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Preventing and Controlling Tuberculosis Along the U.S.-Mexico Border

Work Group Report

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U.S.-Mexico Border**

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Summary

Converging factors contribute to elevated tuberculosis (TB) incidence and complicate case management in the U.S. states bordering Mexico. These factors include a) Mexico's higher TB rate; b) low socioeconomic status and limited access to health care in the border area; c) frequent border crossings and travel in the United States for employment, commerce, health services, and leisure; d) language and sociocultural differences; and e) lack of coordinated care across health jurisdictions on both sides of the U.S.-Mexico border. Prevention and control efforts that address the challenges created by border-crossing populations require collaboration among local, state, and national TB control programs in both countries. In June 1999, to facilitate future discussions with Mexican counterparts, CDC convened a meeting of TB control officials from the four U.S. states bordering Mexico (i.e., California, Arizona, New Mexico, and Texas) to address TB prevention and control in the border area. Focus areas included a) surveillance needs, b) case management and therapy completion, c) performance indicators and program evaluation, and d) research needs. Meeting participants' deliberations and resulting proposals for action by CDC and state and local TB control programs are detailed in this report.

INTRODUCTION

During 1994--1998, approximately 3.9 million legal immigrants entered the United States. Of those immigrants, 16.5% were from Mexico, the leading country of birth for all legal immigrants, and 5% were from seven countries in Central America (1). Additionally, an estimated 2.7 million persons from Mexico and Central America live in the United States without documentation of citizenship or visas (2). Persons from these countries contribute substantially to U.S. tuberculosis (TB) morbidity.

TB disease among foreign-born persons living in the United States is increasing. In 1999, 43%

(7,553) of the 17,531 TB cases reported in the United States were among foreign-born persons, compared with 24% (6,262) of the 25,701 cases reported in 1990. In 1999, Mexico was the country of origin for 23% (1,753) of all foreign-born persons with TB. Of TB cases among Mexican-born persons, three fourths were reported from the four U.S. states bordering Mexico: California, 820 cases; Texas, 364 cases; Arizona, 67 cases; and New Mexico, 17 cases (3). In 1999, TB cases among Mexican-born persons represented approximately 25% of all reported TB in the four border states. Incidence of TB was higher for the majority of border counties than the national TB rate.

TB is brought into the United States from Mexico and Central America in three ways: a) persons with active TB disease move northward across the border; b) persons with latent TB infection experience active disease after arrival in the United States; or c) U.S. residents touring Mexico, including immigrants, acquire TB disease after returning to the United States (4--7). After a person with TB enters the United States, further transmission might occur, which contributes to TB morbidity in the United States directly from source patients and indirectly from their contacts.

Converging factors contribute to elevated TB incidence and complicate TB control efforts along the U.S.-Mexico border. Mexico's higher TB rate of approximately 27 cases/100,000 population, compared with that of the United States, and the migratory flow across the border result in elevated TB incidence in the geographic areas most affected by cross-border immigration. Low socioeconomic status, crowded living conditions, and limited access to health care increase the risk for TB transmission on both sides of the border. Frequent bilateral border crossings and movement within the United States contribute to delays in TB diagnosis and impede treatment completion. Language and sociocultural differences also contribute to delays in seeking care and influence adherence to treatment (8,9). Coordinating TB case management across an international border is complicated, and among certain TB patients, outcomes are compromised.

Ultimately, lowering TB rates in the border area and reducing racial and ethnic disparities of TB disease depend on identifying and treating infected persons on both sides of the border until patients are cured. Therefore, TB prevention and control efforts along the U.S.-Mexico border require the cooperation of local, state, and national TB control programs in both countries, including strategies for coordinated interventions and funding to ensure that adequate resources are available (Box).

