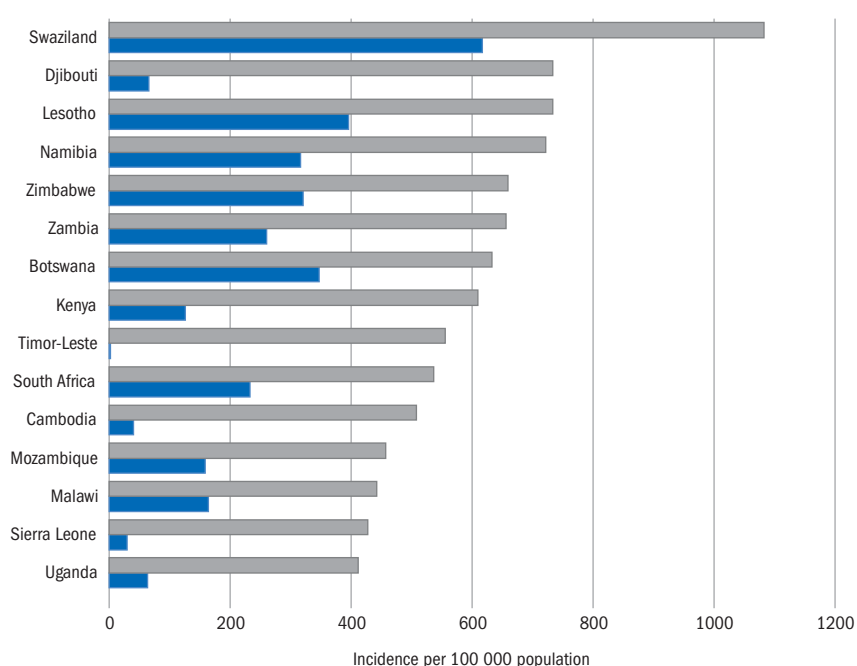


TABLE 4
Estimated TB burden, 2003

| | POPULATION 1000s | INCIDENCE | | | | PREVALENCE | | MORTALITY | |
|------------------------------|---------------------|-----------------|--------------------------|----------------------|--------------------------|---|--------------------------|-----------------|--------------------------|
| | | ALL CASES | | SMEAR-POSITIVE CASES | | ALL FORMS OF TB, INCLUDING IN HIV-INFECTED PEOPLE | | NUMBER 1000s | RATE PER 100 000 POP. |
| | | NUMBER 1000s | RATE PER 100 000 POP. | NUMBER 1000s | RATE PER 100 000 POP. | NUMBER 1000s | RATE PER 100 000 POP. | | |
| 1 India | 1 065 462 | 1 788 | 168 | 798 | 75 | 3 086 | 290 | 352 | 33 |
| 2 China | 1 304 196 | 1 334 | 102 | 600 | 46 | 3 203 | 246 | 236 | 18 |
| 3 Indonesia | 219 883 | 627 | 285 | 282 | 128 | 1 484 | 675 | 143 | 65 |
| 4 Nigeria | 124 009 | 363 | 293 | 156 | 126 | 677 | 546 | 105 | 85 |
| 5 Bangladesh | 146 736 | 361 | 246 | 162 | 111 | 719 | 490 | 84 | 57 |
| 6 Pakistan | 153 578 | 278 | 181 | 125 | 82 | 551 | 359 | 67 | 43 |
| 7 Ethiopia | 70 678 | 252 | 356 | 109 | 155 | 377 | 533 | 56 | 79 |
| 8 South Africa | 45 026 | 242 | 536 | 98 | 218 | 206 | 458 | 33 | 73 |
| 9 Philippines | 79 999 | 237 | 296 | 107 | 133 | 366 | 458 | 39 | 49 |
| 10 Kenya | 31 987 | 195 | 610 | 84 | 262 | 283 | 884 | 43 | 133 |
| 11 DR Congo | 52 771 | 195 | 369 | 85 | 160 | 298 | 564 | 43 | 81 |
| 12 Russian Federation | 143 246 | 161 | 112 | 72 | 50 | 229 | 160 | 29 | 20 |
| 13 Viet Nam | 81 377 | 145 | 178 | 65 | 80 | 195 | 240 | 19 | 23 |
| 14 UR Tanzania | 36 977 | 137 | 371 | 58 | 157 | 194 | 524 | 32 | 86 |
| 15 Brazil | 178 470 | 110 | 62 | 49 | 28 | 164 | 92 | 15 | 8 |
| 16 Uganda | 25 827 | 106 | 411 | 46 | 179 | 168 | 652 | 25 | 96 |
| 17 Thailand | 62 833 | 89 | 142 | 40 | 63 | 130 | 208 | 12 | 19 |
| 18 Mozambique | 18 863 | 86 | 457 | 36 | 190 | 120 | 636 | 24 | 129 |
| 19 Zimbabwe | 12 891 | 85 | 659 | 34 | 265 | 85 | 660 | 20 | 153 |
| 20 Myanmar | 49 485 | 85 | 171 | 38 | 76 | 92 | 187 | 12 | 25 |
| 21 Afghanistan | 23 897 | 80 | 333 | 36 | 150 | 160 | 671 | 22 | 93 |
| 22 Cambodia | 14 144 | 72 | 508 | 32 | 225 | 108 | 762 | 13 | 95 |
| High-burden countries | 3 942 338 | 7 027 | 178 | 3 112 | 79 | 12 896 | 327 | 1 423 | 36 |
| AFR | 687 405 | 2 372 | 345 | 1 013 | 147 | 3 487 | 507 | 538 | 78 |
| AMR | 867 768 | 370 | 43 | 165 | 19 | 503 | 58 | 54 | 6 |
| EMR | 518 063 | 634 | 122 | 285 | 55 | 1 120 | 216 | 144 | 28 |
