In the early 1990s, the global public-health community woke up to the reality that despite the availability of effective diagnostic and therapeutic tools, tuberculosis was one of the world’s leading killers. The strategy that was subsequently devised, DOTS, was based on decades-old principles and technologies, but was engendered by new energy and political will (panel); the aim, to achieve 70% case detection and 85% cure rate by 2005. Although these goals were not achieved on a global scale and implementation of the programme has been patchy and sporadic in places, overall its roll-out has been rapid and effective. That said, DOTS can only be the foundation for global tuberculosis control; to truly contain the disease, much more is needed in the control of multidrug-resistant tuberculosis (MDR-TB) and the development of drugs, diagnostics, and vaccines.

As of 2005, DOTS had been implemented in 182 countries, covering 77% of the world’s population. Globally, the case detection rate under DOTS increased from 11% in 1995 to almost 45% by 2003, and was expected to be greater than 50% by the end of 2005. In 2003, about 1·8 million new smear-positive cases were treated by DOTS. Even in the WHO African region, which is burdened by multiple health crises, the case detection rate rose from 24% in 1995 to 50% by 2003.

In India and China, the two most populous countries in the world, expansion has been impressive, with 60% of additional DOTS cases treated in these two countries in 2003. In India, which accounts for 20% of the global incidence of tuberculosis and has more cases than any other country, DOTS expansion has been rapid. Between 1997, when the Revised National Tuberculosis Control Program (RNTCP) was expanded nationally, and early 2005, DOTS coverage increased from 20 million (less than 2% of the population) to more than 1 billion people (90%). In China, DOTS implementation began in 13 of the 31 mainland provinces in 1991 and, by the middle of 2005, coverage was 100%.

Since the epidemiology of tuberculosis is affected by multiple social and biological factors, assessment of the actual effect of DOTS is difficult. While results have been exceedingly good in the WHO Western Pacific region, the cure rates have been disappointing in the African region, the established market economies, and eastern Europe. Overall data, though encouraging, cannot single out DOTS as a causal factor in slowing the tuberculosis pandemic. However, in China, between 1990 and 2000, greater reductions were seen in the prevalence of pulmonary (32%), smear-positive (32%), and culture-positive (37%) disease in DOTS-covered areas than elsewhere, and in Peru the incidence of pulmonary tuberculosis has decreased by 6% per year since DOTS was expanded nationwide. In India, 600 000 additional lives were saved during the first 8 years of DOTS operation. Although similar success has been noted in Uganda, Tanzania, and Malawi, the results have been equivocal in countries with good tuberculosis control programmes already in place, such as Vietnam.

Clearly the biggest failure of DOTS has been in Africa, where rates of tuberculosis continue to rise, seemingly unabated. In 2002, the African region showed less than 75% cure rates and death rates as high as 8% in patients coinfected with *Mycobacterium tuberculosis* and HIV. Whether this statistic indicates a failure of DOTS or is the result of the rapid spread of the HIV epidemic is debatable. Eastern Europe, another region plagued by poor health systems and an expanding HIV epidemic, witnessed continued increases in tuberculosis incidence rates throughout the 1990s, though this increase seems now to have peaked. Increases in incidence rates of disease are also noted in central Asian countries, though the death rate in DOTS recipients remains stable at 5%. Both eastern Europe and central Asia are also the hotspots of MDR-TB.

Although there is an absence of rigorous data to lend support to the efficacy of DOTS, the strategy can be said to have strengthened public health-care capacity. Indeed, DOTS’ greatest legacy to the overall health of poor countries might not be in control of tuberculosis, but rather in helping to build the basic infrastructure of a public-health system. In India, for example, where the public-health-care sector is especially weak, more than 422 182 health workers have been trained during expansion of DOTS.

