VIEWPOINT

Resources Required for Global Tuberculosis Control

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We estimate that to achieve the World Health Organization's tuberculosis control targets, the 22 high-burden countries (HBCs) that collectively account for approximately 80% of the world's tuberculosis cases require about $1 billion per year during the period 2001 to 2005. A further $0.2 billion per year is needed for low and lower-middle income countries outside the 22 HBCs. There is a resource gap of up to around $300 million per year. Substantial progress in tuberculosis control could be achieved with increased investment that is large in the context of existing spending, but small in the wider context of global health expenditure.

In the past 2 years, there has been a substantial increase in commitment to tackling three major global health problems: tuberculosis, malaria, and HIV/AIDS (human immunodeficiency virus and acquired immunodeficiency syndrome). In March 2000, 20 of the 22 HBCs that collectively account for approximately 80% of the world's tuberculosis cases committed to achieving the World Health Organization's (WHO) tuberculosis control targets (*1*). The WHO targets are to detect 70% of new smear-positive cases and to cure 85% of detected smear-positive cases by the year 2005 (*2*, *3*). In July 2000, the G8 countries pledged additional resources and set their own targets for the control of HIV, tuberculosis, and malaria (*4*). A "Global Fund to Fight AIDS, Tuberculosis and Malaria" (GFFATM) was established in January 2002; to date, contributions from governments and private sources total almost $2 billion (*5*).

Estimates of the financial resources required for a strengthened response to the HIV/AIDS epidemic have recently been made (*6*). Here, we estimate the financial resources needed for tuberculosis control in the 22 HBC for the period 2001–2005 if WHO targets are to be reached. Existing sources of financing and resource gaps are identified. We also assess total needs and resource gaps for all low and lower-middle income countries (*7*) outside the 22 HBCs. This grouping should cover all countries with resource gaps and almost all countries with a moderate or high burden of tuberculosis.

The 22 HBCs were defined as the countries that ranked first to twenty-second in terms of total estimated tuberculosis cases in 1998, and are as follows: India, China, Indonesia, Bangladesh, Pakistan, Nigeria, the Philippines, South Africa, Ethiopia, Vietnam, the Russian Federation, DR Congo, Brazil, Tanzania, Kenya, Thailand, Myanmar, Afghanistan, Uganda, Peru, Zimbabwe, and Cambodia. They accounted for 6.5 million of the estimated global total of 8.1 million cases in 1998 (*8*).

Estimates were made on a country-by-country basis in three steps (*9*). First, we estimated the total number of new cases that would need to be treated during the period 2001–2005 to achieve the WHO targets. Second, we estimated costs from the perspective of HBC governments and international technical agencies in terms of U.S. ($) prices in the year 2000. We focused on the costs associated with implementation of the internationally recommended DOTS strategy (*10*), as this is the strategy that HBC countries have adopted to achieve the targets (*1*). Costs were grouped into three categories: tuberculosis control-specific needs (*11*), use of general health services for treatment, and technical assistance provided by international agencies. Third, we identified financing according to four categories: HBC governments (i.e., regular budgets and loans), grant funds, identified gaps (i.e., those gaps already recognized by HBCs), and possible gaps (i.e., those gaps that may exist but have not been identified by HBCs). Possible gaps were defined in two circumstances. One was when financing for tuberculosis control-specific inputs had not been identified. Where this was the case, we assumed a gap equivalent to the total estimated need. The other was when financing of general health services had not been identified, and capacity was believed insufficient to manage a major expansion in caseload. Here, we conservatively assumed that guaranteed government funding in each year would equate to the cost per patient multiplied by the number of cases detected in 1999. We estimated total costs and gaps for other low and lower middle-income countries by extrapolating from the 22 HBCs.

Our estimates suggest that if control targets are met in 2005, approximately 21 million new tuberculosis cases will need to be treated in the 22 HBCs during the period 2001–2005. Almost half of these cases will be in India and China. Treatment costs amount to $5 billion (Fig. 1), an average of $1 billion per year and $240 per patient treated. South Africa, the Russian Federation, India, and China have the largest needs, averaging $230 million, $167 million, $111 million, and $97 million per year, respectively. Most other HBCs need $10 to 40 million per year. Technical assistance from international agencies—essential for successful tuberculosis control in several HBCs—is low cost (around $40 million per year).

