CDC's Response to Ending Neglect: The Elimination of Tuberculosis in the United States

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Contents

Executive Summary

In collaboration with divisions in the National Center for Infectious Diseases, the Public Health Practice Program Office, and the National Institute for Occupational Safety and Health, the Division of Tuberculosis (TB) Elimination of the National Center for HIV, STD, and TB Prevention (NCHSTP),* Centers for Disease Control and Prevention (CDC), is the functional equivalent of a national TB program in the United States. As such, CDC is the federal government's lead agency for TB prevention, control, and elimination.

In 1989, CDC published *A Strategic Plan for the Elimination of Tuberculosis in the United States.* This plan had been developed by the Advisory Council for the Elimination of Tuberculosis (ACET) and proposed a national strategy for TB elimination by 2010. The implementation of this plan was set back by the TB resurgence that occurred in the late 1980s and early 1990s. This rekindling of TB disease was fueled by the onset of the human immunodeficiency virus (HIV) epidemic, increases in TB cases among foreign-born persons, outbreaks in congregate settings, and the appearance and transmission of deadly multidrug-resistant (MDR) TB strains. These occurred at a time when decades of cuts in TB funding had resulted in the deterioration of TB control programs, and TB control officials had very few resources with which to fight back. CDC published the *National Action Plan to Combat Multidrug-Resistant Tuberculosis* in 1992 to complement the 1989 TB elimination document.

A renewed downturn in TB incidence since 1993 points to the successful implementation of these national plans over the past decade. Unprecedented low rates of TB disease now provide a historic opportunity to accelerate the decline in TB morbidity and the drive toward elimination. This opportunity is threatened, however, by several converging factors: 1) the retreat of TB into high-risk populations at the margins of society where it can resist detection, 2) the persistence and growth of the global TB epidemic, 3) the limitations of current control measures and recognition of the need for new tests and treatments, plus an improved vaccine, and 4) changes in the health care system that make the current context for TB elimination very different from that of a decade ago.

Given this altered landscape, in late 1998 CDC commissioned the Institute of Medicine (IOM) of the National Academy of Sciences to conduct a study and determine if TB elimination is still feasible as a national goal and, if so, to provide recommendations on how to make that goal a reality. The resulting report, *Ending Neglect: The Elimination of Tuberculosis in the United States,* concluded that TB elimination in the United States is indeed feasible but will require "aggressive and decisive action beyond what is now in effect." To break the "cycle of neglect" that has characterized U.S. tuberculosis control efforts, the report recommended an aggressive strategy to 1) maintain control of TB, 2) speed the decline in TB incidence, 3) develop new tools for TB diagnosis, treatment, and prevention, 4) increase U.S. efforts to help fight the global epidemic, and 5) mobilize and sustain public support for TB elimination and track progress.

**NCHSTP provides leadership in preventing and controlling human immunodeficiency virus (HIV) infection, other sexually transmitted diseases (STDs), and TB.*

Rationale for TB Elimination

TB maintains its grim historical notoriety as one of the leading infectious causes of death worldwide. Ironically, it is preventable and, in most cases, treatable. Infection-control precautions can help reduce the risk of TB transmission. Medical treatment of persons with latent TB infection can prevent the subsequent development of active TB disease. TB disease can usually be cured with anti-TB drugs taken exactly as prescribed. Even persons with drug-resistant strains can often be cured by alternative regimens of medications. The downturn in TB incidence that occurred between 1993 and 2001 is directly attributable to the resources used to strengthen TB control programs and implement these measures nationwide. The question now is whether this success will lead to waning interest and another cycle of neglect or provide the impetus for a final push toward TB elimination.

The continuing social, public health, and economic costs of TB provide a compelling rationale for TB elimination. Almost 16,000 new cases of TB disease occurred in 2001 in the United States, and an estimated 10 million to 15 million persons have latent TB infection with the attendant risk of future disease. Costly TB outbreaks continue to occur in the United States, and MDR TB continues to spread. TB-related costs approach $1 billion each year in this country.

Nonetheless, TB incidence is presently at an all-time low, and several factors strengthen the feasibility of and justification for elimination. TB is retreating into geographically and ethnographically distinct populations that, although hard to reach, can nonetheless be targeted for prevention and control interventions. Arguments based on social justice support increased efforts to combat a grave health problem that disproportionately affects disenfranchised persons. Finally, a U.S. initiative can stimulate other nations to seek the social and economic benefits to be derived from TB elimination.

CDC's Response to Ending Neglect: the Elimination of TB in the United States

This document is CDC's response to the IOM's TB elimination challenge. The plan reflects the scientific, programmatic, and health-sector developments of the last decade and supercedes the 1989 *Strategic Plan for the Elimination of Tuberculosis in the United States*. The goals, objectives, and action steps that comprise CDC's contribution to TB elimination will serve as a guide for CDC's work, in collaboration with its partners, to finally rid the nation of the human suffering and societal harm caused by TB disease.

The plan is organized around six goals that frame TB elimination efforts in the context of the IOM's recommendations. The goals and corresponding objectives are as follows:

Goal I: Maintain control of TB

Maintain the decline in TB incidence through timely diagnosis of active TB disease, appropriate treatment and management of persons with active disease, investigation and appropriate evaluation and treatment of contacts of infectious cases, and prevention of transmission through infection control.

Objectives:

A. Maintain and enhance local, state, and national public health surveillance for TB.

B. Support the infrastructure needed for laboratory-based identification and treatment of TB.

C. Ensure that patient-centered case management and monitoring of treatment outcomes are the standard of care for all TB patients.

D. Develop community partnerships, and strengthen community involvement in TB control.

E. Improve the timely investigation and appropriate evaluation and treatment of contacts with active TB disease and latent TB infection.

F. Ensure appropriate care for patients with MDR TB, and monitor their response to treatment and their treatment outcomes.

G. Ensure that health care facilities maintain infection-control precautions.

H. Develop improved engineering and personal protective techniques to prevent TB transmission.

I. Improve TB control in foreign-born populations entering or residing in the United States.

J. Educate the public and train health care providers to maintain excellence in TB services.

Goal II: Accelerate the decline

Advance toward TB elimination through targeted testing and treatment of persons with latent TB infection, appropriate regionalization of TB control activities, rapid recognition of TB transmission using DNA fingerprinting methods, and rapid outbreak response.

Objectives:

A. Increase the capacity of TB control programs to implement targeted testing and treatment programs for high-risk persons.

B. Explore the appropriateness of regionalizing TB control activities in high, intermediate, and low TB-incidence areas of the United States.

C. Characterize circulating *M. tuberculosis* strains using DNA fingerprinting methods.

D. Develop national, state, and local capacity to respond to outbreaks of TB.

Goal III: Develop new tools

Develop and assess new tools for the diagnosis, treatment, and prevention of TB.

Objectives:

A. Develop a coordinated plan for TB research.

B. Develop new methods for diagnosing persons with latent TB infection and for identifying infected persons who are at high risk for developing active TB.

C. Develop and assess new drugs for improving TB treatment and prevention.

D. Develop a new and effective TB vaccine.

E. Develop and implement a program of research on behavioral factors related to TB treatment and prevention.

F. Rapidly transfer findings from research studies into practice.

Goal IV: Reduce the global burden of TB

Increase U.S. involvement in international TB control activities.

Objectives:

A. Provide leadership in public health advocacy for TB prevention and control.

B. Provide technical support and build capacity for implementation of the World Health Organization strategy for TB control (i.e., DOTS), especially in those countries that contribute significantly to the U.S. TB burden.

C. Develop models for the diagnosis and treatment of patients with MDR TB.

D. Provide technical, programmatic, and research support to reduce the incidence of TB as an opportunistic disease in high HIV-burden countries.

Goal V: Mobilize and sustain support

Mobilize and sustain support for TB elimination by engaging policy and opinion leaders, health care providers, affected communities, and the public. Implement a comprehensive health communication campaign that supports TB elimination and ensures the development and delivery of effective TB elimination messages. Improve communication efforts through consistent monitoring and evaluation of the plan's methods and strategies.

Objectives:

A. Develop and implement a health communications effort focusing on the achievable goal of eliminating TB, if both political commitment and resources are made available.

B. Help communities foster nontraditional, multisectoral, public-private partnerships to improve the effectiveness of their communications activities, with particular attention to culturally appropriate materials.

C. Support the development of state- or area-specific TB elimination plans that contain communications activities designed to build support for TB elimination.

Goal VI: Track progress

Monitor progress toward the goal of TB elimination, and regularly report on progress to all target audiences.

Objectives:

A. Develop innovative analyses for examining surveillance data to help focus elimination efforts.

B. Develop novel indicators of progress toward elimination.

C. Conduct periodic evaluations of TB program performance at federal, state, and local levels.

D. Conduct an annual progress review.

CDC's Response to Ending Neglect: The Elimination of Tuberculosis in the United States complements a separate, more comprehensive, coordinated federal response to the IOM's recommendations by providing more detail on CDC's part of the federal strategy. Implementation of these plans will set in motion the activities needed to eliminate TB in the United States.

Introduction

Historical Perspective

Tuberculosis (TB), once the leading cause of death in the United States, appeared to be receding into history by the latter part of the 20th century. Thanks to improved social and economic conditions and the development of effective drugs, TB case counts had fallen off so dramatically by the 1980s that U.S. TB experts believed TB could be virtually eliminated from the United States by the year 2010. The Advisory Council for the Elimination of Tuberculosis (ACET) developed and outlined these projections in *A Strategic Plan for the Elimination of Tuberculosis in the United States*, which was published by the Centers for Disease Control and Prevention (CDC) in 1989. In this document, ACET proposed a national strategy for TB elimination, defined as an incidence rate of less than one TB case per 1 million persons per year.[1] Actions to achieve that goal centered on making better use of existing TB prevention and control methods; creating and evaluating new tools for diagnosing, treating, and preventing TB; and rapidly applying these tools to clinical and public health practice.

The implementation of this plan was set back by the unexpected resurgence of TB that occurred in the mid 1980s and early 1990s. The reversal of the longstanding downward trend in TB incidence was fueled by several converging factors: the onset of the human immunodeficiency virus (HIV) epidemic, increases in TB cases among foreign-born persons, outbreaks in congregate settings (e.g., hospitals, correctional facilities, hospices), and delays in recognizing the appearance and transmission of deadly, drug-resistant TB strains that defy traditional treatments.[2-4] At the same time, premature cuts in TB funding and the subsequent deterioration of TB prevention and control programs impaired the ability of these programs to respond to the resurgent TB. The *National Action Plan to Combat Multidrug-Resistant Tuberculosis* was promptly developed and published in 1992 to complement the 1989 TB elimination plan.[5]

During the past decade, these plans have guided the nation's TB control programs and propelled its mobilization against the resurgent TB. Efforts to implement the strategies recommended in these plans have been largely successful, as evidenced by a renewed downturn in TB incidence).[6,7] Nonetheless, some emerging changes in the features and management of TB in the United States are challenging control efforts and threatening to thwart the drive toward elimination:

- As numbers of TB cases have steadily dropped, the disease has retreated into localized areas and population groups who may be hard to reach using the traditional public health approaches, so that it can lie hidden and resist detection. The persistence of TB in these high-risk populations poses threats for yet another widespread comeback.
- Although screening and treatment efforts have led to great progress in blocking the spread of TB, it has become increasingly clear that elimination will require better tests and treatments, plus an improved vaccine.[8]
- Despite falling numbers of cases in the United States and in a few other resource-rich countries, the global TB epidemic continues to rage in many other countries, and remains an important source of new U.S. cases in the person of immigrants and refugees. As of 2001, TB cases in foreign-born persons now account for at least 50% of all cases

reported in the United States annually.[7] In contrast to the marked decline in TB case rates in U.S.-born persons, the TB control measures implemented in the early 1990s have had little impact on TB case rates in foreign-born persons.[9]

- Changes in the organization, delivery, and financing of health care brought about by the shift to managed care make the current context for TB prevention, control, and elimination very different from that of a decade ago.[10]

Given this altered landscape, in late 1998 CDC commissioned the Institute of Medicine (IOM) of the National Academy of Sciences to conduct a study to determine if TB elimination is still feasible as a national goal and, if so, to provide recommendations for making that goal a reality. In the resulting report, *Ending Neglect: The Elimination of Tuberculosis in the United States*,[11] the IOM concluded that TB elimination in the United States is indeed feasible but that meeting this goal will require "aggressive and decisive action beyond what is now in effect." Current efforts in TB control will not be sufficient, and doing less could be disastrous. To break the "cycle of neglect" that has characterized U.S. tuberculosis control efforts, the report recommended an aggressive campaign to release TB's tenacious grip on the nation.

At the current rate of decline in TB incidence, it is estimated that it will take at least 70 years to reach the U.S. elimination goal of less than 1 case per million population by the target year of 2010. To speed progress toward elimination, the IOM pressed for an acceleration in the rate of reduction in the incidence of new TB cases. Stepping up the pace would yield numerous benefits to the nation[11] by reducing the

- Number of persons suffering with TB
- Costs of medical care for TB patients
- Risk of a resurgence of TB
- Risk of multidrug-resistant TB (MDR TB)
- Risk of spread to TB-free areas of the United States
- Complications caused by TB in HIV-infected persons

Additionally, it would contribute to a reduction in the global burden of TB and hasten the eventual elimination of TB from the United States.

CDC's Response to Ending Neglect: The Elimination of Tuberculosis in the United States outlines the background and rationale for eliminating TB in the United States and presents the goals, objectives, and action steps that comprise CDC's new strategy for TB elimination. The plan will serve as a guide for CDC's work, in collaboration with its partners, to finally rid the nation of the human suffering and societal harm caused by TB disease.