To begin addressing this public health problem, the TB Along the U.S.-Mexico Border Work Group was formed. In June 1999, staff of CDC's National Center for HIV, STD, and TB Prevention/Division of Tuberculosis Elimination convened a meeting of TB control officials from Arizona, California, New Mexico, and Texas to develop a coordinated domestic strategy. After reviewing the epidemiology of the TB epidemic from national and local perspectives, the work group focused on a) surveillance needs, b) case management and therapy completion, c) performance indicators and program evaluation, and d) research needs. For each of these topics, the participants identified key problems, objectives, and resources needed to enhance TB prevention and control efforts along the border. The following programmatic actions for federal agencies and state and local TB control programs were then identified:

- establishing a consensus case definition for a binational TB case and assessing the need for a registry of binational cases;
- improving the clinical care of binational TB patients and their close contacts in the border states by expanding existing activities and developing new programs for TB diagnosis and case management to ensure treatment completion;
- creating evaluation tools for TB prevention and control efforts, including contact investigations and targeted testing of populations at high risk; and
- setting research priorities.

This report contains the work group's proposals regarding these programmatic actions. These

proposals are not CDC directives, but they should be regarded as a starting point for public health practice and TB prevention and control interventions.

BACKGROUND

Geographic Characteristics of the U.S.-Mexico Border

The U.S.-Mexico border is approximately 2,000 miles long and separates four U.S. states --- California, Arizona, New Mexico, and Texas --- from six Mexican states --- Baja California Norte, Sonora, Chihuahua, Coahuila, Nuevo León, and Tamaulipas (Figure 1). Approximately 1 million persons cross the U.S.-Mexico border daily. Major metropolitan areas straddle the border, including San Diego-Tijuana (population: 4 million persons), El Paso-Ciudad Juárez (1.9 million), Laredo-Nuevo Laredo (0.4 million), Brownsville-Matamoros (0.5 million), and Harlingen/McAllen-Reynosa (1 million). Two of these areas, San Diego-Tijuana and El Paso-Ciudad Juárez, account for 40% of daily border crossings. Although they are legally separate cities, these sister cities have become closely integrated binational and bicultural communities by sharing social, environmental, and economic interests and problems.

Counties along the U.S.-Mexico border are among the poorest economically in the United States. Approximately one third of U.S. border families live at or below the poverty line compared with a national average of 11% (10,11). An estimated 400,000 persons live in the United States along the Texas border in *colonias* (i.e., semirural communities) without access to public drinking water or wastewater systems. Unemployment rates in the border area are approximately threefold higher than those in the rest of the United States. A total of 10 of 24 counties evaluated along the U.S.-Mexico border are medically underserved and of low socioeconomic status (12). During 1990--1996, communicable diseases other than TB (i.e., brucellosis, measles, hepatitis A, hepatitis B, mumps, pertussis, salmonellosis, and shigellosis) occurred at higher rates in U.S. border counties than in nonborder counties (13). Diabetes, which increases the risk for TB, is also more common among Hispanics and American Indians compared with non-Hispanic whites (14).

TB Rates in the Border Area

TB rates among border communities are higher than the rates for their respective states overall (Figure 2, Table 1). During 1998--1999, the average TB rates/100,000 population were 22.9 in Laredo and 39.7 in Nuevo Laredo, compared with 8.7 in Texas and 33.1 in Tamaulipas. Rates in other border-city pairs were 21.8 in Brownsville and 70.3 in Matamoros; 15.1 in McAllen and 43.9 in Reynosa; and 10.1 in El Paso and 17.8 in Ciudad Juárez (Eugene J. Tamames, Texas Department of Health, personal communication, July 2000). The TB rate in San Diego County was 10.3/100,000 population, but among Hispanics of predominately Mexican descent, the rate was 23.5 cases/100,000 population, higher than the state rate of 12.9 for Hispanics (Reuben M. Granich, M.D., M.P.H., California Department of Health Services, personal communication, July 2000). A 1998 tuberculin testing program in one San Diego County school district identified a 32% skin-test--positive rate among Mexican-born high school students (15).

Overall TB incidence is higher in Mexico than in the United States. The 1999 incidence of pulmonary TB in Mexico was 17 cases/100,000 population nationally and 27.1 cases/100,000 population along the U.S.-Mexico border (Elizabeth Ferreira, M.D., Mycobacterium Prevention and Control Program of Mexico, personal communication, July 2000). Adjusting for underreporting, the World Health Organization estimates the incidence of pulmonary TB in Mexico to be 45 cases/100,000 (16).