Existing financing is predominantly from HBC governments, with relatively minor contributions from grant funding (4%) and a resource gap of up to 27% of total needs (Fig. 2). In absolute terms, the largest identified funding gaps are in China ($45 million per year), Indonesia ($10 million per year), and DR Congo ($7 million per year). In relative terms, identified gaps are highest (25 to 100% of total needs) in Afghanistan, Myanmar, DR Congo, China, Indonesia, and Uganda.

The total funding required in all low and lower-middle income countries outside the 22 HBCs is approximately $200 million per year, with an annual gap of about $20 million.

These estimates suggest that, for a relatively small amount of money, millions of tuberculosis patients in developing countries could be treated and cured with a proven intervention. For comparison, with approximately 110,000 tuberculosis patients per year and a cost per patient of approximately $10,000 (*12*, *13*), total annual expenditures in the 23 high-income

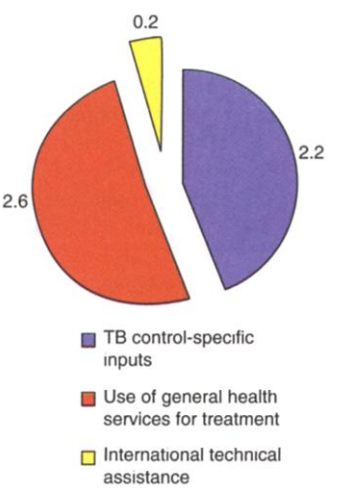

Fig. 1. Estimated resources (in billions of dollars) required for tuberculosis control in the 22 HBCs during the period 2001 to 2005.

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OECD (Organization for Economic Co-operation and Development) countries may surpass $1 billion. Nevertheless, there are large funding gaps, which must be filled if major progress is to be made in global tuberculosis control. The share of total funding needs being provided by HBC governments varies even among countries with similar overall levels of income. This indicates that some of the increased resource requirement could be provided locally. The poorest countries are likely to require increased support from traditional donors or the GFFATM.

There are few studies with which to compare our results. One recent analysis has estimated total needs of around $6 billion for a very similar group of countries during the period 2001–2005 (*14*), which is consistent with our figures. The report of a Commission on Macroeconomics and Health indicates that an additional $0.5 billion per year is required during the period 2002–2007, compared with existing expenditures (*15*). The indicator of "additional resources required" used in this report is most analogous to our gap estimate. However, our gap estimate is lower because it accounts for the increased budgets being pledged for tuberculosis control and for capacity to manage an increase in cases in some countries.

Our analysis has three important strengths. First, we were able to use data from country-specific plans and budgets, including detailed budgets for the two countries with the largest number of cases, India and China. Second, all estimates of the costs associated with use of general health services in the 22 HBCs were based on a country's current approach to diagnosis and treatment. Third, for the two HBCs estimated to have the largest resource requirements, we used recent and detailed cost study data.

The analysis also has several limitations. Reflecting uncertainty in incidence rates, there is uncertainty regarding the total number of cases that will need to be treated if control targets are to be achieved.

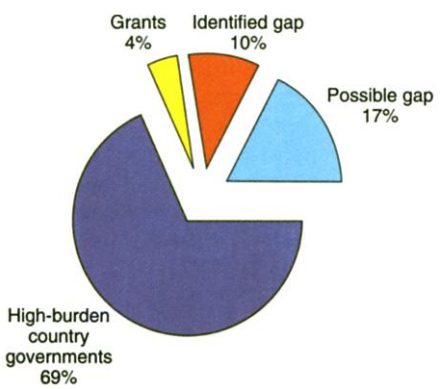

Fig. 2. Estimated funding and funding gaps for tuberculosis control in the 22 HBCs during the period 2001 to 2005.

Plans and budgets are not yet available for three HBCs: the Russian Federation, South Africa, and Zimbabwe. Few plans include analysis of whether general health services can manage an expansion in the number of treated cases with existing capacity or whether new investment will be necessary. For most HBCs, there is only one study of the costs associated with use of general health services. We deliberately focused on the resource requirements associated with a country's existing policies and approaches to provision of treatment. However, it should be highlighted that in some countries, notably South Africa and the Russian Federation, reduced reliance on hospital care could increase efficiency and lower total funding needs and funding gaps.