TB: A Preventable and Treatable Disease

Tuberculosis is a contagious and potentially life-threatening infectious disease caused by bacteria of the *Mycobacterium tuberculosis* complex. The bacteria that cause TB are spread from person to person through the air. People with TB disease of the lungs or larynx spray the bacteria into the area when they cough, sneeze, talk, or otherwise expel air, dispersing droplets containing *M. tuberculosis*. People nearby can breathe the infectious droplets into their lungs and become infected. Infection usually requires prolonged contact in a confined area with a person who is actively expelling TB bacteria into the air. In rare cases, TB infection has been documented after short exposures to persons with active TB.[12,13]

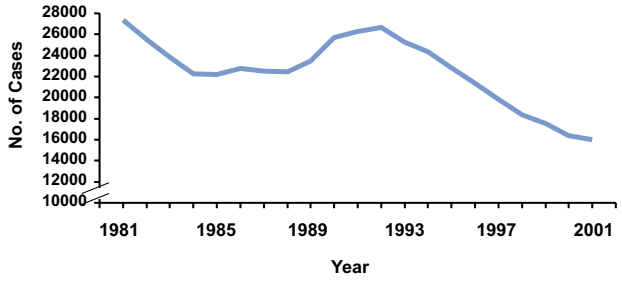
In most infected persons, merely harboring TB organisms is not enough to cause symptoms or to produce an active case of the disease. The body's immune system is usually able to contain the infection but may not be able to eliminate it without help from anti-TB drugs. A person with latent TB infection remains infected until correct treatment is completed. Without treatment, infected persons can develop active, clinical disease at any time. The persons most likely to become ill are those whose immune systems have been weakened by illness, old age, or malnutrition. To spread TB to others, a person must have active TB disease.

TB maintains its grim historical notoriety as one of the leading infectious causes of death worldwide; yet, it is preventable and, in most cases, treatable. Infection-control precautions can help reduce the risk of TB transmission. Treatment of persons with latent TB infection can prevent the subsequent development of active TB, and TB disease can usually be cured with available anti-TB drugs. Even persons with drug-resistant strains can often be cured by alternative regimens of medications. Nonetheless, TB continues to menace Americans. Several closely interconnected social, political, and medical factors persist in fueling disease transmission and imperiling elimination goals.

Cycles of Resurgence and Control

The resurgence of the U.S. TB epidemic that occurred in the late 1980s had its origins in the complacency of the early 1970s. When medical advances and improved societal conditions seemed to be controlling TB by the 1960s, funding dedicated to fighting the disease was prematurely cut. The result was a breakdown in control efforts in many parts of the country. TB soon returned with a vengeance. Disease rates jumped, deadly drug-resistant strains emerged, and new outbreaks in the late 1980s quickly turned into an epidemic that cost billions of dollars to control[3, 14] and also cost many people their health or even their lives. Hundreds of difficult- and expensive-to-treat drug-resistant cases developed. The nation had dropped its guard, and a preventable and treatable disease had once again turned deadly.

Studies conducted during the period of resurgence (1985-1992) indicated substantial ongoing transmission of TB and development of disease in larger-than-expected numbers in recently infected persons.[15, 16] However, in a pattern suggesting the existence of several concurrent U.S. epidemics, the phenomenon appeared to be mainly affecting certain high-risk populations: HIV-infected persons (TB thrives in a weakened immune system), foreign-born persons (people from areas where TB is common often have latent TB infection), homeless persons (TB is easily spread in the crowded confines of homeless shelters), and persons living in congregate settings (persons with unrecognized or undiagnosed TB are often housed among susceptible people in close quarters). The increase in the number of persons with drug-resistant TB was attributed largely to institutional outbreaks involving persons with HIV infection.[3, 4] The rise in total cases, coupled with increased drug resistance, created formidable challenges for state and local control programs.[5]



The resurgence of TB in the United States

The comeback of TB prompted the mobilization of improved prevention and control efforts. These centered on rapid identification of persons with TB, initiation of appropriate treatment, and implementation of strategies such as directly observed therapy (DOT) to ensure that patients complete their treatment.[17, 18, 19] Many areas expanded their TB screening and treatment efforts directed toward high-risk groups, especially persons at risk for HIV infection and those in correctional facilities. Surveillance data and research on adherence to treatment further characterized risk groups, leading to more targeted interventions. In parallel with these surveillance and research activities, public health agencies produced much-needed training and educational products for health care providers, with timely development of materials to reflect clinical advances and changing TB epidemiology. ACET and CDC jointly issued a series of statements on TB control practices, and three Model TB Centers were established as national resources for TB services, consultation, and training. As a result, cases have dropped each year since 1993, reaching an all-time low in 2001.[7]

Challenges to Elimination

The downturn in TB incidence that has occurred since 1993 is directly associated with the increased resources used to strengthen state and local TB control programs nationwide.[11] The question now is whether this success will lead to complacency, then to waning interest and another cycle of neglect, or provide the impetus for a final push toward TB elimination. At a minimum, future planning for TB control will have to address several recalcitrant problems.

Proven and essential measures that would improve the timely completion of TB treatment are underused in many areas.[20] In addition, the investigation of contacts of infectious cases and the treatment of persons with latent TB infection are often inadequate.[21,22] In some areas where TB case counts have been declining, an erroneous and dangerous perception is again emerging that TB may no longer be a serious problem requiring sustained resources. With such perceptions, we risk losing what we have recently gained.

The marked changes in the provision and financing of health care in the United States that have come about as a result of managed-care policies and practices during the past decade present added challenges for TB control. Nearly 80 million Americans are now enrolled in health-maintenance organization plans.[10] Managed-care programs serve one third of Medicaid beneficiaries, with enrollment in such programs growing at the rate of 30% to 40% annually.[23] The opportunity exists for TB control programs to work with managed-care programs in the provision of high-quality — and potentially cost-saving — preventive TB services to high-risk persons.[24, 25] However, it is uncertain to what extent these organizations will support optimal TB surveillance and reporting, as well as provide treatment and prevention services. Additionally, the large numbers of uninsured persons not covered by managed-care plans pose an ongoing challenge to TB prevention and control efforts.

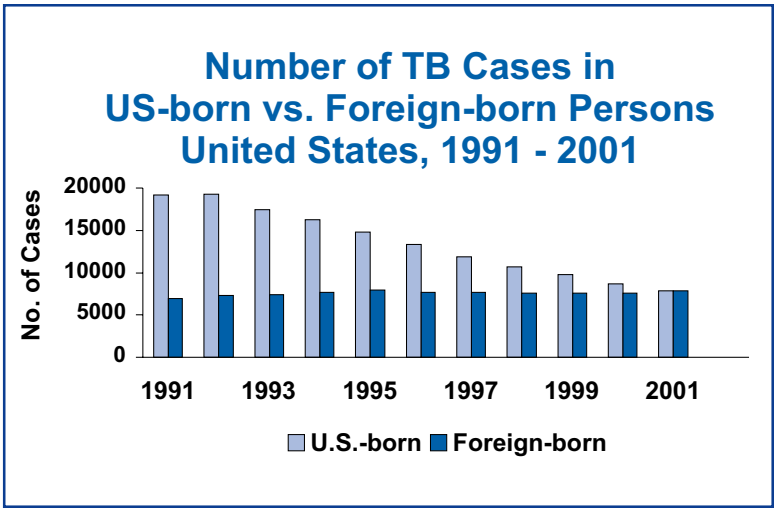
TB control is also hampered by inefficient and outdated diagnostic tools. The current TB skin test takes 2 days to complete, is difficult to read, and is often inaccurate in populations with a low prevalence of TB. Technological advances can help speed the way toward TB elimination, but methods for optimizing the use of new technology are still being evaluated. The past decade has seen notable advances in TB diagnostics, including the development of new methods that greatly reduce the time needed to detect the growth of TB organisms in diagnostic

specimens.[26-27] Rapid methods for identifying drug-resistant TB are under investigation,[28, 29] and new blood tests for detecting latent TB infection show promise.[26, 27, 29-33] DNA fingerprinting methods have been used to identify *M. tuberculosis* strains implicated in outbreaks, and the role of these methods in detecting ongoing community TB transmission is being assessed.[32, 34]

The TB drug development process is moving more slowly than diagnostics development. Scientists have made advances in describing the mechanisms of drug actions and drug resistance, and these advances are contributing to the development of new types of anti-TB drugs. In 1997, CDC established the TB Trials Consortium (TBTC) and tasked it with undertaking clinical trials of new drugs for TB treatment and prevention in the United States. TBTC data assisted the Food and Drug Administration (FDA) in its evaluation in 1998 of rifapentine, the first new TB drug approved in more than 25 years.[35] Clinical trials of "short-course" treatment for latent TB infection have led to CDC recommendations for the use in selected settings of a 2-month regimen of the anti-TB drugs rifampin and pyrazinamide as an alternative to longer courses of isoniazid.[36] Unfortunately, despite the need for new drugs, too few pharmaceutical companies are involved in TB drug development.[37]

A significant research effort is being directed to the development of new TB vaccines. The successful decoding of the complete genome of *M. tuberculosis* should accelerate the process of vaccine development,[38] and several candidate vaccines will likely be available soon for human testing. In 1998, the National Institutes of Health (NIH), together with the National Vaccine Program Office (NVPO) and ACET, issued the *Blueprint for Tuberculosis Vaccine Development.*[39] The agencies concluded that a safe and protective TB vaccine could be developed but that the effort would require a sustained and substantive commitment (20 years and approximately $800 million) and international and public-private sector collaboration.

Most importantly, the United States' recent success in TB control is tempered by the heavy impact of TB in foreign-born persons living in the country. The global burden of TB is staggering, with nearly 8 million new cases and 2 million deaths each year.[40] As the number of cases in indigenous persons drops, an increasing percentage of U.S. cases is occurring in persons from Asian, Latin American, and African countries, where TB rates are 5 to 30 times those of the United States.[41] The TB case rate for foreign-born persons in the United States has remained at least four to five times higher than that for U.S.-born persons, and the proportion of U.S. TB cases occurring in foreign-born persons has increased steadily since the mid-1980s.[9] In 2001 the proportion of TB cases among foreign-born persons living in the United States had reached 50% (see graph).[7]



TB elimination in the United States will therefore not be possible without a substantial reduction in the global burden of TB. Global TB control efforts are, however, hampered by a combination of barriers. Foremost among these is the inability of the governments of

some TB-affected nations to develop the political will needed, and of some donor nations to provide the financial resources needed, for effective TB control. The World Health Organization (WHO) estimates that in 1997 only 32% of the world's population lived in areas where effective TB control programs were fully operational.[42] In much of sub-Saharan Africa, HIV has led to the doubling and tripling of TB cases, threatening to collapse unstable TB control programs.[43] To date, it appears that none of the strategies for TB control recommended for low-income countries have stemmed the tide of HIV-associated TB. Increases in drug-resistant TB add urgency to the push for effective interventions worldwide.[40, 44]

How to Eliminate TB? – The IOM Report

The IOM report *Ending Neglect: The Elimination of Tuberculosis in the United States*[11] reviewed the lessons learned from the neglect of TB between the late 1960s and early 1990s and reaffirmed the necessity of a commitment to the goal of TB elimination. The IOM emphasized, however, that TB elimination will require a new level of resources and intersector collaboration. The authors called on the federal government to "set the pace in fostering efforts to manage and prevent tuberculosis" and identified five areas for decisive action.

Maintain Control of TB

> *"...without question the major reason for the resurgence of tuberculosis was the deterioration of the public health infrastructure essential for the control of tuberculosis."* p. 2

In the 1970s and early 1980s, the country became complacent about TB, and many states and cities redirected TB prevention and control funds to other programs. Consequently, the trend toward elimination was reversed, and the nation experienced a TB resurgence. To maintain control of TB, the IOM recommended

- Mandating completion of therapy for all patients with active TB
- Evaluating case-management systems used in TB control efforts in new ways
- Regionalizing TB control activities
- Retaining federal categorical funding for TB control
- Educating the public, and training health care providers to maintain excellence in TB services

Accelerate the Decline

> *"At the current rate of decline, approximately 6 percent per year, it will take more than 70 years to reach the target for elimination of tuberculosis of 1 case of tuberculosis per million population."* p. 122

Maintaining control of TB is not enough to eliminate it. People can unknowingly carry TB organisms for years. Finding and treating the estimated 10 million to 15 million Americans with latent TB infection before they become sick — and infectious — is essential to eliminating TB. To speed the decline of TB, the IOM recommended

- Developing better ways to find persons who have been in close contact with someone with infectious TB and, if needed, treat them for latent infection
- Performing TB skin testing as part of the medical examination for immigrants from countries with high rates of TB
- Performing TB skin testing in inmates of correctional facilities
- Increasing targeted TB testing and treatment of latent TB infection in other high-risk groups

Develop New Tools

> *"...the greatest needs in the United States are new diagnostic tools for the more accurate identification of individuals who are truly infected and who are also at risk of developing tuberculosis."* p. 122

The goal of TB elimination cannot be reached with currently available tools. State-of-the-art tools are needed, such as

- Effective tests for latent TB infection and improved methods to determine who will progress from latent TB infection to TB disease
- New drugs to shorten and simplify treatment of both latent TB infection and active TB
- An effective vaccine to prevent infection and active disease
- Behavior-change models to influence at-risk persons and their health care providers

Increase Involvement in Global Efforts

> *"Although an altruistic argument for promoting the global control of tuberculosis can easily be advanced, worldwide control of this disease is also in the nation's self-interest."* p. 149

The United States will never be able to eliminate TB until the global epidemic is under control. The IOM therefore recommended

- Supporting training in TB control in countries with high rates of disease
- Supporting WHO's TB-control initiative
- Targeting resources by development and use of a multiagency strategic plan

Mobilize and Sustain Support

> *"Only an aggressive effort aimed at building political commitment can prevent the elimination of funding for tuberculosis research...before the elimination of the disease, leading to yet another period of neglect."* p. 4

Underlying all of these actions must be a concerted effort to educate the public that TB elimination is achievable, promote scientific consensus on what needs to be done, establish partnerships with leaders of affected groups, and use the media to create public interest. The IOM recommended

- Increasing resources for activities designed to secure and sustain public understanding of and support for TB elimination
- Securing the participation of nontraditional partners
- Tracking progress toward elimination

Why Eliminate TB? – Rationale for TB Elimination

The continuing social, public health, and economic costs of TB provide a compelling rationale for TB elimination. Thousands of new cases of TB disease still occur every year in the United States — there were almost 16,000 in the year 2001 — and an estimated 10 million to 15 million persons have latent TB infection with the attendant risk of future disease. Costly TB outbreaks continue to occur in the United States, and MDR TB continues to spread. Despite recent progress, 43 states and the District of Columbia reported at least one MDR TB case between 1993 and 1997.[45] As a consequence, the cost of TB in the United States is estimated to approach $1 billion yearly.[2]

At present, TB incidence is at an all-time low, and several factors favor the feasibility of the elimination goal. TB is retreating into geographically and ethnographically distinct populations that can be targeted for effective prevention and control interventions. Such targeted interventions are likely to yield excellent results and be cost-effective in further reducing the incidence of TB. A commitment to eliminate TB also reflects society's willingness and ability to combat a grave health problem that disproportionately affects disenfranchised persons. A desire for social justice and the recognition of widespread racial and ethnic disparities in the incidence of TB in the United States argue for more effective TB control and for political action that addresses the root causes of the disparities.[46]

Finally, elimination of TB from the United States evokes the greater vision of worldwide eradication of TB. A U.S. elimination initiative could serve as encouragement to other nations that are aware of the social and economic benefits of a healthy, long-lived population and the social justice that would be served by eliminating TB.