Prevalence of drug-resistant TB strains increases concerns regarding the cross-border spread of TB. In 1997, CDC and the Secretariat of Health of Mexico conducted a population-based survey to gather data regarding TB drug resistance for the three Mexican states of Baja California Norte, Sinaloa, and Oaxaca (17). In those Mexican states, drug-resistance rates for

>1 of the first-line drugs (i.e., isoniazid, rifampin, or pyrazinamide) used among new and retreatment patients with sputum-smear-positive pulmonary TB were 13% and 51%, respectively. However, one study demonstrated that limiting drug-resistance surveillance to acid-fast bacilli smear-positive cases might underestimate the rate of primary drug resistance in Mexico (18). Similarly, retreatment patients were more likely than new patients to have isolates of multidrug-resistant TB (i.e., resistance to isoniazid and rifampin) (2.4% and 22%, respectively). In 1997, in contrast, 1.4% of culture-positive patients in the United States had multidrug-resistant TB (19).

Characteristics of TB Cases Reported from U.S. States Bordering Mexico*

During 1993--1998, the four border states reported to CDC a total of 8,661 TB cases among Mexican-born persons. The proportion of TB cases among Mexican-born persons from counties bordering Mexico was similar for Arizona (43%), New Mexico (41%), and Texas (42%); however, the proportion was substantially lower for California (14%). A higher proportion of cases were among Mexican-born persons aged 15--44 years; otherwise, characteristics were similar between Mexican-born and U.S.-born TB patients (Table 2).

Data reported to CDC during 1993--1998 confirm higher drug-resistance rates among Mexican-born TB patients than among U.S.-born TB patients. Ninety five percent (5,756) of reported culture-positive TB cases among Mexican-born persons and 92% (12,969) of cases among U.S.-born persons without a previous history of TB had initial drug-susceptibility test results for isoniazid and rifampin. Of these, 9.1% of initial isolates from Mexican-born persons and 4.4% of those from U.S.-born persons were resistant to isoniazid at least; 1.4% of initial isolates from Mexican-born persons and 0.6% of isolates from U.S.-born persons were multidrug-resistant TB.

During 1993--1998, date of arrival in the United States was reported for 89% of TB cases among foreign-born persons from the four border states. Approximately 54% of Mexican-born TB patients resided in the United States for >5 years before their TB was diagnosed; 14% of Mexican-born TB patients had lived in the United States for <1 year before their TB was diagnosed.

During 1995--1997, a study was conducted of TB cases reported among foreign-born Hispanics from eight U.S. counties bordering Mexico and seven urban nonborder counties in the four border states (20). Results from that study regarding the migration practices of TB patients in the border area demonstrated that, compared with patients from nonborder counties, foreign-born Hispanic TB patients

- had lived in the United States longer (17 versus 11 years);
- more often had immigrated from Mexican border communities (62% versus 25%);
- more often had returned to Mexico weekly (38% versus 2%) or during the past 12 months (72% versus 47%); and
- more often had been born in Mexico (94% versus 80%).

SURVEILLANCE NEEDS

To better understand the epidemiology of TB cases along the U.S.-Mexico border, surveillance needs (e.g., development of a case definition and TB registry for binational cases) should be addressed.

Case Definition

No standard surveillance definition for a binational TB case is in use by border TB control programs; thus, using a uniform case definition would enable standardized data collection and increase accuracy in data analysis and comparison. A standardized case definition should be flexible enough to encompass all factors related to binational TB patients and the health

providers who serve them, yet specific enough to facilitate accurate, consistent reporting. Additionally, the binational TB case definition should enable collaboration with Mexico's programs and public health providers who might use a different TB case definition than that used in the United States.

Work Group Proposal

The work group defines a binational TB case as one that meets the U.S. or Mexican case definition for active TB disease (21,22) plus one of the following criteria:

- Optimal case management requires communication or collaboration with TB control programs or health-care providers on the opposite side of the border. For example, a TB control program in the United States would transfer clinical or laboratory data, refer a patient for treatment completion, or share information for contact investigation with a Mexican TB control program.
- The case-patient is a contact of a binational TB case-patient or is the TB source case-patient for contacts on the opposite side of the U.S.-Mexico border.