| EUR | 878 902 | 439 | 50 | 196 | 22 | 577 | 66 | 67 | 8 |
| SEAR | 1 614 648 | 3 062 | 190 | 1 370 | 85 | 5 662 | 351 | 617 | 38 |
| WPR | 1 732 104 | 1 933 | 112 | 868 | 50 | 4 081 | 236 | 327 | 19 |
| Global | 6 298 890 | 8 810 | 140 | 3 897 | 62 | 15 430 | 245 | 1 747 | 28 |

FIGURE 3
Fifteen countries with the highest estimated TB incidence rates per capita (all ages, all forms; grey bars) and corresponding incidence rates of HIV-infected TB (among adults aged 15–49 years; blue bars), 2003



countries is better expressed as the incidence rate per capita. Among the 15 countries with the highest estimated TB incidence rates per capita, 12 are in Africa (Figure 3).

Case notifications from African countries show other patterns that are likely to be associated with HIV infection. First, women aged 15–24 years make up a higher proportion of TB cases in countries with higher rates of HIV infection (Figure 4a). This is consistent with the observation that HIV prevalence tends to be higher in women than men in this age range, and the difference between the sexes is bigger where HIV infection rates are higher. Second, the average age of smear-positive TB cases is typically lower where HIV infection rates are higher, especially for women (Figure 4b). This is another sign that younger rather than older women are more likely to be infected with HIV. Third, the proportion of smear-negative cases among all pulmonary TB cases tends to be higher in African countries with higher rates of HIV infection (data not shown). However, this last association is weak ($R^2 = 0.16$, $P = 0.02$) and could be confounded by the quality of diagnosis if, for example, smear microscopy has become less reliable where the number of HIV-infected TB patients has increased substantially.

Some patterns in the case notification data are striking, but not easy to explain. For example, the number of extrapulmonary TB cases as a proportion of the total reported is consistently different among WHO regions. Between 1995 and 2003, the proportion was lowest in the Western Pacific Region (mostly <5%) and highest in the Eastern Mediterranean Region (20–30%; see Figure 5). We do not know whether these are real epidemiological differences, or due to regional diagnostic biases. Surprisingly, the proportion of cases diagnosed as extrapulmonary disease has not increased in the African Region, despite the growing impact of HIV on the TB epidemic. This raises the question of whether NTPs in Africa are missing extrapulmonary cases.