Who Will Lead? – CDC's Response

In collaboration with divisions in the National Center for Infectious Diseases, the Public Health Practice Program Office, and the National Institute for Occupational Safety and Health, the Division of TB Elimination of the National Center for HIV, STD, and TB Prevention, CDC, is the functional equivalent of a national TB program in the United States.[47] As such, CDC is the federal government's lead agency for TB prevention, control, and elimination. Several other federal agencies share crucial roles in contributing to TB prevention and control and its eventual elimination. For example, the FDA approves new drugs and diagnostics and ensures drug quality, the Health Resources and Services Administration (HRSA) and Health Care Financing Administration (HCFA) facilitate access to and financing of health care, and the NIH conducts and supports biomedical research and health care worker training. These and several other agencies form part of the Federal TB Task Force, the members of which coordinate federal TB activities in the United States.

Although current activities to control TB are yielding significant results nationwide, CDC recognizes that TB elimination will require sustained effort, long-term commitment, new tools, and strong partnerships with other federal health agencies and state and local health departments. This document, *CDC's Response to Ending Neglect*, describes CDC's new strategy for achieving TB elimination, taking into account the challenges, advances, and collaborations of the past and building on them.

The plan reflects the scientific, programmatic, and health-sector developments of the last decade and supersedes the 1989 *Strategic Plan for the Elimination of Tuberculosis in the United States*. The response details the CDC priority activities required for the elimination of TB in the United States in the context of the recommendations issued by the IOM report *Ending Neglect* and is organized around six goals and corresponding objectives (Table 1):

I. Maintain control of TB
II. Accelerate the decline
III. Develop new tools
IV. Increase involvement in global efforts
V. Mobilize and sustain support
VI. Track progress toward elimination

CDC's Response to Ending Neglect complements a more comprehensive federal plan to respond to the IOM's recommendations. Implementation of these plans should set in motion the activities needed to arrest TB in the United States.

Table 1. CDC's Response to *Ending Neglect: The Elimination of Tuberculosis in the United States.* Summary of Goals and Objectives

Goal I: Maintain control of TB

Objectives:

A. Maintain and enhance local, state, and national public health surveillance for TB.

B. Support the infrastructure needed for laboratory-based identification and treatment of TB.

C. Ensure that patient-centered case management and monitoring of treatment outcomes are the standard of care for all TB patients.

D. Develop community partnerships, and strengthen community involvement in TB control.

E. Improve the timely investigation and appropriate evaluation and treatment of contacts with active TB disease and latent TB infection.

F. Ensure appropriate care for patients with MDR TB, and monitor their response to treatment and their treatment outcomes.

G. Ensure that health care facilities maintain infection-control precautions.

H. Develop improved engineering and personal protective techniques to prevent TB transmission.

I. Improve TB control in foreign-born populations entering or residing in the United States.

J. Educate the public and train health care providers to maintain excellence in TB services.

Goal II: Accelerate the decline

Objectives:

A. Increase the capacity of TB control programs to implement targeted testing and treatment programs for high-risk persons.

B. Promote the appropriate regionalization of TB control activities in high, intermediate, and low TB-incidence areas of the United States.

C. Characterize circulating *M. tuberculosis* strains using DNA fingerprinting methods.

D. Develop national, state, and local capacity to respond to outbreaks of TB.

Goal III: Develop new tools

Objectives:

A. Develop a coordinated plan for TB research.

B. Develop new methods to diagnose persons with latent TB infection and to identify infected persons who are at high risk for developing active TB.

C. Develop and assess new drugs to improve TB treatment and prevention.

D. Develop a new and effective TB vaccine.

E. Develop and implement a program of research on behavioral factors related to TB treatment and prevention.

F. Rapidly transfer findings from research studies into practice.

Goal IV: Increase involvement in global efforts

Objectives:

A. Provide leadership in public health advocacy for TB prevention and control.

B. Provide technical support and build capacity for implementation of DOTS, especially in those countries that contribute significantly to the U.S. TB burden.

C. Develop models for the diagnosis and treatment of patients with MDR TB.

D. Provide technical, programmatic, and research support aimed at reducing the incidence of TB as an opportunistic disease in high HIV-burden countries.

Goal V: Mobilize and sustain support

Objectives:

A. Develop and implement a health communications campaign focusing on the resources and support needed to eliminate TB.

B. Help communities foster nontraditional, multisectoral, public-private partnerships to improve the effectiveness of their communications activities, with particular attention to culturally appropriate materials.

C. Support the development of state- or area-specific TB elimination plans that contain communications activities to build support for TB elimination.

Goal VI: Track progress toward elimination

Objectives:

A. Develop innovative analyses for examining surveillance data to help focus elimination efforts.

B. Develop novel indicators of progress toward elimination.

C. Conduct periodic evaluations of TB program performance at federal, state, and local levels.

D. Conduct an annual progress review.

GOAL I: Maintain control of TB

Maintain the decline in TB incidence through timely diagnosis of active TB disease, appropriate treatment and management of persons with active disease, investigation and appropriate evaluation and treatment of contacts of infectious cases, and prevention of transmission through infection control.

Tuberculosis control efforts have two priorities: 1) to detect persons with active TB and treat them with effective anti-TB drugs, and 2) to identify contacts of infectious TB cases and evaluate and treat them as needed.

Effective treatment cures patients of TB disease and stops the transmission of infection to others. Being treated for active TB involves taking multiple anti-TB drugs daily or several times a week for at least 6 months. Anti-TB drugs must be prescribed properly and taken for the full treatment period. Otherwise, the disease may not be cured and could recur. Also, the TB organisms could become resistant to standard anti-TB drugs. To maintain control of TB and prevent drug-resistant disease, TB must be accurately diagnosed, an effective treatment regimen must be prescribed, and patients must take all of their medicine. The best way to ensure that patients adhere to anti-TB drug regimens is to provide a patient-centered approach that uses DOT, meaning that a provider watches the patient take the medication.

Contact investigation and follow-up are important for detecting cases of active TB and identifying persons who have latent TB infection and are at high risk for developing TB disease. The identification of every infectious or suspected case of TB should prompt an epidemiologic investigation to locate others who have potentially been exposed and are therefore at risk of infection. To maintain control of TB, contacts of potentially infectious TB cases must be evaluated and, if found to be infected, treated appropriately.

Objective I-A

Maintain and enhance local, state, and national public health surveillance for TB.
State and local health departments are legally responsible for protecting the public health.[48] In the setting of active TB, this responsibility includes 1) ensuring that each patient with active TB completes appropriate treatment, 2) ensuring that a contact investigation is conducted to identify other persons with potentially infectious TB, 3) arranging for the evaluation and treatment of persons with active TB or latent TB infection, and 4) conducting epidemiologic investigations in response to potential outbreaks and implementing control and prevention measures.

The foundation for these activities is public health surveillance (the ongoing, systematic collection, analysis, interpretation, and dissemination of health data). TB surveillance is critical for ensuring complete case finding, appropriate linkages to diagnostic and treatment services and contact investigations, and reliable information systems for monitoring TB trends and evaluating control programs. All states require designated health care professionals to report TB cases (and usually suspect TB cases) to local or state health departments.[48] All state health departments maintain TB surveillance systems. The extent of local surveillance activities depends on state statutes and the delegation of authority by state health departments. States and

localities provide information on the numbers and characteristics of TB cases to the national surveillance system at CDC. The national system plays a critical role in monitoring national TB trends and guiding the planning and evaluation of national TB control efforts.

Ensuring that the surveillance system captures all persons with TB requires active case finding (also called active surveillance). Active case finding is a particularly important activity when the number of cases is decreasing and disease elimination is the goal. Active case finding can be supplemented by screening of high-risk populations.

Activities

1. Assist state and local health departments in periodic evaluations of TB surveillance systems.
2. Maintain support for the national TB surveillance system.
3. Conduct comprehensive and standardized evaluations of surveillance activities in all 50 states, the District of Columbia, and U.S. territories to help in the development and implementation of strategies to improve and enhance surveillance, especially active surveillance.

Objective I-B

Support the infrastructure needed for laboratory-based identification and treatment of TB.

TB control efforts depend on well-functioning mycobacteriology laboratories that can 1) detect, isolate, and identify TB organisms, 2) determine the organisms' susceptibility to anti-TB drugs, and 3) communicate promptly with clinicians so that diagnoses can be confirmed and treatment started. Both the laboratory and the clinician should have confidence in a laboratory's results. Accordingly, laboratories must institute efficient procedures, refer specimens to referral laboratories when necessary, and be adequately staffed to provide results in a rapid and efficient manner. All mycobacteriology laboratories must participate in recognized proficiency testing programs and establish levels of service that reflect the demonstrated quality of performance.

Diagnostic Standards and Classification of Tuberculosis in Adults and Children

In April 2000, CDC and the American Thoracic Society (ATS) published *Diagnostic Standards and Classification of Tuberculosis in Adults and Children.*[49] These standards are designed to provide a framework for and an understanding of the diagnostic approaches to latent TB infection and disease and to present a classification scheme that facilitates patient management. A person classified as having "clinical active TB" (Class 3) must have clinical, bacteriologic, or radiographic evidence of current TB. The bacteriologic evidence is established by isolation of *M. tuberculosis* in a fully functioning mycobacteriology laboratory.

Activities

1. Sustain state and local health department laboratories, and upgrade them as necessary.
   - Continue to support state and local health departments' mycobacteriology laboratories through cooperative agreements.
   - Strengthen the ability to provide technical support to state and local mycobacteriology laboratories.
   - Ensure the availability of back-up services to state and local mycobacteriology laboratories as needed.
   - Support the development of effective quality assurance and training programs for all laboratories that process mycobacteria specimens.
2. Enhance laboratory capacity to support outbreak investigations.
   - Continue to support TB outbreak investigations through DNA fingerprinting and enhanced drug-susceptibility testing.
   - Develop strategies for transferring technologies for DNA fingerprinting to state and city health departments, as appropriate.
   - Support regional laboratories that provide DNA fingerprinting services to state and local TB control programs.
3. Evaluate and support new approaches to providing reliable and timely laboratory services for TB diagnosis.
   - Monitor laboratory practices and capabilities in state and territorial mycobacteriology laboratories to determine work volume and proficiency levels.
   - Conduct operational studies in order to develop models for referring specimens and cultures that ensure rapid test results for smears, culture identification, and drug susceptibility testing, as well as studies to explore the feasibility of alternate approaches to providing laboratory services for TB diagnosis at the local, state, and regional levels.
   - Establish mechanisms for the timely feedback of laboratory results to health departments and clinicians charged with the care of TB patients and suspected TB patients.
   - Ensure that CDC has appropriate laboratory staff for conducting operational research and national assessments of laboratory practices, provide laboratory training, and promote quality testing.

Objective I-C

Ensure that patient-centered case management and monitoring of treatment outcomes are the standard of care for all TB patients.

Promoting patient-centered case management involves assessing each TB patient's needs and identifying a treatment plan that ensures the completion of therapy. High rates of completion of TB treatment (exceeding 90%) are most likely when treatment incorporates DOT, with multiple enablers (something that helps the patient complete treatment, e.g., transportation vouchers), incentives (something that will motivate the patient to successfully carry out program goals, e.g., food coupons), and other treatment enhancers (e.g., alternative treatment delivery sites, strategies to overcome social and cultural barriers to completion of treatment, use of outreach workers).[18] DOT has been shown to be more effective than self-administered therapy in several observational studies in the United States[18,50] and also to be a cost-effective and, in some cases potentially cost-saving, alternative to self-administered therapy.[51]

Activities

1. Ensure that all patients with active TB are tested for HIV infection and that all patients with TB disease and HIV infection are appropriately and adequately treated.
2. Promote the use of enhanced DOT, including incentives and enablers, to ensure the completion of treatment in persons with active TB.
   - Continue to support DOT, including the use of incentives and enablers, through CDC cooperative agreement grants.
   - Where possible, provide housing for homeless TB patients, e.g., through Housing Opportunity for Persons with AIDS programs (administered by HUD).
   - Support the infrastructure needed to provide well-trained outreach workers.
   - Encourage DOT in primary-care facilities, drug treatment centers, HIV/AIDS residential facilities, HIV clinics, migrant clinics, and shelters.
   - Provide ongoing technical assistance, both on-site and by telephone, to promote the expanded use of DOT by health departments and other providers in the field and in clinics and other sites.

Effectiveness of Enhanced DOT

The Public Health Tuberculosis Guidelines Panel reviewed 27 studies in which treatment completion for TB was used as an outcome.[18] The studies classified treatment strategies into four categories: enhanced DOT, DOT, modified DOT, and unsupervised therapy. Enhanced DOT was defined as a comprehensive, patient-centered strategy of fully supervised DOT with multiple incentives and enablers. DOT was defined as fully supervised DOT without incentives or enablers. Modified DOT included DOT for only part of the treatment period, and unsupervised therapy involved no DOT. The median treatment completion rate for enhanced DOT was 90%, compared to rates of 86%, 81%, and 61% for DOT, modified DOT, and unsupervised therapy, respectively.