Registry of Binational TB Cases

U.S. TB control programs along the border identify locally defined binational cases in their own TB registries, but none maintains local or statewide electronic records for these cases. An electronic registry of binational TB cases available to all programs would a) enhance documentation of the number of TB cases not included in the annual TB morbidity count, b) facilitate sharing of up-to-date clinical data (e.g., prior anti-TB drug treatment), and c) improve case management of binational TB cases.

Fundamental requirements for creating an electronic binational TB case registry are a standard case definition and key database variables. Those key database variables should reflect the unique characteristics of binational TB cases. Critical variables include information regarding the frequency and duration of border crossings before and during treatment, INS custody and disposition, anti-TB drug treatment regimen, drug resistance, treatment using directly observed therapy, and beginning and ending treatment dates. Creating a binational TB case database also requires decisions regarding

- responsibility for database development and maintenance,
- data validation and security,
- ability to link with other databases,
- ease of modification and updating,
- data analysis capability,
- report-generation capability,
- patient confidentiality, and
- cost.

The work group proposes the following three options for developing a unified registry of binational TB cases:

- **CDC's TB Information and Management System (TIMS).** TIMS is a comprehensive software for surveillance, patient management, and program evaluation that is used by U.S. state health departments to report TB surveillance data to CDC. In each jurisdiction, TIMS can be adapted for local use as a registry of binational TB cases via the user-defined variable option. Advantages include the current availability of the system throughout the United States. Disadvantages include the necessary computer support, confidentiality, and the current limitations to directly link TIMS with other jurisdictions in the United States; however, indirect links are possible by using exported data sets from TIMS.
- **Internet-based system.** An Internet-based system, modeled on fully operational existing

systems (e.g., OpenEMed ** [formerly TeleMed], which was developed by Los Alamos National Laboratory and National Jewish Medical and Research Center), could provide a secured database of binational TB case records available for viewing and updating. Such a system would have advantages for following and managing patients whose TB care spans multiple locations in the United States and Mexico. An Internet-based system would require data security, analytic capabilities, ability to link with existing databases, platform- and operating-system independence, and users' ability to access a secured Internet site. Additional information is needed regarding feasibility, cost, maintenance, data security, data integrity, and access to data in English and Spanish.

- **Existing binational program databases.** Electronic databases from existing binational referral and follow-up programs could be used. CURE-TB and TB Net are two such programs that have electronic databases, but they use different software and formats. In addition, their primary function is patient follow-up and management rather than surveillance.

Work Group Proposals

CDC should

- work with TB control programs in the United States and Mexico to a) verify the need for a unified registry of binational TB cases; and b) determine if an existing system could be modified for broader use and interfaced to reliably and securely share information or if a new system should be developed.
- work with TB control programs, if developing a registry, to a) define the registry variables, b) ensure data security and validation, and c) analyze registry data to monitor case trends and identify populations at high risk.
- review current public health laws and clarify which surveillance data can be shared among TB control programs in the United States and Mexico.

State and local TB control programs should

- collaborate with one another and CDC to determine a) the feasibility of creating and maintaining a secure registry of binational TB cases, b) the sharing of responsibilities for maintaining and updating the registry, and c) what would be ideal mechanisms for data sharing, security, and use.
- collaborate with one another and CDC to determine a) the type of database template to use, b) the primary function of the database (e.g., surveillance, case management, or both), and c) key variables to be included. If an Internet-based database is preferred, the collaborators should first assess users' Internet-access capabilities and the costs for ensuring Internet access for users of the surveillance system.
- consider adding variables to the locally defined fields in TIMS to identify and follow trends among binational TB cases to facilitate data comparison among jurisdictions.
- work with CURE-TB, TB Net, and other binational referral and follow-up systems to avoid duplication of effort and improve case referral, follow-up, and documentation of patients' medical histories.