Using the series of notifications of all TB cases from countries thought to have reliable data, and scaling by

FIGURE 4

(a) The proportion of notified TB patients aged 15–24 years that were women, in relation to HIV prevalence in adults aged 15–49 years ($R^2 = 0.63$, $P < 0.0001$). (b) Average age of women with smear-positive TB, in relation to HIV prevalence in adults aged 15–49 years ($R^2 = 0.46$, $P < 0.0001$). Data are for countries in Africa.

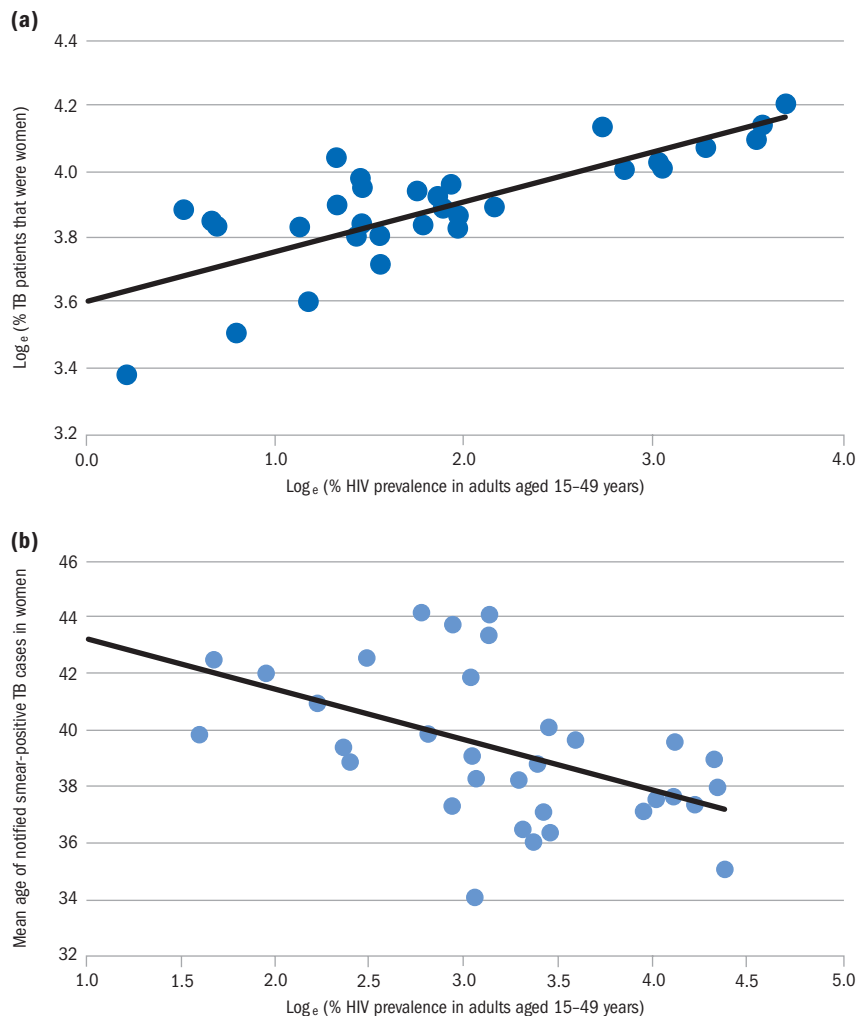


FIGURE 5

The number of extrapulmonary TB cases as a percentage of the total number of cases reported, for each of the six WHO regions