3. Develop guidelines and standards for patient-centered case management in public health clinics, managed-care settings, and other private sector settings.
   - Compile and review published studies of patient-centered case management.
   - Review effective models of patient-centered case management in state and local TB programs.
   - Convene a national meeting of TB controllers, TB nurse consultants, and clinicians experienced in TB care to develop guidelines and standards for patient-centered case management.
   - Through ACET, issue guidelines and standards for patient-centered case management.
4. Develop the capacity of state and local TB control programs to conduct systematic and comprehensive reviews of the outcome of treating patients with active TB (i.e., "cohort reviews").
   - Provide ongoing technical assistance to promote the use of cohort reviews of patients with active TB disease to monitor treatment outcomes.
   - Develop guidelines, models, and training materials for developing programmatic capacity to conduct cohort reviews.
5. Develop case-management information systems to facilitate the appropriate management of patients and the evaluation of their treatment outcomes.
   - Define the elements needed for effective case management and evaluation of case-management systems.
   - Develop an information system that captures these elements and promotes the effective management of patients with active TB.
   - Provide financial and technical support to allow programs to establish and use case-management information systems.
6. Explore ways to increase third-party reimbursement for TB services.
   - Conduct a study to 1) identify funding sources for outpatient TB services in a sample of TB cases, 2) determine facilitating factors and barriers to third-party billing and reimbursement, and 3) determine the current programmatic and fiscal impact of reimbursement.
   - Using study results, develop recommendations for strategies to maximize and improve third-party reimbursement for TB control activities.

Objective I-D

Develop community partnerships, and strengthen community involvement in TB control.

Because each community has its own TB management needs, optimal TB prevention and control activities require a multifaceted, multidisciplinary approach. Collaborative efforts between TB prevention and control programs and community groups, health care providers, and other organizations serving TB patients can 1) educate the public about TB, 2) ensure that community leaders, health care providers, and policy makers are knowledgeable about TB, 3) identify persons with TB disease and ensure that they complete appropriate treatment, 4) identify contacts of persons with infectious TB disease and ensure that they are

appropriately evaluated and treated, and 5) coordinate, and in some instances provide, screening and prevention services for persons at high risk for developing TB disease.

Public health activities that are culturally appropriate and have broad-based community support have been shown to have a substantial effect on the health status of high-risk communities. Too often, TB patients and high-risk persons are suspicious or simply unaware of TB prevention and control services that are available to them. To ensure the quality, effectiveness, and appropriateness of activities, TB prevention and control programs need help from local groups in high-prevalence communities. Partnerships with community-based organizations (CBOs) and with health care providers with established relationships in the community can help ensure that high-risk populations have access to TB prevention services and that the services reflect local needs.

Activities

1. Promote the development of partnerships between local TB control programs and community-based health centers and organizations.
   - Develop local epidemiologic profiles of TB disease and infection to assist in the identification of high-risk groups and of health care providers with whom partnerships should be established.
   - Identify gaps in services to high-risk groups that can be met by the development of partnerships.
   - Emphasize partnership development in cooperative agreement announcements, program reviews, and site visits.
   - Assist in developing the capacity of state and local TB prevention and control programs to evaluate community partnerships.
   - Assist state and local health departments in increasing the capacity of CBOs to deliver TB services.
   - Ensure that local TB control programs develop working partnerships with Ryan-White providers and other HIV-care providers.
2. Ensure that community-based health care providers are trained in the diagnosis and treatment of TB disease and latent TB infection.
   - Conduct formative research on culturally appropriate training for community-based health care providers who serve diverse populations.
   - Develop training targeted to community-based health care providers.
   - Continue to support the National TB Model Centers' development of culturally appropriate training materials.
   - Support efforts by state and local TB control programs to identify and provide training to community-based health care providers, including CBOs.
   - Support efforts by HIV/AIDS providers funded under the Ryan-White Care Act Program and other HIV-care providers to ensure adequate and appropriate treatment, including enhanced DOT, of HIV-coinfected persons with TB disease or latent TB infection.

DOT Provider Network

In 1992, the New York State Department of Health created a network of public and private community providers to deliver DOT services to TB patients. The DOT Provider Network includes CBOs, social service providers, and advocacy organizations that were already serving high-risk, hard-to-reach persons. This network has allowed New York to offer DOT both at fixed treatment centers (e.g., chest clinics, drug treatment centers) and, through outreach, at locations convenient to the persons being served. Providers are reimbursed through Medicaid and work closely with the local health department. More than 20 institutions representing at least 70 fixed treatment centers have become part of the network and now provide outreach services. More than 1,700 referrals to the network were reported by the end of 1993. Efforts to maximize referrals and expand the network are ongoing. New alliances between DOT providers and CBOs can establish support systems for patients, promote adherence to therapy, and address the health and social problems that place clients at high risk for TB.

Objective I-E

Improve the timely investigation and appropriate evaluation and treatment of contacts with active TB disease and latent TB infection.

Contacts of persons with infectious TB are at high risk for infection and disease. The risk to contacts is related to the infectiousness of the source patient, the characteristics of the contact, and the characteristics of the environment they share. Prompt identification and evaluation of contacts of infectious cases are essential for good TB control. This is especially true for vulnerable high-risk populations. For example, HIV-infected contacts who are also infected with *M. tuberculosis* can develop clinically active disease very rapidly, as early as 20 days after infection.[52] The priority, speed, and extent of a contact investigation should reflect the likelihood of transmission (based on the characteristics of the source patient, contact, and environment) and the possible consequences of infection (especially for HIV-infected contacts and young children).

Activities

1. Develop guidelines and standards for contact investigations.
   - Review guidelines and standards for contact investigations developed by state and local TB control programs.
   - Develop draft recommendations and guidelines for conducting contact investigations.
   - Seek comments on the recommendations and guidelines from state and local TB control officials, health departments, ACET, the National Tuberculosis Controllers Association (NTCA), and others as appropriate.
   - Publish the recommendations/guidelines for contact investigations.
2. Enhance the capacity of state and local TB control programs to conduct contact investigations, and ensure that infected contacts complete TB treatment.
   - Provide funding for enhanced contact investigation and treatment of infected contacts through CDC's cooperative agreement grants.

- Provide ongoing technical assistance to health departments, both on-site and by telephone, to promote expanded contact investigations.
- Develop and support training for TB control program staff to enhance their ability to interview and investigate contacts.
- Conduct behavioral research to investigate reasons for nonadherence with curative treatment and treatment of latent TB infection; develop interventions to increase adherence.
- Develop the capacity of TB controllers to use social network analysis in contact investigations

3. Develop the capacity of state and local TB control programs to evaluate the outcomes of contact investigations and respond appropriately to the results of the evaluations.
   - Include guidance on evaluation of contact investigations in newly developed recommendations/guidelines.
   - Increase the capacity of state and local TB programs to conduct process and outcome evaluations of contact investigations.
   - Conduct research to identify appropriate measures of effectiveness for contact investigations.
4. Develop systems to provide the information needed to manage contacts and evaluate contact investigations.
   - Define the elements needed for effective management of contacts and evaluation of contact investigations.
   - Develop an information system that captures these elements and promotes the effective management of contacts of persons with infectious TB.
   - Provide financial and technical support to programs to establish and use contact-management information systems.

Objective I-F

Ensure appropriate care for patients with MDR TB, and monitor their response to treatment and their treatment outcomes.

The resurgence of TB in the United States that started in 1985 exposed an insidious problem for TB control: the rise in MDR TB (*M. tuberculosis* strains resistant to at least the two first-line TB drugs, isoniazid and rifampin). From 1982 through 1986, only 0.5% of new TB cases were resistant to both isoniazid and rifampin.[53] By 1991, however, 3% were resistant to both drugs, and 14% were resistant to at least one.[54] Against this background of increasing numbers of TB cases and increasing drug resistance, a dangerous new phenomenon appeared: outbreaks of MDR TB in institutional settings. From 1990 through 1992, CDC investigated outbreaks in eight hospitals and one correctional system and identified almost 300 cases of MDR TB. Death rates were shockingly high – 43% to 100%. Although most cases occurred in HIV-infected patients, several health care workers and prison guards were also stricken.

The flare-up of cases and outbreaks of MDR TB reflected serious underlying problems in the U.S. health care infrastructure. Increasing proportions of TB cases were occurring in persons who were homeless; were born in other countries; or had substance abuse, mental health, or other problems, such as HIV infection, that made adherence with treatment difficult. At the

same time that the number and complexity of TB cases were increasing, financial constraints were resulting in cutbacks in TB control programs. As a result, health departments lacked the resources needed to manage difficult-to-treat patients and control outbreaks.

Reversing the increase in TB and MDR TB required vigorous TB control measures and a significant hike in public spending.[14, 19, 55] With the drop in TB cases, however, there has also come a decline in TB treatment expertise, especially MDR TB, which requires complicated drug regimens and meticulous patient monitoring. Because the cost of treating MDR TB is so high, many programs are unable to provide optimal treatment for affected patients. Without renewed funding and support, MDR TB outbreaks may once again spread unchecked and exact their heavy price.

National Action Plan to Combat Multidrug-Resistant Tuberculosis

In response to the emergence of MDR TB, a federal Task Force was convened in 1991 to develop a national plan to combat the problem. The resulting *National Action Plan to Combat Multidrug-Resistant Tuberculosis*[5] identified the problems to be addressed, outlined objectives for addressing each problem, and listed the implementation steps needed to attain each objective. The main objectives were to 1) determine the magnitude and nature of the MDR TB problem, 2) improve the rapidity, sensitivity, and reliability of diagnostic methods, 3) manage MDR TB patients and prevent patients with drug-susceptible TB from developing drug-resistant disease, 4) identify persons infected with or at risk of developing MDR TB and prevent them from developing clinically active TB, 5) minimize the risk of transmission to patients, workers, and others in institutional settings, 6) control outbreaks, 7) increase TB programs' effectiveness in managing patients and preventing MDR TB, 8) enhance training, education, and information dissemination, and 9) conduct research on more effective tools with which to combat MDR TB.

Activities

1. Enhance the capacity of laboratories to rapidly diagnose MDR TB.
   - Monitor laboratory practices and capabilities in all mycobacteriology laboratories.
   - Provide funding through cooperative agreements for the upgrading of state and local mycobacteriology laboratories as appropriate.
   - Continue support of state and regional laboratories that can rapidly identify and determine drug susceptibilities of *M. tuberculosis* isolates.
2. Develop networks of providers with expertise in the management of patients with MDR TB to facilitate the referral of patients and the initiation of appropriate therapy.
   - Identify providers and centers with expertise in the management of patients with MDR TB.
   - Work with selected health departments, acute-care institutions, medical schools, and public and private providers to establish regional centers of excellence for treating difficult-to-manage MDR TB cases.
3. Develop information systems for use in managing and monitoring the treatment outcomes of patients with MDR TB.
   - Define the elements needed for the effective management of persons with MDR TB.

- Develop an information system that captures these elements and promotes the effective management of persons with MDR TB.
- Provide financial and technical support to programs for establishing and using MDR TB patient-management information systems.

Objective I-G

Ensure that health care facilities maintain infection-control precautions.
TB control programs are sources of information and consultation to the medical community on infection-control practices that should be maintained to prevent TB transmission. During interactions with the medical community, TB control programs should emphasize the need to maintain a high level of suspicion for TB in evaluating patients who have TB symptoms and the importance of early diagnosis, appropriate isolation, and prompt initiation of treatment.

Activities

1. Update and disseminate guidelines for the prevention of TB transmission in health care facilities, including outpatient settings.
2. Promote the development of partnerships between local TB control programs and congregate living settings (e.g., prisons, jails, homeless shelters) to ensure appropriate infection control and prevent the transmission of TB.
   - Develop local epidemiologic profiles of TB disease, including DNA fingerprinting results, to help in the identification of groups with ongoing TB transmission.
   - Identify the congregate living settings and health care providers of these high-risk groups with whom partnerships should be established.
   - Identify gaps in services to high-risk groups that would best be met by developing partnerships to ensure infection control and prevent TB transmission in congregate living settings.
   - Emphasize partnership development in cooperative agreement announcements, program reviews, and site visits.
   - Provide assistance in developing programmatic capacity to evaluate community partnerships.

Objective 1-H

Develop improved engineering and personal protective techniques to prevent TB transmission.
CDC's 1994 TB infection control guidelines presented recommendations for TB control based on a risk assessment process that classified healthcare facilities according to various categories of TB risk.[56] A corresponding series of controls, which included administrative, environmental, and personal protective control measures, was presented. The second level of this hierarchy is the use of environmental controls to prevent the spread and reduce the concentration of infectious droplet nuclei. These environmental controls include:
1) controlling the source by use of local exhaust ventilation, 2) controlling the airflow to prevent contamination of air in areas adjacent to the source, 3) diluting and removing contaminated air by use of general ventilation, and 4) cleaning the air by use of air filtration alone or together with ultraviolet germicidal irradiation (UVGI). The first two levels of the

hierarchy (administrative and environmental controls) minimize the number of areas where exposure to infectious TB may occur. They also reduce, but do not eliminate, the risk in the few areas where exposure can still occur (e.g., airborne infection isolation rooms; treatment rooms in which cough-inducing or aerosol-generating procedures are performed; autopsy rooms; etc.). Because persons entering these areas may be exposed to *M. tuberculosis*, the third level of this hierarchy of controls is the use of personal respiratory protective equipment in situations that pose a relatively high risk for exposure.

The foundation for these activities is derived from basic research, and information gained will be used to aid in the selection of effective engineering controls and respirators.

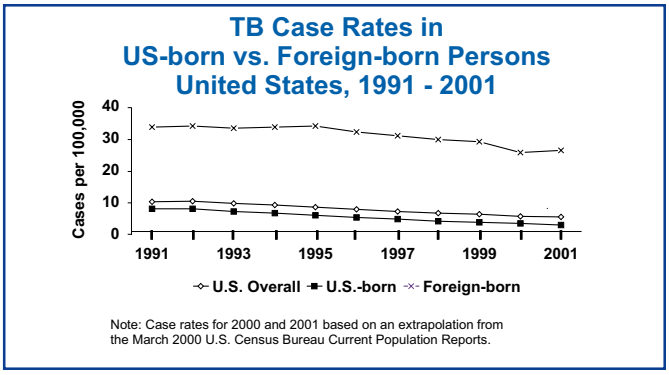
Activities

1. Improve engineering control measures for TB.
   - Encourage and support research into development of improved engineering techniques for preventing transmission of *M. tuberculosis* in high risk environments.
   - Utilize computational fluid dynamics (CFD) to assess the efficacy of environmental controls supplemental to room ventilation.
   - Utilize CFD to evaluate the ability of various ventilation configurations/designs to prevent the migration of TB from one room to another.
2. Access adequacy of personal protective equipment.
   - Determine if the current user-seal checks as described by the manufacturers of N95 filtering facepiece respirators actually help to ensure an adequate fit.
   - Develop a no fit-test, high-protection factor respirator performance test.
   - Conduct a workplace study of how well N95 filtering facepiece respirators perform in actual health-care settings, including determining penetration and service time restraints.
   - Conduct surveillance of how respirators are used for protection against TB in health-care settings (types, duration of use, types and frequency of fit-tests used, and other critical elements).
   - Conduct testing of newly certified N95 respirators to determine how well each certified respirator performs, enabling health care workers to make informed and proper respirator selection.