CASE MANAGEMENT AND THERAPY COMPLETION

Optimal TB case management includes prompt disease diagnosis, close monitoring of medical regimens, assurance of adherence to treatment, and identification and evaluation of close contacts. Each of these strategies becomes more difficult when case management must be coordinated among health jurisdictions, particularly across international borders. Because the highest percentage of foreign-born TB patients living in the United States comes from Mexico, shared case management could occur frequently between the two countries. Coordination mechanisms should address differing national case definitions, national protocols, priorities, and resources as well as cultural and language differences. In the immediate U.S.-Mexico border area, case management involves substantial numbers of persons moving across the

border as often as daily. TB patients who live on one side of the border might have their disease diagnosed or treated in the adjacent country; therefore, investigation of close contacts often involves school, work, and social settings on both sides of the border. Limited forums exist for disseminating information regarding successful case-management strategies across international borders. Ongoing coordination among TB control programs in border areas is vital, and local efforts to enhance these relationships should be encouraged.

Finding and Managing Active TB Cases

U.S. and Mexican citizens cross the border for TB diagnosis and treatment without routinely notifying health departments of either country of their origin or destination. Additionally, immigrants from Mexico and Central America who do not have documentation of citizenship or visas are not screened for active TB. Case management might be compromised because of gaps and changes in treatment and failure to share clinical and diagnostic information, perform timely contact investigations, and promote therapy completion (23). Improved communication among TB agencies and health-care providers at local, state, national, and international levels is needed to ensure effective case management and to coordinate care and completion of therapy.

Work Group Proposals

CDC should

- review privacy laws and clarify what case-specific information can be shared among health departments and private health-care providers in the United States and Mexico for providing clinical care.
- determine, for those Mexican and Central American immigrants identified during immigration screening as possibly having TB, the number who complete their diagnostic evaluation and treatment. The number of legal immigrants who are required or advised but fail to appear at the health department for testing and evaluation should also be determined.

State and local TB control programs should

- develop new or strengthen existing partnerships with counterpart health departments in Mexico to report and refer active TB case-patients and close contacts who cross the U.S.-Mexico border for case management. Also, procedures should be developed for referrals among U.S. and Mexican nonborder TB control programs, including use of CURE-TB and TB Net.
- facilitate partnerships with health-care providers of TB patients on both sides of the U.S.-Mexico border. Partnership agreements (e.g., memoranda-of-understanding) should include timely reporting of active TB cases, treatment outcome evaluations to improve completion of therapy, educational material distribution, and training sessions for private health-care providers to improve the recognition of TB symptoms and the evaluation of symptomatic persons. Further, health-care providers along the U.S.-Mexico border should have current guidelines for the care, treatment, and referral of active TB case-patients and for seeking expert consultation for drug-resistant cases.
- document effective strategies that can be used in other communities for cross-border notification of active TB case-patients and close contacts. These strategies should be shared formally and informally at meetings or through publications and the Internet.
- establish links with physicians (i.e., civil surgeons and panel physicians) who evaluate immigration applicants and with community-based organizations (CBOs) to conduct case-finding activities and provide information for those persons in need of local TB services.
- develop and evaluate activities to inform communities and educate family members of TB patients regarding the availability of local services and reevaluate those activities regularly.

- identify potential barriers to establishing rapport with binational TB patients and then develop case-management practices that actively address these barriers.

Funding To Provide Direct Services

TB control programs use their financial resources to provide services along the U.S.-Mexico border. Certain U.S. health departments have memoranda-of-understanding with Mexican health departments to provide diagnostic and therapeutic services in Mexico. Other health departments provide services to Mexican TB patients in the United States or facilitate co-management of patients who work or live on both sides of the border. However, current Health Care Financing Administration (HCFA) regulations only permit reimbursement for emergency care to persons without documentation of citizenship or visas, but when these persons fail to complete TB treatment, the health of the U.S. public is at risk. Ensuring treatment completion for active TB disease is a priority for TB control programs. In addition, treatment of latent TB infection is cost-effective in reducing the burden of disease and limiting future spread of TB infections (24).