Despite substantial success with DOTS expansion, most countries will probably not meet the UN Millennium

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**Panel: Current DOTS strategy and next steps**

**DOTS strategy**
- Political commitment with long-term planning and adequate human and financial resources
- Case detection by sputum-smear microscopy in symptomatic patients
- Standard short-course treatment given under direct observation
- Adequate uninterrupted drug supply
- Systematic monitoring and accountability for every patient diagnosed

**Next steps**
- Continue DOTS expansion with more funding and oversight
- Build on existing DOTS programmes to pursue DOTS-Plus
- Increased funding for research into improved diagnostics, therapeutics, and vaccines
- Revisit strategies of chemoprophylaxis and active case finding
- Use DOTS to strengthen public-sector infrastructure and community-based health programmes and insurance schemes
Government commitment, diagnosis through microscopy, standardised and supervised treatment, uninterrupted drug supply, and regular monitoring, which together constitute DOTS—the WHO recommended tuberculosis control strategy—are all essential for controlling tuberculosis. DOTS has helped make remarkable progress in global control of the disease over the past decade. The gain is evident: nearly 20 million patients have been cured of tuberculosis. However, global statistics suggest that DOTS alone is not sufficient to achieve the 2015 tuberculosis-related Millennium Development Goals (MDG) and the Stop TB Partnership targets. The need for a new strategy that builds on, and goes beyond, DOTS has also been recognised by the Second Ad-hoc Committee on the Global TB Epidemic and the 2005 World Health Assembly.

In June, 2005, WHO’s Strategic, Technical and Advisory Group on tuberculosis approved a new Stop TB Strategy, which was then endorsed by a 400-strong Stop TB Partnership meeting held in October, 2005. Many of the participants of that meeting—tuberculosis programme managers, technical and financial partners, researchers, policymakers, HIV/AIDS experts, health activists, and WHO staff—had a large amount of empirical and modelling support behind them, but have largely been discarded as unfeasible in developing countries. As DOTS lays the framework for local, community-based control, however, these techniques could become more viable. The final strategy involves enhancement of public-private partnerships, especially at a local level, with increased involvement of private practitioners who are typically the first to see patients.

Work in HIV and other emerging infectious and non-communicable diseases has shown that simple disease-based interventions are woefully inadequate in actually improving public health. Tuberculosis thrives on malnutrition, poverty, and AIDS; as such, DOTS or any other single-minded programme, will always fall short. We hope that DOTS can strengthen the public sector infrastructure, including through funding for community-based health initiatives and health insurance, which are necessary to move beyond the single-disease model. In summary, the successes of DOTS have clearly shown that when governments commit themselves to the health of their most vulnerable citizens, great advances can be achieved. Its failings have, however, shown that further gains need to be made in overall health status, availability of free and accessible basic health-care services, and the development of newer diagnostic and therapeutic methods.

WHO’s new Stop TB Strategy

Mario C Raviglione, Mukund W Uplekar

Development Goals’ target of halving the prevalence of tuberculosis and the associated death rates between 1990 and 2015. Further innovative steps need to be taken as the public-health community moves beyond DOTS expansion to global tuberculosis control (panel).

DOTS-Plus—WHO’s supplemental strategy for use in areas with a high prevalence of MDR-TB—is a first step in moving beyond DOTS. Already several countries, with the help of the WHO’s Green Light Committee, are rolling out DOTS-Plus to treat MDR-TB. Two more strategies that need to be considered are active case finding and chemoprophylaxis. Both these methods have a large amount of empirical and modelling support behind them, but have largely been discarded as unfeasible in developing countries. As DOTS lays the framework for local, community-based control, however, these techniques could become more viable. The final strategy involves enhancement of public-private partnerships, especially at a local level, with increased involvement of private practitioners who are typically the first to see patients.

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Conflict of interest

We declare that we have no conflict of interest.

References


11 Kim JY, Mukherjee JS, Rich ML, Mate K, Bayona J, Becerra MC. From multidrug-resistant tuberculosis to DOTS expansion and beyond: making the most of a paradigm shift. Tuberculosis (Edinb) 2003; 83: 59–65.