Objective 1-I

Improve TB control in foreign-born populations entering or residing in the United States.

In 2001, the TB case rate among foreign-born persons was 26.6 per 100,000 population, a rate which is almost 9 times higher than the rate of 3.1 per 100,000 observed among the U.S.-born population (see graph).[7] Mexico, the Philippines, and Vietnam are the countries of origin for nearly half of all foreign-born persons with



TB in the United States. Although screening with a chest radiograph, followed by acid-fast bacilli (AFB) smears for persons with abnormal radiographs, is required for the approximately 435,000 immigrants and refugees prior to arrival in the United States annually, approximately 32 million foreign-born persons entering the United States each year are not screened for TB (approximately 30.2 million persons with a nonimmigrant visa status; 275,000 undocumented immigrants; and 50,000 - 1.5 million asylees). Furthermore, a number of recent studies suggest that the screening, tracking, and notification system currently in place for immigrants and refugees is not uniformly effective in identifying persons with active TB or ensuring appropriate treatment and follow-up in the United States. Since the immigration status of foreign-born persons with TB at the time of entry to the United States is not systematically collected, it is unclear how many foreign-born persons with TB were missed at the time of mandatory immigrant and refugee screening, were appropriately screened but developed TB after entering the country, or were in a visa category for which no screening was required. Information is urgently needed in order to develop strategies to reduce the incidence of TB among the ever-increasing pool of foreign-born persons entering and residing in the United States.

Activities

1. Conduct studies of at-entry immigration characteristics of foreign-born persons with TB, to include
   - Prospectively collect information on immigration and refugee status in the Report of Verified Case of Tuberculosis (RVCT) form used for reporting individual case data to CDC via the Tuberculosis Information Management System (TIMS), a surveillance and case management software application used by TB control programs.*
   - Conduct studies in various epidemiologic settings (border states, Hawaii, port cities, and U.S. heartland areas with large numbers of immigrants and refugees) in order to refine current estimates of risk of TB among various groups of foreign-born persons.
2. Use 2000 census data to update TB case rates for foreign-born persons overall and by country of origin.
3. Increase information about foreign-born populations in the United States by
   - Conduct contact investigation studies involving foreign-born persons.
   - Modify program management reports to collect separate data for foreign-born persons.
   - Add immigration status to the RVCT.
   - Build local capacity to collect and analyze data on foreign-born persons with TB that can be used to develop local profiles.
4. Improve state and local health department capacity to develop epidemiologic profiles of their foreign-born TB patients.
   - Conduct prospective studies of immigration profiles of foreign-born persons with TB to assist in targeting newly arrived immigrants for targeted testing and treatment of latent TB infection.

**Any reference to future development of the RVCT (such as adding variables to it) is also part of CDC's transition plan to the TB program area module in the new National Electronic Disease Surveillance System (NEDSS-TB).*

5. Conduct operational research to develop better methods and procedures for identifying and accessing high-risk border populations.
6. Improve TB case tracking of TB patients who move across the U.S.-Mexico border by adding a binational variable to the RVCT, and by improving TB information exchange between the United States and Mexico.
7. Improve the sensitivity and specificity of the overseas screening algorithm:
   - Conduct studies to evaluate the efficacy of overseas screening.
   - Based on pilot study data, develop new algorithms (such as conducting repeat testing in the United States, conducting all screening in the United States, adding skin test requirements for certain immigration categories, and adding culture to the algorithm).
8. Minimize improper classification.
   - Expand and enhance the existing quality assessment program training for panel physicians who evaluate immigrant and refugee applicants outside the United States.
   - Update technical instructions and forms for panel physicians.
9. Minimize loss of information from panel physicians.
   - Implement a system of overseas data capture and transmission to the United States.
   - Improve training of responsible Department of State staff.
   - Evaluate all immigrant and refugee arrivals.
   - Consolidate all arrival data at one site.
10. Improve health department notification about arrival of immigrants with radiographic evidence of (noninfectious) TB (classification "B1") by developing and implementing a system of electronic TB notification.
11. Minimize delayed or omitted follow-up of class B1 immigrants by conducting intervention studies to improve immigrants' understanding of follow-up in the United States.
12. Improve ongoing assessment of immigrants with radiographic evidence of TB (classes A/B1/B2) and refugees by adding an indicator to program management reports.
13. Improve quality of civil surgeon screening for immigrants, refugees, and asylees by
   - Revising technical instruction and medical forms for civil surgeons.
   - Collaborating with the Immigration and Naturalization Service (INS) for civil surgeon training.
   - Assigning responsibility for civil surgeon designation to the public health arena (state health departments or CDC).
14. Improve communication with foreign-born TB patients to improve their compliance with therapy and contact investigation by hiring field staff conversant in major foreign-born community languages.
15. Minimize risk of treatment interruption due to INS custody, deportation, or return to country of origin by

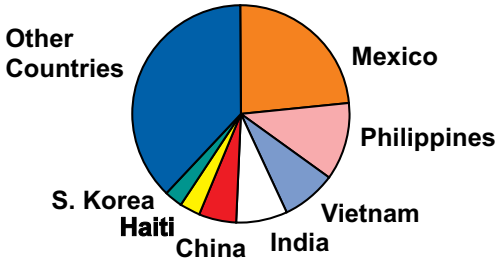
Chest X-Ray and Tuberculosis Classification for Immigrant and Refugee Applicants[57]

Class	TB Condition
A	Active, infectious
B1	Active, noninfectious
B2	Inactive

- Working with INS to establish policy to ensure that TB patients in INS custody are managed appropriately and followed to cure.
- Conducting a cohort study to assess TB outcomes.

16. Improve tracking of foreign-born persons across jurisdictions by electronic notification of immigrants with class A/B1/B2 status to health departments.
17. Improve case surveillance along the Mexican border by
    - Including TB in the CDC Division of Global Migration and Quarantine Binational Infectious Disease Surveillance project.
    - Establishing a binational TB case registry.
18. Ascertain risk of TB in foreign-born children and children of foreign-born parents by
    - Conducting special epidemiologic/risk factor studies among immigrant/refugee children and adoptees arriving in the United States through collaborative epidemiologic research projects.
    - Studying TB in foreign-born children and children of foreign-born parents to determine why TB was not prevented.

Countries of Birth for Foreign-born Persons Reported with TB United States, 2001



Objective I-J

Educate the public and train health care providers to maintain excellence in TB services.

As stated in the IOM report, as TB becomes less common, there will also be fewer individuals with the experience and the correct knowledge to ensure that the right steps are taken and procedures followed to control and eliminate this disease. The IOM report also states, "The most direct solution for decreased experience is increased training."

In an effort to identify and coordinate TB education and training resources, in 1997 the CDC funded a project to develop a strategic plan for TB training and education. To ensure a broad representation of issues and sectors for inclusion in the strategic plan, six work groups were established. These work groups gathered information on specific topics and summarized their findings in position papers that were presented at a 2-day summit held in October 1998, a meeting that brought together experts to forecast TB training needs and efforts for the next 5 years. The recommendations from the summit were used to develop the *Strategic Plan for Tuberculosis Training and Education*, which was designed to provide guidance to U.S. agencies and organizations that conduct TB training and education for public and private sector providers.

As the result of recommendations highlighted in the *Strategic Plan for Tuberculosis Training and Education*, DTBE established the TB Education and Training Network (TB ETN) for educators in state, big city, and territorial health departments. The goals of the TB ETN are to

- Build, strengthen, and maintain collaboration among the key agencies and organizations in TB education and training
- Provide a mechanism for the sharing of TB education and training resources to avoid duplication of effort
- Develop, improve, and maintain access to TB training and education resources
- Provide updated information about TB courses and training initiatives
- Assist representatives in building education and training skills

Activities

1. The *Strategic Plan for Tuberculosis Training and Education*, the blueprint that addresses the training and educational needs for TB control, should be fully funded.
2. Develop and fund programs for the education of health care providers and TB patients.
   - Further the development of culturally and linguistically appropriate educational materials for persons with or at risk for TB.
   - Continue the development of an academic detailing project targeting high-risk providers and patients with latent TB infection.
   - Develop partnerships with CBOs to ensure that TB control staff are skilled in working with their communities.
   - Continue to support an educators' network for developing and disseminating educational materials, as well as enhancing the skills of these TB educators.
   - Collaborate with training partners, such as the NIH, to expand TB education at the academic medical center level (i.e., medical, nursing and allied health professions schools).
3. Provide funding for projects that call for government, academic, and nongovernmental agencies to work in collaboration with international partners to develop training and educational materials.
   - Provide training and educational technical assistance for the national TB programs in high-burden countries.
   - Participate in international advisory groups, including the Collaborative for Training and Education in Russia and the Newly Independent States; the Training Task Force of the Tuberculosis Coalition for Technical Assistance; the Stop TB Partnership Advocacy and Communications Task Force; the International Union Against TB and Lung Disease (IUATLD) TB Education Work Group; and the Partners in Health Peru Project.
   - Utilize the training and education expertise in the United States to build capacity with global partners to systematically identify and address training and education needs in TB control efforts.

GOAL II: Accelerate the decline

Advance toward TB elimination through targeted testing and treatment of persons with latent TB infection, appropriate regionalization of TB control activities, rapid recognition of TB transmission using DNA fingerprinting methods, and rapid outbreak response.

Unprecedented low rates of TB disease and the focal distribution of pockets of lingering infection provide a historic opportunity to accelerate the decline in TB incidence and push toward TB elimination. TB programs can prevent new cases by 1) reducing the reservoir of persons with latent TB infection who will progress to active disease, 2) rapidly containing the transmission of TB disease and infection, 3) adding regionalized TB control activities to ensure the availability of infrastructure and expertise wherever TB cases occur, 4) characterizing circulating TB strains using DNA fingerprinting methods to rapidly recognize and interrupt continued TB transmission, and 5) quickly identifying, investigating, and responding to outbreaks of TB to interrupt transmission and prevent disease.

Objective II-A

Increase the capacity of TB control programs to implement targeted testing and treatment programs for high-risk persons with latent TB infection.

Targeted tuberculin skin testing for latent TB infection is a strategic component of TB control. Targeted testing identifies persons at high risk for developing TB who would benefit from treatment. Persons at increased risk for developing TB include those with recently acquired TB infection and those with clinical conditions that are associated with an increased risk for progression from latent infection to active disease. Targeted testing should be conducted only among groups at high risk and should be discouraged in those at low risk. Infected persons who are considered to be at high risk for developing active TB should be offered treatment for latent infection regardless of age.

In CDC's 1989 *A Strategic Plan for the Elimination of Tuberculosis in the United States*,[1] public health agencies were assigned responsibility for detecting and treating latent TB infection in high-risk groups. At that time, the administration of skin tests, interpretation of test results, and intensive follow-up required to ensure adherence with treatment were believed to be beyond the scope of private health care providers. By the mid-1990s, however, most routine TB testing was being done outside the public health system and the participation of other providers was recognized as essential to community efforts to prevent TB in high-risk groups. In recommendations published in 1995, health departments were charged with helping providers develop, implement, and evaluate locally appropriate TB screening programs.[58]

The key roles for TB control programs in these efforts are to identify candidates for targeted testing and treatment (i.e., persons who, because of epidemiologic characteristics, are at high risk for having latent TB infection or developing TB disease if infected), ensure that TB patients have access to appropriate TB services, ensure that patients are evaluated and placed on treatment for latent TB infection as appropriate, and ensure that patients complete their treatment.

Activities

1. Develop and enhance the capacity of state and local TB control programs to implement effective targeted testing and treatment programs for latent TB infection.
   - Promote the development of partnerships with CBOs that provide health care services and other health promotion activities for high-risk groups.
   - Provide funding to ensure collaboration between TB control programs and CBOs.
   - Conduct research to identify effective strategies and interventions that increase the proportion of persons with latent TB infection who initiate and complete treatment.
   - Develop systems to evaluate targeted testing programs for high-risk persons and to ensure that the programs are effective in preventing the development of TB.
2. Enhance the capacity of local TB control programs to identify appropriate populations for targeted testing.
   - Provide training in epidemiologic methods and data analysis to increase the ability of TB program staff to analyze local surveillance data.
   - Identify additional sources of data (e.g., immigration patterns, HIV-seroprevalence studies) for use in making decisions about appropriate populations for targeted testing.
   - Provide ongoing technical assistance to TB control programs to help in the identification of appropriate high-risk groups for targeted testing.
   - Promote the development of partnerships with CBOs that might have access to persons at high risk and that might be appropriate sites for targeted testing programs.
3. Ensure that all patients with HIV infection are evaluated for latent TB infection and are appropriately treated.
   - Ensure that TB program staff are aware of the epidemiology of HIV infection, the prevalence of TB/HIV coinfection, and the prevalence of HIV infection in persons with active TB in their communities.
   - Promote the development of partnerships with CBOs that might have access to persons with HIV infection and that might be appropriate sites for targeted testing programs.
   - Provide funding to ensure collaboration between health departments and HIV providers to establish targeted testing programs.
   - Work with national organizations and other federal agencies to ensure that the practice of testing for and adequately treating latent TB infection is the standard of care for persons with HIV infection.
   - Develop systems to evaluate targeted testing programs for persons with HIV infection and to ensure that the programs are effective in preventing the development of TB in persons with HIV infection.
4. Promote the development of partnerships between TB control programs and correctional facilities to ensure that inmates are appropriately screened for latent TB infection and TB disease.
   - Ensure that TB control programs establish contacts in the correctional system and promote the development of partnerships with correctional facilities to establish

effective targeted testing programs and to follow inmates released before the completion of treatment.

- Provide funding to ensure collaboration between health departments and correctional health care providers for establishment of targeted testing programs.
- Work with national organizations and other federal agencies to ensure that testing for and adequately treating latent TB infection are components of correctional health care.
- Develop systems to evaluate targeted testing programs for persons incarcerated in correctional facilities and to ensure the effectiveness of the programs in preventing the development of TB in inmates.