Work Group Proposals

CDC should

- work with border TB control programs to address case-management priorities and ensure that activities are evaluated against established goals, objectives, and outcomes. Border states will need guidance regarding federal funding sources for TB case-management and program evaluation activities.
- collaborate with HCFA to explore amending Medicaid regulations to allow funding for TB treatment to cure for persons without citizenship or visa documentation but who otherwise would be eligible for Medicaid.

State and local TB control programs should

- emphasize technical assistance, quality improvement, and enhanced follow-up and communication to co-manage binational patient care in their interactions with Mexican counterparts.

Ensuring TB Patient Care While in INS Custody

In 1996, approximately 5 million immigrants were living in the United States without documentation of citizenship or visas (25). As with legal immigrants, Mexico was the leading country of origin for undocumented foreign-born immigrants, accounting for an estimated 54% of the total number and 54% of the estimated annual increase (25). Approximately 2 million immigrants were living in California without documentation of citizenship or visas, and 700,000 more were living in Texas. In 1996, approximately 73,000 undocumented immigrants (73% from Mexico) were expelled through the judicial process, and 1.6 million (99% from Mexico) were expelled through an INS procedure known as "voluntary return under safeguards." All such persons are detained in custody under INS observation until their departure. Although the exact proportion of INS detainees having TB is unknown, the rate of active TB disease among Mexican-born persons without documentation of citizenship or visas could be higher than Mexico's national average. For example, at the Port Isabel, Texas, facility in 1998, 14 persons had active TB disease, a rate of 116 cases/100,000 detainees, which is substantially higher than the rate in Mexico (Abraham Miranda, M.D., personal communication, October 2000).

Because standard data regarding the disposition and outcomes of TB patients in INS custody are not collected, the magnitude of this problem is unknown. In addition, the majority of detainees are housed in local jails and state prisons, each of which has its own TB screening policies and relationships with TB control programs. Detainees are transferred frequently

between facilities, and certain facilities might not transfer medical records containing TB status information.

Another barrier to TB patient care while in INS custody is the lack of communication among TB control programs, federal agencies, and local and state facilities that house INS detainees. Immigrants without documentation of citizenship or visas might be released to the community or deported to their country of origin without notification of medical staff providing care to TB patients while in INS custody or the local health department. Also, undocumented immigrants might return to the United States after release in their country of origin. INS has no system for informing local TB programs regarding the disposition of active or suspected TB cases. Resulting lapses in treatment can lead to continued TB transmission and development of drug-resistant TB.

Work Group Proposals

CDC should

- discuss the INS system, problems related to TB patients in INS custody, and areas for collaboration with INS, USPHS/Division of Immigration Health Services, and local, state, and federal correction agencies.
- clarify what case-specific information can be shared legally among health departments, private health-care providers, and INS. Legalities of ensuring completion of therapy by TB patients slated for exclusion or deportation should also be determined by the legally responsible agencies.
- consult with USPHS/Division of Immigration Health Services regarding policies and practices for TB case reporting; discharge planning, including notification of Mexican consulates; continuity of care; and notification of local TB control programs for community contact investigations for active and suspected TB cases.
- work with INS to develop a system for monitoring and collecting data regarding active and suspected TB patients in INS custody (e.g., number of cases identified, length of treatment before release, drug-resistant TB, arrangements for ongoing care, location of release, and rate of return to the United States). These data should be shared with health departments.

State and local TB control programs should

- create liaisons with local INS officials to provide educational materials regarding TB to personnel who work directly with detainees, ensure timely reporting of active and suspected TB cases, establish referral systems to increase continuity and completion of treatment, and provide medical consultation as needed.
- work with local facilities housing INS detainees to ensure that systems are in place for identifying, isolating, and treating active and suspected TB patients.
- identify barriers to therapy completion after patients with active TB are released from INS custody and assess the impact of measures to maintain continuity of TB care among detainees or deportees.
- collaborate in developing Spanish-language materials that specify the locations of local TB services, including binational TB referrals, that do not require documentation of residence status and that state that confidentiality will be maintained. These materials should be given to TB patients in INS custody and to TB patients who do not have citizenship or visa documentation and are therefore at risk for being detained by INS.