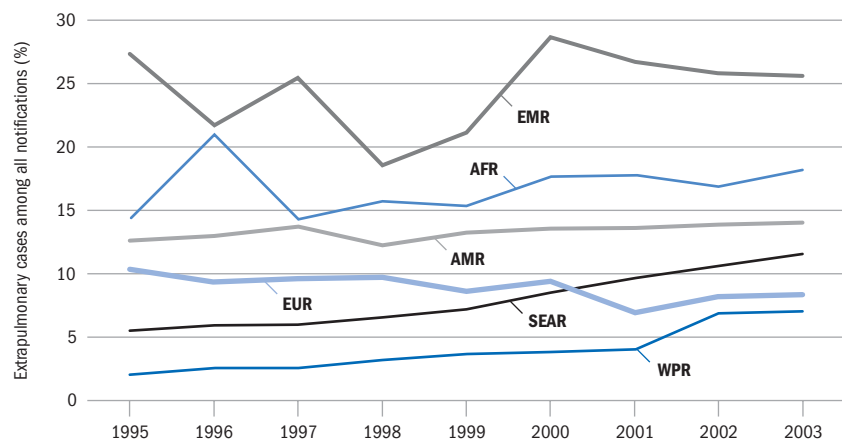
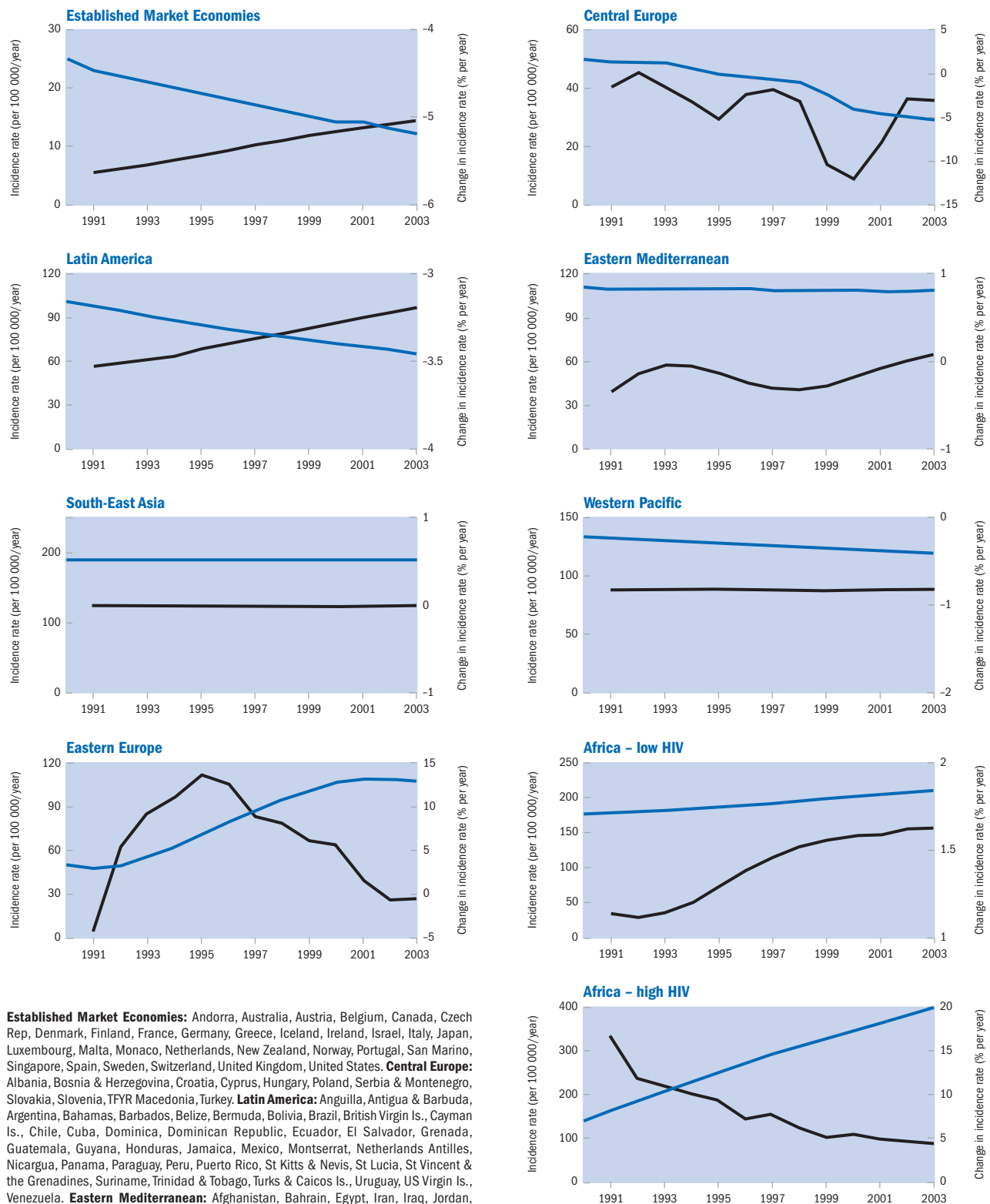