5. Develop and implement information management systems to provide the data needed to evaluate targeted testing programs.
   - Define the elements needed for effective management of persons with latent TB infection.
   - Develop an information system that captures the elements of targeted testing and promotes the effective management of persons with latent infection.
   - Provide financial and technical support to programs to establish and use patient information management systems for targeted testing programs.
   - Establish criteria for the effectiveness of targeted testing programs, and base future funding on those criteria.

Objective II-B

Promote the appropriate regionalization of TB control activities in high, intermediate, and low TB-incidence areas of the United States.

As the incidence of TB declines, economies of scale dictate that the geographic focus for TB control activities should be expanded. Ideally, patients should not have to travel to regional centers for treatment of their disease; however, regionalization of resources for case management, contact investigation, and outbreak investigations should be evaluated.

Activities

1. Implement the recommendations of ACET on control of TB in low-incidence areas.
2. Implement geographically defined operations research to assess the role of regional approaches in high, intermediate, and low TB-incidence areas.
   - Work with programs in low-incidence areas to develop operational research studies and protocols.
   - Implement these protocols in high-, intermediate-, and low-incidence areas.
   - Publish the results of the studies, and base the development or continued support of appropriate interventions on the results.
3. Convene a national meeting to disseminate the results of the operational research studies and to develop recommendations for the regionalization of TB control activities.

Objective II-C

Characterize circulating *M. tuberculosis* strains using DNA fingerprinting methods. Characterization of *M. tuberculosis* with DNA fingerprinting is a powerful tool for 1) confirming TB cases linked by traditional epidemiologic methods, 2) identifying clusters of patients infected with genetically related or identical strains of *M. tuberculosis* and determining common sources of infections, 3) guiding contact investigations and the appropriate use of preventive therapy, and 4) identifying laboratory cross-contamination as the cause of misdiagnosis. When used to track the transmission of a specific strain, DNA fingerprinting can help assess the effectiveness of TB control programs — a particularly useful methodology for areas with low TB incidence as the United States approaches TB elimination.

Activities

1. Use DNA fingerprinting to strengthen TB control efforts.
   - Create Regional Centers of DNA Fingerprinting Excellence that can provide DNA fingerprinting for all new isolates of *M. tuberculosis.*
   - Establish a DNA Fingerprinting Training Program to build laboratory, epidemiologic, and analytic capacity to assess and promote fingerprinting standards and practices, including newer DNA fingerprinting approaches.
   - Establish a National DNA Fingerprinting Registry and Surveillance System to facilitate the identification of TB outbreaks that cross state lines.
   - Develop local capacity in the use of DNA fingerprinting to identify laboratory misdiagnoses of TB and thereby reduce the number of persons who are inappropriately treated for TB.

> The National Tuberculosis Genotyping and Surveillance Network (NTGSN) was established in 1996 as a 5-year project involving seven regional genotyping laboratories and sentinel surveillance sites in the United States. All patients from each sentinel site had *M. tuberculosis* (TB) isolates genotyped using one or more molecular technologies. Routine surveillance data were collected for each culture-positive case patient. In addition, follow-up interviews were conducted for case-patients who had isolates that were genetically identical to other patients in the surveillance area. Genotyping technology has been used effectively in outbreak investigations and in identifying false-positive TB culture results that are caused by laboratory contamination.

2. Use DNA fingerprinting to increase the understanding of TB epidemiology and provide the scientific foundation for improved interventions to eliminate TB.
   - Study geographic and temporal variability in genotypes to better understand the natural history of *M. tuberculosis* strains currently in circulation in the United States (especially MDR strains, strains that cause relapses, and geographically widespread strains) and to evaluate the impact of interventions locally and regionally.
   - Identify and investigate unrecognized transmission of TB in groups at high risk (e.g., HIV-infected persons, residents of correctional and long-term–care facilities, migrant farm workers, homeless persons).

- Identify and investigate unusual and difficult-to-recognize settings where TB transmission has occurred, especially in areas that have achieved low TB incidence.
- Study the frequency of reinfection, relapse, and infections with multiple strains of *M. tuberculosis.*
- Use DNA fingerprinting to monitor progress toward eliminating TB transmission.

3. Develop and evaluate new DNA fingerprinting tools.
   - Evaluate newly developed DNA fingerprinting technologies (e.g., spoligotyping, minisatellite-based typing systems, fluorescent amplified fragment-length polymorphism).
   - Develop novel strain typing and DNA fingerprinting approaches.
   - Develop and evaluate fingerprinting methods or strategies that can provide rapid strain typing for real-time application in TB control efforts.

Objective II-D

Develop national, state, and local capacity to respond to outbreaks of TB.

When TB is very common, clusters of cases caused by recent transmission blend into the generally high morbidity. However, when TB is less common, even small case clusters are very noticeable and are considered to be "outbreaks." In the United States, several interrelated factors are converging to make TB case clusters more prominent and troublesome. First, *M. tuberculosis* transmission is now uncommon, and most members of the population have not been infected. Therefore, a burst of transmission causes a disturbance that stands out from the low background level. At the same time, however, the low background level has led to reduced personnel resources and thus limited our capacity to find and cure TB and to investigate contacts. Many health care providers now lack familiarity with TB, have difficulty diagnosing it, and are unaware of current treatments. The combination of delayed case detection, enhanced opportunities for transmission to susceptible contacts, and reduced response capacity yields sporadic "TB outbreaks."

Each TB outbreak is a setback for TB elimination. As the incidence of TB declines, the identification of and response to outbreaks will become a more important component of TB control. Responding to these outbreaks will require careful planning, marshaling of resources, development and maintenance of expertise, and development and use of interventions to interrupt transmission and prevent TB disease.

Activities

1. Implement and evaluate CDC's outbreak response plan.
   - Conduct a pilot study on implementation of the outbreak response plan.
   - Evaluate the plan, and identify needed improvements.
   - Finalize the plan based on results of the evaluation.
   - Implement the plan.
   - Devise mechanisms for ongoing evaluations and revisions.
2. Provide guidelines, technical assistance, and templates to help state and local TB control programs develop and implement their own outbreak response plans.
3. Enhance the capacity of CDC and state and local TB control partners to respond rapidly to

outbreaks, conduct appropriate investigations, and implement necessary programmatic activities to interrupt TB transmission.

- Ensure that CDC maintains appropriate numbers of trained scientific staff to help states and localities investigate TB outbreaks.
- Ensure that CDC maintains appropriate numbers of trained program staff both in the field and at headquarters to respond appropriately to TB outbreaks and to provide technical assistance as needed to state and local TB programs.
- Through training and funding, develop the capacity of state and local TB programs to respond rapidly and appropriately to TB outbreaks.

4. Evaluate the cost and impact of outbreak investigations and subsequent programmatic interventions.
   - Define the data elements needed to evaluate the cost and impact of outbreak investigations and interventions.
   - Develop data management systems to capture these elements.
   - Conduct a comprehensive evaluation of outbreak responses by CDC, and help state and local programs develop evaluations of their responses to outbreaks.

GOAL III: Develop new tools

Develop and assess new tools for the diagnosis, treatment, and prevention of TB.

Improving the application of current tools can enhance TB prevention and control efforts, but achieving the goal of TB elimination will require more. The United States needs to develop and then quickly and appropriately implement new technology to accelerate the decline in TB morbidity and make TB elimination a reality. In the long run, an effective vaccine would have the greatest impact on the ability to control and ultimately eliminate TB. However, new tools are also needed to improve the accuracy and speed of TB diagnosis and the effectiveness of TB treatment. The nation therefore needs to expand its research program, capitalizing on past investments and progress and creating critically needed new tools for diagnosing, treating, and preventing TB.

Objective III-A

Develop a coordinated plan for TB research.

NIH and CDC have the lead in federally funded research on TB. Other agencies involved in TB research include FDA, HRSA, the Veterans Administration (VA), the Occupational Safety and Health Administration (OSHA), the Indian Health Service (IHS), and the Department of Defense (DoD). Despite the involvement of each of these agencies in basic and operational research on TB, the nation lacks a clearly articulated research strategy that addresses each group's responsibilities and contributions. A coordinated research plan is needed to maximize efficiency, ensure attention to highest priority activities, and avoid duplication of efforts. In part to address this need and to move operational research forward, in 2001 the CDC established the Tuberculosis Epidemiologic Studies Consortium (TBESC). TBESC is composed of 22 collaborative research groups, each existing as a formal partnership between an academic institution and a state or metropolitan TB control program.

Activities

1. Achieve consensus that a coordinated research plan is needed.
2. Convene a meeting of representatives of interested public sector agencies and private companies to develop a prioritized list of research activities and to assign lead responsibilities for these activities.
3. Disseminate the research plan.

Objective III-B

Develop new methods to diagnose persons with latent TB infection and to identify infected persons who are at high risk of developing active TB.

Achieving the goal of TB elimination will require increased attention to persons with latent TB infection and those at greatest risk of developing active TB.[8, 11] Identifying and treating these persons can prevent the onset of active TB and interrupt the spread of disease. Until recently, skin testing with purified protein derivative (PPD) tuberculin was the only practical way to detect latent TB infection. In the United States, the tuberculin skin test (TST) is used as an initial screening test for both latent infection and active TB; a positive TST indicates an increased risk of subsequently developing, or currently having, active TB.[59] Despite its widespread use and a large body of data on its standardization, the TST has several elemental shortcomings that limit its usefulness:

- Persons infected with nontuberculous (environmental) mycobacteria and those previously vaccinated with BCG (an anti-TB vaccine used in many other countries) can test falsely positive.
- Many conditions, most notably HIV-associated immunosuppression, can blunt the response to tuberculin and lead to false-negative results.
- The lack of standardization in administering and reading the test can affect the results.[59]

In "Comparison of a Whole-blood Interferon Assay with Tuberculin Skin Testing for Detecting Latent *Mycobacterium tuberculosis* Infection," the authors conclude that the interferon assay was comparable with the TST in its ability to detect latent infection, was less affected by BCG vaccination, was able to discriminate responses due to nontuberculous mycobacteria, and avoided the variability and subjectivity associated with placing and reading TSTs.[33]

A promising advance may address at least one of these limitations. The discovery of the role of T-lymphocytes and gamma-interferon in the immune process has led to the development of a blood test for cell-mediated immune reactivity to *M. tuberculosis*. An initial assessment of this test suggests that it may be useful in distinguishing persons with positive TST reactions due to BCG vaccination and sensitization by environmental mycobacteria.

TB control is also hampered by the inability to reliably identify infected persons who are most likely to develop active TB.[11] Factors related to the progression from latent infection to active TB include 1) the intensity of the initial exposure, 2) recent rather than remote infection, and 3) medical conditions such as HIV infection that weaken immunity. A better understanding of the immunologic and genetic factors associated with the human response to TB infection is needed to predict which persons with latent infection are at highest risk of progressing to active disease. This information is also needed to guide the development of an optimal TB

vaccine. Involving private sector biotechnology and pharmaceutical companies in collaborative endeavors will be increasingly important.

Activities

In coordination with other federal agencies

1. Continue the development and assessment of cytokine-based assays for the diagnosis of latent TB infection. Continue support for studies of more specific mycobacterial antigens that might enhance diagnostic accuracy.
2. Provide continued support for the development of specific skin-test antigens to improve the diagnosis of latent TB infection, and conduct studies of the usefulness of purified and specific antigens for TB skin testing. The immunologic response measured by skin testing differs from that assessed by cytokine assays, and it is possible that a combination of skin testing and cytokine assays will be able to better identify persons with latent infection who are at highest risk of progression to active TB.
3. Through the TBESC, support and expand epidemiologic studies to identify immunologic and genetic markers that are associated with protection against TB and susceptibility to progression from latent infection to active disease.
4. Develop and refine new molecular, biochemical, and immunologic methods for rapid, accurate, and cost-effective diagnosis of active TB and drug-resistant TB, including technologies for use in low-income countries.

Objective III-C

Assess new drugs to improve TB treatment and prevention.

Until the FDA approval of rifapentine in 1998, it had been more than 25 years since the introduction of a novel compound for the treatment of TB. Despite many calls over the past two decades for the development of new anti-TB drugs, the pharmaceutical industry has, with few exceptions, indicated little interest in undertaking work in this area. One factor impeding this pursuit is the erroneous perception that current drugs are adequate for the control of TB. In fact, new TB drugs are urgently needed to 1) improve current treatment regimens by shortening the duration of treatment and/or offering more widely spaced intermittent treatment; 2) improve the treatment of MDR TB; and 3) provide more effective treatment for latent TB infection.[60]

Although the current TB treatment regimens are highly effective, they are far from ideal. The main drawback is the prolonged duration of treatment; currently, at least 6 months of treatment is required. Not only is treatment lengthy, but the regimens are complex; the initial part of therapy requires taking four different medications. Although rates of serious adverse reactions are low, therapy can also be associated with unpleasant side effects.

To be effective, treatment must be continued to completion. The prolonged TB drug regimens are associated with high rates of nonadherence and subsequent increased mortality and creation of chronic drug-resistant cases.[61] Development of drug resistance is far more likely when treatment is not supervised and when recommended regimens are not used. To ensure that patients take their medicine correctly, DOT is generally advised. New drugs that could be

administered in shorter, simpler regimens would have the greatest impact on the TB problem in the near term.

As rates of MDR TB increase in many countries,[44, 62] finding alternative drugs to improve the treatment of patients with drug-resistant TB is also a high priority. Patients with MDR TB must be treated with a combination of "second-line" drugs that are not only more expensive but also more toxic and less effective than the standard medications.[63]

The final impetus for the development of new TB drugs is to improve the treatment of latent infection. Among the approximately 2 billion persons worldwide with latent TB infection, an estimated 100 million to 200 million will develop active disease. In the United States and several other low-incidence countries, isoniazid has been used for the treatment of latent infection in persons at greatest risk of disease progression. Isoniazid has also been shown to be effective in preventing the development of TB in TB-HIV coinfected persons, and WHO has recommended the use of isoniazid in such persons.[64] Because isoniazid therapy has significant limitations, however, new drugs to improve the treatment of latent infection are needed to eliminate TB from low-incidence countries.[11]

Historically, CDC has been the lead U.S. agency for the conduct of clinical trials to evaluate TB treatments. From 1993 to 1994, CDC contracted with investigators at academic medical centers, health departments, and VA hospitals to conduct U.S. Public Health Service (USPHS) Study 22, a randomized trial to evaluate rifapentine. The findings demonstrated the efficacy of once-weekly treatment for selected TB patients and are being used to update TB treatment recommendations being issued jointly by CDC and ATS.