PERFORMANCE INDICATORS AND PROGRAM EVALUATION

Performance Indicator: TB Testing Among Border Populations

Unlike immigrants with citizenship or visa documentation, immigrants to the United States from Mexico without such documentation are not screened upon entry for TB disease, human

immunodeficiency virus (HIV) infection, and other health conditions that influence the risk for progression from latent TB infection to active disease. Previously uninfected immigrants from Mexico sometimes acquire latent TB infection after settling in U.S. communities that have a high prevalence of TB. Targeted testing of specific populations at high risk is one strategy for finding and treating binational patients who arrive in the United States with active TB disease or who are at risk for progression to active disease (26,27). Priority groups for targeted testing and completion of treatment include a) persons with HIV infection or other medical conditions (e.g., diabetes) that increase the risk for active TB disease, b) medically underserved persons (e.g., incarcerated persons or persons from areas of low socioeconomic status), and c) immigrants from Mexico who have lived in the United States for <5 years (27). However, identifying, evaluating, and treating to completion the close contacts of infectious TB patients should remain a higher priority than targeted testing of certain populations. Screening of populations at low risk is strongly discouraged.

Work Group Proposals

CDC should

- assist in developing tools to evaluate the cost-effectiveness of targeted testing programs.
- evaluate the usefulness of surveillance data and epidemiologic investigations for defining populations in border communities with a high prevalence of latent TB infection.
- develop an ethnographic and epidemiologic profile of persons at risk for TB, investigate the health beliefs and care-seeking patterns of those at risk, and define the patterns for TB transmission to other populations.

State and local TB control programs should

- evaluate outcomes for persons who have been started on treatment for latent TB infection, stratified by ethnicity and place of birth.
- establish working relationships and formal memoranda-of-understanding with providers who serve targeted populations (e.g., correctional facilities, managed care organizations, HIV clinics, and migrant health clinics) to evaluate the effectiveness of testing and treatment practices.
- seek partnerships with CBOs, schools, work sites, and others to evaluate and improve the testing of recent immigrants and treatment-completion rates for those person with active TB disease.
- train private providers who serve targeted populations regarding techniques of tuberculin skin testing and educate them regarding the importance of appropriate treatment for latent TB infection.
- inform communities of immigrants without documentation (e.g., through Spanish-language community radio announcements) that persons who have or believe they have active TB disease or latent TB infection can be evaluated and treated with confidentiality.

Performance Indicator: Laboratory Support

Sharing laboratory data regarding binational TB patients whose disease was diagnosed in Mexico should be a critical component of case management for TB patients in the United States. In addition, laboratory data for binational TB patients should be linked with U.S. surveillance data. However, transfer of laboratory data among programs requires a secure, confidential information system. Laboratory facilities in certain Mexican border health departments lack the equipment and infrastructure to confirm diagnosis of TB bacteriologically (cultures are not routinely performed by Mexican TB control programs along the border). Collaboration between Mexican and U.S. laboratories could increase Mexico's expertise in diagnosing TB disease and enhance their quality control.

Work Group Proposals

CDC should

- work with state and local TB control programs to develop key variables for reporting laboratory data; these variables should be incorporated in the proposed registry of binational TB cases.
- continue working with the Mexican National Public Health Laboratory Program and U.S. and Mexican border states to build laboratory quality and proficiency testing.

State and local TB control programs should

- seek opportunities, in collaboration with CDC, to strengthen TB diagnostic capabilities in Mexican border states, with an emphasis on improving smear microscopy and culture capability consistent with Mexican TB control policies. Suggested support activities include improving quality control, training for technicians, and identifying funding resources for equipment.

Performance Indicator: Contact Tracing

Contact tracing is a critical but complex component of identifying persons who have active TB disease or who have latent TB infection and are at high risk for experiencing active TB disease. Contact tracing for binational TB patients can be made even more complex by a patient's reluctance to divulge contacts, even to bicultural outreach workers (28). Binational patients fear the stigma of disease and the possible social and legal repercussions of a TB diagnosis (e.g., loss of housing, employment, and income or legal action against persons without citizenship or visa documentation). Also, lack of experience with or understanding of preventive health models, cultural beliefs regarding causes of TB other than a germ-based etiology, and self-medication approaches to treatment (e.g., use of herbal products) might interfere with adherence to public health interventions (29).