FIGURE 6

Trends in estimated TB incidence rates (all forms; blue lines), and the annual change in incidence rates (black lines), for nine groups of countries, 1990–2003



Established Market Economies: Andorra, Australia, Austria, Belgium, Canada, Czech Rep, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Israel, Italy, Japan, Luxembourg, Malta, Monaco, Netherlands, New Zealand, Norway, Portugal, San Marino, Singapore, Spain, Sweden, Switzerland, United Kingdom, United States. **Central Europe:** Albania, Bosnia & Herzegovina, Croatia, Cyprus, Hungary, Poland, Serbia & Montenegro, Slovakia, Slovenia, TFYR Macedonia, Turkey. **Latin America:** Anguilla, Antigua & Barbuda, Argentina, Bahamas, Barbados, Belize, Bermuda, Bolivia, Brazil, British Virgin Is., Cayman Is., Chile, Cuba, Dominica, Dominican Republic, Ecuador, El Salvador, Grenada, Guatemala, Guyana, Honduras, Jamaica, Mexico, Montserrat, Netherlands Antilles, Nicaragua, Panama, Paraguay, Peru, Puerto Rico, St Kitts & Nevis, St Lucia, St Vincent & the Grenadines, Suriname, Trinidad & Tobago, Turks & Caicos Is., Uruguay, US Virgin Is., Venezuela. **Eastern Mediterranean:** Afghanistan, Bahrain, Egypt, Iran, Iraq, Jordan, Kuwait, Lebanon, Libyan Arab Jamahiriya, Morocco, Oman, Pakistan, Qatar, Saudi Arabia, Syrian Arab Rep., Tunisia, United Arab Emirates, West Bank & Gaza Strip, Yemen. **South-East Asia:** Bangladesh, Bhutan, DPR Korea, India, Indonesia, Maldives, Myanmar, Nepal, Sri Lanka, Thailand, Timor-Leste. **Western Pacific:** American Samoa, Brunei Darussalam, Cambodia, China, China Hong Kong SAR, China Macao SAR, Cook Is., Fiji, French Polynesia, Guam, Kiribati, Lao PDR, Malaysia, Marshall Is., Micronesia, Mongolia, Nauru, New Caledonia, Niue, N. Mariana Is., Palau, Papua New Guinea, Philippines, Rep. Korea, Samoa, Solomon Is., Tokelau, Tonga, Vanuatu, Viet Nam, Wallis & Futuna Is. **Eastern Europe:** Armenia, Azerbaijan, Belarus, Bulgaria, Estonia, Georgia, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Rep. Moldova, Romania, Russian Federation, Tajikistan, Turkmenistan,

Ukraine, Uzbekistan. **Africa - low HIV:** Algeria, Angola, Benin, Burkina Faso, Cape Verde, Chad, Comoros, Djibouti, Equatorial Guinea, Eritrea, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Madagascar, Mali, Mauritania, Mauritius, Niger, Sao Tome & Principe, Senegal, Seychelles, Sierra Leone, Somalia, Sudan, Togo. **Africa - high HIV:** Botswana, Burundi, Cameroon, Central African Rep., Congo, Côte d'Ivoire, DR Congo, Ethiopia, Gabon, Kenya, Lesotho, Malawi, Mozambique, Namibia, Rwanda, South Africa, Swaziland, Uganda, UR Tanzania, Zambia, Zimbabwe.

the estimated rates of case detection, we have estimated the trends in TB incidence rate (all forms) for nine epidemiologically distinct regions of the world (Figure 6). In six of these regions, the trend in the incidence rate has been downward.