From 1997 to 1998, CDC worked with the same group to establish the TBTC, an investigator-driven program modeled on the NIH-supported Community Program for Clinical Research in AIDS (CPCRA). The TBTC is evaluating rifapentine and other drugs to improve and shorten TB treatment and has embarked on a study of treatment of latent TB infection with a once-weekly, 12-dose regimen of rifapentine and isoniazid.

Globally, several countries with high rates of TB (e.g., Kenya, Uganda, South Africa, India, Brazil) also have considerable capacity to conduct clinical trials. In the past, CDC has supported TB research in several of these countries, and investigators at many sites are interested in collaborating on both treatment and prevention studies. Such studies would greatly facilitate the development of new treatment and prevention drugs that are needed not only in the United States and other industrialized countries but also in high-burden countries where the TB epidemic is most severe.

Activities

1. Continue and enhance support for the TBTC. Provide needed resources to both increase capacity at the research sites and recruit new sites, and collaborate with interested partners (within and outside the United States), so that ongoing and additional studies can be completed expeditiously.
2. Encourage enhanced private-sector support and public- or private-sector collaboration for the development of new, effective drugs and other therapeutic interventions to improve the treatment of both active TB and latent TB infection.
3. Work with interested partners to develop and support an international TB trials network.

Objective III-D

Develop a new and effective TB vaccine.

A concerted and sustained national effort to develop an effective new TB vaccine is crucial to eliminating TB from the United States and significantly reducing the global burden of TB. Vaccine development will require the sustained commitment of both private and public sector funds over several decades to support intramural and extramural research. Much of this work will fall within the mission of NIH, but CDC, as well as other federal agencies, have important roles to play.[65]

> The Global Alliance for TB Drug Development is an international nonprofit organization whose vision is the provision of new medicines with equitable access for the improved treatment of TB. Its mission is to accelerate the discovery and/or development of cost-effective, affordable new TB drugs that will shorten or simplify treatment, provide a more effective treatment of multidrug-resistant TB, and improve the treatment of latent TB infection. The Global Alliance seeks to have a new drug that achieves these improvements registered by 2010. The Global Alliance is one of a new breed of public-private partnerships that pursue a social mission by drawing upon best practices, expertise, and resources from both the public and private sectors.

Activities

Assist relevant federal agencies and other national and international partners to-

1. Establish consensus among public and private funding agencies, vaccine manufacturers, and professional organizations that a new TB vaccine is an urgent public health priority. Identify a long-term commitment of private- and public-sector funds to support vaccine research.
2. Develop a comprehensive vaccine development strategy that builds on the *Blueprint for Tuberculosis Vaccine Development*.[39] The strategy should specify
   - Desirable characteristics of a new vaccine.
   - Action steps for vaccine development.
   - Roles and responsibilities of the public sector, industry, and academia.
   - Projected time line.
   - Estimate of resource needs.
3. Increase biomedical research to define host factors for TB protection and susceptibility.
   - Expand basic research efforts to define 1) host factors that may protect against both the establishment of infection and the development of TB disease, and 2) the properties of the tubercle bacillus that permit it to survive years after the establishment of infection. Organize studies with hypothesis-generating protocols linking epidemiology, human immune status and response, and other physiological responses to TB infection and disease and the bacteriology of infecting organisms, taking advantage of the best available science, incident cases, contacts, and laboratory facilities.
   - Expand studies to determine the immunologic and genetic markers related to protection and progression from latent infection to active disease.

- Determine correlates of protection for trial participants to facilitate vaccine trials.

4. Develop new animal models for assessing vaccine efficacy.
5. Increase collaborations between the private and public sectors for implementation of clinical vaccine trials.
   - Increase collaboration among CDC, FDA, and NIH[5] through regular communications of the Federal TB Task Force.
   - Develop and foster relationships with international organizations (e.g., WHO), funding agencies (e.g., U.S. Agency for International Development [USAID], World Bank, private foundations), and vaccine manufacturers.
   - Convene a working group with representatives from these agencies to develop protocols for fieldtesting of candidate vaccines.
   - Identify vaccine trial sites in the United States and in high-incidence countries, and make immediate preparations for clinical testing. Avoid committing major funding expenditures for vaccine testing sites too far in advance of the availability of minimally suitable vaccine candidates.
   - Increase dialogue among the USPHS, FDA, WHO, USAID, vaccine manufacturers, and other interested parties (e.g., public health and medical communities, private foundations).
   - Seek collaborations domestically and internationally with public and private partners to advance vaccine development. Work with sister agencies and other national and international partners to enhance the activities of established groups that provide guidance and oversight on TB vaccine development.

Objective III-E

Develop and implement a program of research on behavioral factors related to TB treatment and prevention.

Despite the efforts of national, state, and local TB programs, nonadherence with prescribed treatment remains a major barrier to TB elimination.[11] An additional weapon in the TB elimination arsenal is research to 1) understand behavioral factors related to TB treatment and prevention in patients and health care providers, and 2) design and implement methods for improving adherence with TB treatment. The IOM charged CDC with developing and implementing a behavioral and social science research agenda to promote this understanding as a needed “new tool” for achieving TB elimination.

The last national effort to assess the state of TB-related behavioral and social research was a conference conducted in 1994.[66] The proceedings generated many ideas but produced no structure for planning and directing research. In the interim, much research has been conducted, and many promising practices and effective interventions have been implemented in state and local TB programs. Data and findings reside, however, with individual researchers and program staff. There is also a wealth of untapped but potentially transferable research on other health problems characterized by similar adherence issues. By comprehensively and critically examining these studies, a research agenda can be developed that builds on what works and that addresses current gaps.

Activities

1. Collect information on current TB-related behavioral research.
   - Review published and unpublished materials to identify effective behavioral initiatives and best practices in the 68 CDC-funded TB control programs.
   - Select promising practices and initiatives, and conduct follow-up interviews to describe and identify the replicable aspects of each.
2. Convene a meeting of experts to develop a research agenda.
   - Include a range of stakeholders, including researchers, program staff, CBOs, and policy makers.
   - Charge the participants with reviewing the status of behavioral and social science research as it relates to TB control.
   - Structure the meeting to identify existing and needed resources and information, set goals and objectives for a research agenda, and develop a plan of action for conducting behavioral and social science research related to TB control and prevention.
   - Establish working groups to review progress and revise and advance the agenda.

Objective III-F

Rapidly transfer findings from research studies into practice.
Successful implementation of new technologies will require education and training to produce changes in the practices of health care providers.

Activities

1. Create messages, materials, and programs for health care providers to ensure their understanding and application of new developments in TB prevention and control.
2. Base the messages, materials, and programs on established communication and behavior-change theories and models.
3. Develop a communications/media strategy to ensure efficient transfer of new technologies into practice.

GOAL IV: Increase involvement in global efforts

Increase U.S. involvement in international TB control activities to reduce the global burden of TB.

TB cannot be eliminated in the United States without a considerable reduction in the global burden of TB.[9] In 2001, approximately 50% of newly diagnosed U.S. TB patients were born outside the United States.[7] Most of these patients acquired their TB infections in countries such as Mexico, the Philippines, Vietnam, India, China, and Korea but did not have clinical disease when they entered the United States. Subsequently, for reasons not sufficiently understood, their immune systems were unable to keep the infections in check and they developed active TB. Within the next several years, it is expected that more than half of the new TB patients diagnosed each year in the United States will be foreign-born persons.

The global community is fighting TB on several fronts. Based on the pioneering work of the IUATLD, WHO has developed a specific strategy for TB control in low-income countries. The

strategy, called “directly observed treatment, short-course” (DOTS), combines five elements: 1) the political commitment of the government to support TB control programs, 2) bacteriologically-based diagnosis, with AFB-smear microscopy of sputum specimens of patients with symptoms of TB, 3) standardized treatment with rifampin-based (short-course) regimens given under direct supervision, 4) a reliable supply of quality drugs and diagnostic supplies, and 5) individualized reporting of treatment outcome coupled with program monitoring and supervision. DOTS coverage has expanded greatly during the past decade, but inadequacies in diagnostic and treatment tools limited its easy applicability. A global partnership, Stop TB was created to help coordinate the efforts of governments, nongovernmental agencies, and donor agencies in global TB control. Working through the Stop TB Partnership, CDC has contributed to DOTS expansion and also addressed the recalcitrant problems of MDR TB and HIV-associated TB.

Although MDR TB has come under control in the United States, it appears to be a much more serious problem internationally. In 1999, the estimated proportion of multidrug resistance in new TB patients was 1.6% in the United States but reached as high as 10% in Latvia and Russia (see graph). Rates of TB and drug-resistant TB have been increasing at an alarming rate in Russia, fueled by 1) lack of continuous access to quality drugs, 2) the country’s inability to support the TB diagnosis and treatment infrastructure, 3) high levels of TB transmission in prisons, 4) limited TB control policies and reluctance to adopt the WHO-recommended DOTS strategy, and 5) increasing levels of HIV infection.

At the request of the USAID mission in Moscow, WHO, CDC, and USAID are implementing DOTS programs in the Orel and Vladimir oblasts (territorial administrative divisions) and strengthening the DOTS program started by WHO in Ivanovo oblast in 1995. As part of the implementation of DOTS-Plus (WHO’s strategy for managing MDR TB in low-resource settings) in the Ivanovo oblast, CDC 1) developed a diagnostic and treatment protocol that has become the basis for the Russian DOTS programs, 2) posted CDC public health advisors to 3-month temporary assignments to help implement DOTS and DOTS-Plus strategies, 3) helped establish a national TB surveillance system, and 4) conducted epidemiologic studies of risk factors for development of MDR TB. CDC has also provided laboratory training, quality assurance for drug sensitivity testing, and consultation. As a result of these actions, cure rates in Ivanovo oblast have risen from 61% to 75%; in the initial cohort in Orel, the cure rate was 83%.

CDC has also been involved in activities to strengthen TB laboratory services in low-income countries. Throughout much of the world AFB microscopy is the basis for diagnosis and control of TB, but there is currently no practical guidance for national programs in monitoring and promoting quality testing at the clinic level. CDC and its Stop TB partners are developing international guidelines on national external quality assessment programs for microscopy. CDC has also developed several products that are focused on providing training to the laboratory technician performing AFB microscopy at the local level in middle- and low-income countries.

CDC is also engaged in WHO-sponsored international efforts to evaluate the effectiveness of treatment strategies for MDR TB in low-resource settings and to conduct large-scale purchases of MDR TB drugs that will lower prices to a fraction of current levels. CDC is a charter member of an MDR TB working group and serves as one of five international agencies that

review MDR TB treatment protocols submitted by national TB programs for potential participation in WHO's MDR TB treatment network.

Efforts to address TB-HIV coinfection include the implementation of the BOTUSA Project in Botswana. In 1995, at the invitation of the Ministry of Health, CDC established a TB-HIV field site in Botswana, a country with high HIV prevalence and high TB case rates. The field site is collaborating with the Botswana Ministry of Health, WHO, and other countries on the provision of TB preventive therapy to persons with HIV infection and the development of methods to improve TB diagnosis in low-resource settings. The BOTUSA site serves as a base for regional USAID-funded TB activities throughout southern Africa, including an assessment of drug quality and the implementation of a computer-based TB surveillance system. Research projects have addressed 1) causes of illness in patients with suspected TB whose initial diagnostic evaluation was negative, 2) use of molecular epidemiology techniques to identify risk factors for TB transmission, 3) absorption of TB drugs in patients coinfected with TB and HIV, 4) TB drug resistance, 5) patients' knowledge and attitudes about HIV and TB testing, 6) acceptability of preventive therapy, and 7) TB patients' risk behaviors for HIV transmission. BOTUSA is working with the national AIDS and TB programs to explore the use of preventive therapy postnatally in HIV-positive women and to identify other populations for TB preventive therapy.

Objective IV-A

In collaboration with WHO and other international partners, provide leadership in public health advocacy for TB prevention and control.

Activities

1. Increase collaboration with the Stop TB Partnership at both the global and regional levels.
2. Working with the USAID-funded TB Technical Advisors Consortium, increase the pool of skilled persons who can provide technical assistance to TB control programs.
3. Support the educational programs of IUATLD.
4. Contribute to the development of technical guidelines and recommendations through participation on international working groups (e.g., Green Light Committee, WHO Scientific and Technical Group for TB, Regional WHO Advisory Committees).
5. Provide technical assistance to USAID for activities related to TB control.
6. Coordinate with NIH in international TB control and research.

Objective IV-B

Provide technical support and build capacity for implementation of DOTS, especially in those countries that contribute significantly to the U.S. TB burden.

1. Contribute technical support and capacity-building assistance to strengthen epidemiologically-based DOTS implementation in 3 to 5 countries from which a high volume of U.S. TB cases originate and in several of the other 22 high-TB burden countries identified by WHO.
   - Conduct operational studies to enhance the implementation of DOTS.
   - Improve TB surveillance.

- Provide training in program management, epidemiologic methods, and operations research.
- Assist in program reviews (WHO, IUATLD, USAID).

2. In collaboration with the Stop TB Partnership, develop technical guidelines and training products that strengthen laboratory services in high-burden countries.

Objective IV-C

In collaboration with WHO and other partners, develop models for the diagnosis and treatment of MDR TB in countries with high rates of drug resistance.

1. Expand and enhance the Latvian model center (see page 50).
2. Provide assistance to the MDR TB project in Peru funded by the Bill and Melinda Gates Foundation.
3. Implement DOTS-Plus in Ivanovo, Russia.

Objective IV-D

Provide technical, programmatic, and research support aimed at reducing the incidence of TB as an opportunistic disease in high HIV-burden countries.

1. Through collaboration with CDC's Global AIDS Program (GAP), provide technical assistance for TB surveillance in countries with high rates of HIV-associated TB.
2. Through collaboration with GAP, provide technical assistance for enhanced TB laboratory capability in countries with high rates of HIV-associated TB.
3. Through BOTUSA and other GAP-supported programs, conduct operational research to improve the diagnosis and treatment of HIV-associated TB.
4. Conduct large-scale feasibility studies of various regimens for the treatment of latent TB infection in HIV-infected persons.