A particularly important limitation is the lack of evidence about what it costs to achieve targets in practice. This makes budgeting for all the inputs required for achievement of global control targets difficult. For example, to achieve the 70% case detection target, 8 of the 22 HBCs will need to more than double their existing case detection rates. The type and magnitude of investment that will be required to do this is not known; all that most countries have at present is knowledge about the resources required for existing levels of case detection. As a result, our estimates of total resource needs and gaps, which usually relied on country budgets for tuberculosis control-specific requirements, could be too low. Across all 22 HBCs, it is notable that less than 10% of these budgets is earmarked for activities specifically aimed at increasing case detection and cure rates. Much more may be required.

Several steps could be taken to improve budget development. These include more analysis of the reasons targets have not yet been met and the actions and funds required to address identified constraints. Definition of the inputs used in pilot projects that have succeeded in raising case detection or cure rates and their costs, as well as the costs of the investments made in places where targets have already been achieved, would also be useful. The 2001–2003 strategic plan for Uganda is a good example of the value of such information (*16*). The main strategy emphasized in this plan is expansion of community-based care (CBC). CBC was piloted in 1998 in response to a situational analysis that identified poor geographical and financial access to health facilities as the main constraint to achievement of control targets; after implementation, cure rates improved dramatically (*16*). CBC is now being introduced countrywide, with the inputs and associated budget for expansion based on what was used in the pilot districts. In the absence of this type of analysis and planning, control targets are unlikely to be achieved even with the provision of additional funds.

Overall, this analysis suggests that substantial progress in tuberculosis control could be achieved with increased investment that is large in the context of existing spending, but small in the context of global health expenditure. Given the limitations of presently available data, important priorities include (i) more country-specific analyses of what additional resources are required to strengthen general health services and (ii) better definition and cost analysis of the new interventions or strategies needed to facilitate improved levels of control. In the meantime, new funds would be best targeted to already-identified funding gaps, which currently total about $100 million per year.

References and Notes

1. Ministerial Conference on Tuberculosis and Sustainable Development, *Amsterdam Declaration to Stop Tuberculosis*, adopted in Amsterdam, Netherlands, 24 March 2000. Available at: www.stoptb.org/conference/Decla.access.html.
2. *An Expanded DOTS Framework for Effective Tuberculosis Control* (World Health Organization, Geneva, 2002), p. 4.
3. Cases are categorized as smear-positive pulmonary, smear-negative pulmonary, or extrapulmonary. Though the targets focus on new smear-positive cases, our estimates cover all three types of case.
4. G8 countries, *Chair's Summary Okinawa International Conference on Infectious Diseases*. Available at: www.stoptb.org/material/G8OkinawaReport.htm
5. The Global Fund to Fight AIDS, Tuberculosis & Malaria. Information available at: www.globalfundatm.org/.
6. B. Schwartländer *et al.*, *Science* **294**, 521 (2001).
7. We defined "low and lower-middle income" as per capita income less than $2996 in 1999, in accordance with the World Bank (see www.worldbank.org/data/databytopic/class.htm).
8. *Global Tuberculosis Control: WHO Report 2000*. WHO/CDS/TB/2000.275 (World Health Organization, Geneva, 2000), p. 10.
9. Full details of methods and results (including uncertainty analyses) are provided in supplementary material, available on *Science* Online at www.sciencemag.org/cgi/content/full/295/5562/2040/DC1.
10. The five elements of the DOTS strategy are as follows: (i) government commitment to sustained tuberculosis control; (ii) diagnosis by sputum smear microscopy, mostly among self-referring patients; (iii) standardized short-course chemotherapy provided under proper case management conditions, including direct observation of treatment; (iv) an adequate supply of drugs; and (v) a recording and reporting system with assessment of treatment outcomes.
11. Tuberculosis control-specific needs are defined as first-line drugs, dedicated tuberculosis program or project staff and facilities, diagnostic supplies and equipment, training, program management, and activities specifically designed to increase case detection and cure rates.
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16. Ugandan Ministry of Health, *National Tuberculosis and Leprosy Programme: A three years strategic plan for the expansion of community-based TB care, 2001/2-2003/4*. (National Tuberculosis and Leprosy Programme, Kampala, Uganda, 2001).
17. We thank the tuberculosis programme managers of the HBCs, WHO regional and country office staff, and C. Watt and C. Dye.