Incidence rates have been increasing for most of the period since 1990 in African countries with low and high rates of HIV infection, and in eastern Europe, although the patterns of change in the three regions are quite different. In African countries with high HIV infection, incidence has been pushed upwards by the spread of HIV, but the rate of increase has fallen from a maximum exceeding 15% per year in the early 1990s (Figure 6). In African countries with lower rates of HIV infection, the rate of increase in TB has never been as high (2–3% per year), but neither are there signs that the increase is slowing. In eastern Europe, the rate of increase reached nearly 15% annually by 1995, but the increase now appears to have been halted, and incidence is once again in decline.

The global trend is obtained by summing the estimated numbers of TB cases across all nine regions (Figure 7). Worldwide, the incidence rate of TB was growing at a maximum of around 1.5% per year in 1995, but less than 1% per year by 2003.

TB and HIV

Some countries have carried out surveys of the prevalence of HIV in TB patients, either nationally or locally, and the results have been reported via the data collection form or the supplementary TB/HIV questionnaire. Although the accuracy of the data is not known because, for example, the design of the surveys has not been fully described, a growing number of countries are testing TB patients for HIV infection.

The prevalence of HIV infection in TB patients can be derived from the incidence rate ratio (IRR). IRR is estimated from the relationship between HIV prevalence in adult TB patients and HIV prevalence in the adult population, where both have been measured together (Figure 8). The IRR derived from the national surveys in this set of data is 8.3 (95% CI, 6.1–

FIGURE 7

Trends in the estimated global TB incidence rate (blue line), and the annual change in incidence rate (black line), 1990–2003

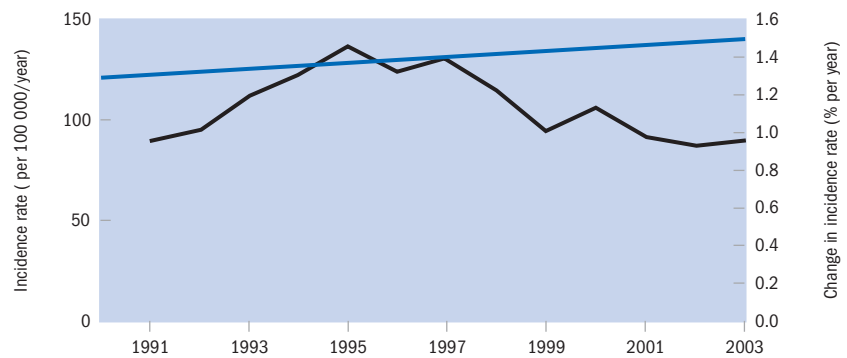


FIGURE 8

The prevalence of HIV in TB patients as measured in national surveys (blue dots) and subnational surveys (data reported to WHO; black dots), plotted against the prevalence of HIV in adults aged 15–49 years (data from UNAIDS). The incidence rate ratio is 8.3 (6.1–10.8; $P = 0.0036$) for the national survey data and 8.4 (7.9–10.0; $P = 0.0029$) for the subnational surveys. The countries are: BFA Burkina Faso; BOT Botswana; BUU Burundi; CAE Cameroon; CAF Central African Republic; CAM Cambodia; CNG Congo; COD DR Congo; DJI Djibouti; ETH Ethiopia; GHA Ghana; HAI Haiti; IVC Côte d'Ivoire; KEN Kenya; LES Lesotho; MAL Malawi; MOZ Mozambique; NIE Nigeria; RWA Rwanda; SOA South Africa; TAN UR Tanzania; ZIM Zimbabwe.