Center of Excellence for the Management of MDR TB in the Baltics

Latvia has one of the highest rates of drug resistance in the world. In 1999, 10% of new TB patients had MDR TB; this compares with 1.6% in the United States and <1% in most African countries. The high rates of MDR TB are attributed to poor treatment programs and drug shortages that occurred in the early 1990s after the fall of the Soviet Union.

In 1999, with fiscal support from the U.S. Department of State, CDC and USAID signed a Memorandum of Agreement to 1) develop a Center of Excellence for the diagnosis and management of MDR TB in Latvia, and 2) disseminate lessons learned to Estonia, Lithuania, and other republics of the former Soviet Union where TB control efforts have been compromised by drug resistance. The Center was designed to develop local expertise and facilities that can provide world-class diagnosis and treatment of MDR TB and to use locally trained experts and facilities to train persons from other countries in the region. The project builds on a foundation of basic TB and MDR TB treatment programs that are being supported by the Latvian government with financial and technical support from the World Bank and the Nordic countries.

Since the signing of the agreement, the Center has made substantial progress in three focus areas:

1) building expertise among Latvian physicians by strengthening clinical practice and management,

2) designing and implementing infection-control measures, and

3) organizing MDR TB training for physicians from elsewhere in the region.

In September 1999, the Center initiated a study of risk factors for primary and acquired MDR TB; findings will facilitate early targeting of patients with likely MDR TB for more rapid diagnosis and possible presumptive treatment. The training component began in March 2000 with a course for Latvian physicians who manage MDR TB patients. By use of videoconferencing, the Center also conducts regular meetings in which Latvian physicians present and discuss difficult management issues with U.S.-based experts. Finally, the Center has started development of an MDR TB data management system that will facilitate case management and treatment outcome studies, the results of which can be used to improve clinical practice. The data system can also serve as a model for a WHO consortium of countries conducting pilot projects in MDR TB management.

Infection-control efforts are designed to respond to evidence of ongoing transmission of MDR TB to staff and patients. The Center is developing an infection-control plan that includes the installation of air-cleaning equipment. A plan to ensure more rapid laboratory diagnosis of drug resistance is also being developed so that MDR TB patients can be segregated from other patients and treated more quickly.

Regional training, the final component of the project, began in January 2001 with the training of the first group of physicians from Russia. The 3-week course, which was taught by CDC's Latvian collaborators in Russian, was an expanded version of the initial MDR TB course staged for Latvian physicians in March 2000 and included extensive opportunities for discussion of case management.

Initiative/Global AIDS Program

In 2000, the U.S. government launched the Leadership and Investment in Fighting an Epidemic (LIFE) initiative with a $100 million increase in U.S. support to 14 countries in Africa and India. CDC received $35 million of the initial funds and through its newly formed Global AIDS Program is working closely with USAID to implement this initiative. CDC's objectives are to 1) reduce HIV transmission through primary prevention of sexual, mother-to-child, and bloodborne transmission, 2) develop programs to improve community and home-based care and treatment of HIV infection, other sexually transmitted infections, and opportunistic infections, and 3) strengthen the capacity of countries to collect and use surveillance data and to manage national HIV/AIDS programs. Improving TB prevention and control efforts is an important component of the project, and CDC staff have been involved in 1) developing project blueprints consisting of "best practices," 2) participating in site visits, and 3) convening experts to provide input into the selection of countries for initial efforts and the proposed content for country-specific projects; initial TB efforts have focused on six countries.

GOAL V: Mobilize and sustain support

Mobilize and sustain support for TB elimination by engaging policy and opinion leaders, health care providers, affected communities, and the public. Implement a comprehensive health communication campaign that supports TB elimination and ensures the development and delivery of effective TB elimination messages. Improve communication efforts through consistent monitoring and evaluation of the plan's methods and strategies.

A comprehensive CDC health communication effort will develop momentum for TB elimination at the national and local levels. At the national level, the communication plan will include the use of news media and outreach to national organizational partners. At the local level, CDC messages and strategies should be an integral component of a data-driven, community-specific plan to foster strong linkages among health departments, community leaders, organizational partners, and the affected community. CDC's communication efforts will be national in scope, but strategies will vary according to TB morbidity levels in a particular area. The use of existing surveillance data will be a key determinant in defining specific target audiences and developing communication strategies to reach the targeted groups of the general public.

Objective V-A

Develop and implement a health communications effort focusing on the achievable goal of eliminating TB.

To secure needed resources and support, all partners — policy makers, leaders from affected communities, clinical and public health organizations, and the general public — must support and advocate for TB elimination. Policy makers must understand the importance of and need for TB elimination and become armed with the tools to become effective advocates and spokespersons.

Activities

1. Develop and implement a national health comunication campaign to raise the awareness of policy makers, health care providers, and the public about the ongoing toll of TB and to create support for elimination efforts. Elements of this campaign include but are not limited to the following:
   - Identify key messages to communicate to these specific audiences.
   - Identify and train national spokespersons. Include representatives from CDC, affected states and communities, and key organizational partners.
   - Create sustained media outreach. Working with national and local TB program staff, plan a calendar of newsworthy events, including data releases, journal articles, conferences, program milestones, grant awards, and other items of interest. Focus outreach on major national print, electronic, and news media outlets as well as outlets associated with affected areas and high-risk populations.
   - Develop features highlighting local success stories and outbreak responses. Examine how these efforts affect individuals and communities and can help prevent the spread of TB.
   - Explore how local outbreak responses can support national communication objectives. Implement protocols for obtaining outbreak information from local health jurisdictions and funneling the information to neighboring and other jurisdictions and to organizational partners, policy makers, and community groups.
2. Encourage support for new diagnostic, treatment, and prevention methods by informing TB prevention leaders and policy makers about progress in TB elimination using local data and the resources needed to ensure continued progress.
   - Develop routine and coordinated communication with state health officers, TB prevention leaders, and other policy makers on TB morbidity in their communities.
   - Create or enhance mechanisms to disseminate TB information rapidly. Tailor the data presented and method of communication to the needs of target audiences.
   - Create a systematic, yearly plan to highlight TB elimination activities at conferences, meetings, and events attended by policy makers and TB prevention leaders.
3. Develop communication partnerships with national organizations.
   - With consultation from members of the National Coalition to Eliminate Tuberculosis (NCET), create a list of the top ten national organizational partners. Selection criteria might include credibility with target audiences, organizational reach to target audiences, and ability to mobilize organizational networks.
   - With consultation from the American Lung Association (ALA), identify key leaders from the top ten organizational partners. Initiate contact, and assess each group's availability to work on the communication campaign.
   - Work with each local and national organization to customize program messages and develop initiatives at the community level. Obtain input from partner organizations during the development, implementation, and evaluation of communication activities.

Objective V-B

Help communities foster nontraditional, multisectoral, public-private partnerships to improve the effectiveness of their communications activities, with particular attention to culturally appropriate materials.

TB elimination will require significant community buy-in, support, and involvement. State and local health departments must build support in affected communities; develop mechanisms for ongoing communication with organizational staff, community leaders, and policy makers; and encourage the community to join the elimination effort. Community groups can help define local needs and assets and specify how needs can be appropriately and effectively addressed and how assets can be deployed. Community partners can facilitate the implementation of rapid outbreak response, provision of clinical and laboratory services, and enhanced health promotion interventions. Credible community leaders can deliver messages and distribute materials that promote health care–seeking behavior in at-risk populations.

Activities

1. Develop consistent and routine communication channels for sharing TB-related information with state and local health departments.
   - Sustain existing communication systems, and develop additional systems (e.g., listservs, broadcast fax, broadcast email) as needed to facilitate the receipt and use of TB-related information by state and local health departments.
   - Provide health departments with access to TB-related health communication and community participation materials.
2. Create unifying TB elimination messages and a partnership-building tool kit for states.
   - Conduct formative research with community representatives to develop community involvement messages.
   - Develop and evaluate a prototype partnership-building tool kit, guided by qualitative research and pretest findings.
3. Support state and local health departments in their efforts to engage community representatives in TB elimination activities.
   - Create mechanisms for dialogue among community representatives, health departments, and CDC staff (e.g., on-site consultations, listservs, discussions at regional meetings).
   - Conduct research on models for conceptualizing, planning, and implementing appropriate community input mechanisms (e.g., town hall meetings). Examine the use or adaptation of the popular opinion leader HIV/AIDS prevention intervention package for TB elimination. Host small meetings to learn what works in states, and disseminate the findings.
   - Create materials (e.g., slide shows, fact sheets, brochures) in collaboration with health departments and community leaders to inform community groups, managed-care organizations, and provider groups about the TB elimination effort.

4. Equip community representatives with local data and tested materials to help them develop interventions and materials that promote TB awareness among at-risk persons.
   - Conduct formative behavioral research with at-risk persons to determine their knowledge, attitudes, and beliefs about TB and TB testing. (See IIB.)
   - Review and incorporate relevant information gleaned from World TB Day efforts.
   - Develop and implement a health communication training/technical assistance strategy for community representatives. Design training courses to enhance health communication capacity in local areas beyond the TB elimination effort.

Objective V-C

Support the development of state- or area-specific TB elimination plans that contain communications activities to build public support for TB elimination.

Activities

1. Provide ongoing technical assistance to state health officers, TB controllers, and other leaders in developing TB elimination strategies, approaches, and plans.
   - Use existing surveillance data to identify successful programs and program challenges.
   - Use the information gathered about successful TB elimination activities to develop tools (e.g., best-practices information, newsletter articles, op-eds) for other states.
   - Host a meeting or session at the National TB Controllers Workshop, American Public Health Association (APHA) annual meeting, and other key national conferences to showcase best practices and lessons learned and to disseminate tools for replication.
2. Conduct "Mobilizing for TB Elimination" workshops for state TB controllers and their partners to train them in the development of state- or area-specific TB elimination plans that contain communications activities to build public support for TB elimination.

Stages in the Health Communication Process

All activities undertaken as part of the CDC communications campaign will be planned and conducted according to the following Stages in the Health Communication Process[67]:

Stage 1: Planning and Selecting a Strategy

- What do we know about the health problem?
- Who are the target audiences? What is known about them?
- What are the program goals?
- What measurable objectives can be established to define success?
- What are the messages?
- How will the initiative be evaluated?

Stage 2: Selecting Channels and Materials

- What existing materials can be used or adapted?
- What formats will best suit the channels, messages, and audiences?

Stage 3: Developing and Pretesting Materials

- How can the messages be presented to the target audiences?
- What has message testing revealed about audience reaction, message clarity, recall, acceptance, and value?
- What changes need to be made to the messages or their format, based on testing responses?

Stage 4: Implementing the Program

- Are the messages making it through the communication channels to the audiences?
- Do any channels need to be changed? Do any new ones need to be added?
- What modifications need to be implemented?

Stage 5: Assessing Effectiveness

- Were the communications objectives met?
- Were the changes that took place the result of the program, other factors, or a combination of both?

Stage 6: Feedback to Refine the Program

- What made this program work or not work?
- What changes should be made to improve the program or better reach the target audience?

GOAL VI: Track progress

Monitor progress toward the goal of TB elimination, and make regular reports on progress to all target audiences.

Objective VI-A

Develop innovative analyses for examining surveillance data to help focus elimination efforts.

Traditional analyses of surveillance data provide basic descriptive epidemiology, including case counts and case rates by time, place, and case characteristics. Since 1993, the expanded TB case report has provided additional information on TB risk factors, such as HIV status, initial drug resistance, and treatment. These additional data elements have enhanced the ability at local, state, and national levels to describe high-risk populations and assess program efforts to ensure prompt and appropriate treatment for active cases. To better focus elimination efforts, innovative analyses to supplement traditional analyses will be needed. For example, the development of a definition of elimination for areas where annual case counts are very low (e.g., <10) and population size fairly small (e.g., <100,000) will help pinpoint regions on track for elimination.

Activities

1. Convene CDC work group(s) to define areas where innovative analyses would be most useful and to devise strategies for development and implementation.
2. Conduct and disseminate the results of innovative analyses to better focus elimination efforts.

Objective VI-B

Develop novel indicators of progress toward elimination.

Traditional program indicators included annual incident case counts and case rates, estimates of primary and acquired drug resistance, and completion-of-therapy rates. Recently developed indicators of successful contact investigations and targeted testing include completion-of-therapy rates for persons identified with latent TB infection. As areas progress toward elimination, further development of novel indicators will be essential.

Activities

1. Develop a CDC unit to work with partners from local, state, and federal levels to periodically review standard indicators and develop new indicators for use in measuring progress toward elimination.
2. Develop meaningful and useful reports for program officials and policy makers highlighting national progress using these standard indicators.

Objective VI-C

Conduct periodic evaluations of TB program performance at federal, state, and local levels.

An important part of TB control efforts is continuous evaluation of the effectiveness of control programs. Program evaluations provide 1) a feedback loop for data that can be used to refine operations and procedures, 2) a rational basis for decisions about the relative value of particular activities, and 3) information about ways to improve specific aspects of a given program. Evaluations force persons close to a program to step back and examine their efforts objectively. This is especially useful for well-intentioned programs that may be more concerned about addressing the immediate TB treatment and control needs in their communities than in determining the best ways to meet those needs. Methods to identify and correct problems in TB control programs and systems must be developed before they result in the further spread of TB disease and the development of drug-resistant TB.

Activities

1. Develop guidelines and standards for TB program evaluation.
   - Conduct research to identify best methods for the evaluation of TB programs.
   - Work with national organizations (e.g., ACET, NTCA, NCET) to develop guidelines and standards for TB program evaluation.
   - Disseminate guidelines and standards to state and local TB programs.
   - Incorporate evaluation as a core component of TB prevention and control programs.
2. Develop the capacity for program evaluation at the federal, state, and local levels.
   - Develop training in evaluation methods and techniques.
   - Provide ongoing technical assistance in program evaluation.
   - Develop information management systems to facilitate program evaluation.
   - Provide funding for program evaluation, utilizing the results for strategic planning and program enhancement.

Objective VI-D

Conduct an annual progress review.

Activities

1. Prepare annual progress reports for review by ACET and NTCA.

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