Health-care providers and public health officials might be unsympathetic regarding the problems of border-crossing patients, which can limit the effectiveness of contact tracing. Further, TB contact investigators might lack training in necessary interviewing skills for eliciting personal information from patients. Investigators might fail to understand patients' motivations, priorities in relation to a TB diagnosis, and adherence to program guidance. Language and cultural barriers can hinder communication even further. Lack of understanding of the social patterns of binational patients can impede contact tracing. As a result, the traditional contact-tracing concentric-circle model (30) might not be effective in identifying close contacts because of differing social patterns. Deficiencies in communication among public health jurisdictions can hinder contact investigations, especially if coordination must span international borders. Finally, protocols for contact tracing differ between the United States and Mexico (22,31,32).

Work Group Proposals

CDC should

- develop, in conjunction with state and local TB control programs, standardized, linguistically and culturally appropriate contact interview questions intended to elicit contact information regarding cross-border social networks and extended family structures.
- work with state and local health departments to develop a culturally sensitive interview training program for TB contact investigators. Training programs should emphasize principles of reflective listening (33--35), and their content should be based on studies of hard-to-reach populations.
- support a sociobehavioral study of binational TB patients' priorities, motivations, and expectations, and the ways in which these affect adherence to recommended TB

evaluation and treatment. Key issues include binational patients' experience with health care in their country of origin and in the United States, reasons for moving to the United States, and perceptions regarding government agencies.

State and local TB control programs should

- work with CDC on projects designed to enhance the understanding of TB patients' culture, experiences, opinions, motivations, and concerns.
- designate a liaison to work with other jurisdictions in coordinating contact investigations across state and international borders, within a context of differing
- protocols and policies in Mexico. The usefulness of patient interviews in the United States to identify close contacts in Mexico should be evaluated.
- collaborate with CBOs that serve binational TB patients to determine if techniques used in other screening programs (e.g., use of nonprofessional community health workers as liaisons and educators) could enhance contact tracing.
- seek to benefit from other public health programs in understanding the social networks in the community and to acquire new, more effective interview techniques.

Program Evaluation

Performance of TB control programs among binational populations has not been characterized adequately in terms of prevention and treatment interventions because program evaluation requires sharing the three performance indicators as discussed previously. These indicators should be based on a hierarchy of programmatic goals: a) measurable outcomes of TB diagnosis and treatment for persons with active disease, b) efficient processes for ensuring the completion of treatment of persons with TB, and c) adequate infrastructure for the system that delivers TB services.

Work Group Proposals

CDC should

- work with local, state, and federal agencies with expertise in TB control and program evaluation to agree on and disseminate a framework for program evaluation designed explicitly for binational TB cases. Specific performance indicators should correlate with the priority goals and activities identified during that process.
- evaluate state-based and other binational TB control programs, including binational referral and follow-up systems, by applying the performance indicators included in the evaluation framework.
- assist in devising tools for evaluating contact investigations of binational cases and determine the operational outcomes and cost-effectiveness of expanding contact investigations beyond close contacts.

State and local TB control programs should

- develop and share instruments for collecting data regarding program performance indicators and set objectives on the basis of those indicators. Pilot testing of the indicators to determine their usefulness and validity would be needed during the development process.
- use program performance indicators and the evaluation framework, including indicators based on standards of practice, to document needed resources.

RESEARCH NEEDS

Identifying Strategies To Eliminate TB Disease

As TB incidence declines in the United States, public health strategies must extend beyond

traditional TB control measures to activities that will eliminate TB disease (31). These strategies should include active case finding, targeted testing and treatment of populations at high risk for latent TB infection, and promotion of regional TB control efforts along the U.S.-Mexico border. Despite advances made during the 1990s, applied public health research is needed to identify the best strategies for eliminating TB disease.

Applied research to improve TB control efforts along the U.S.-Mexico border must address two groups distinguished by their pattern of movement and the health-care systems that serve them. The first group consists of binational patients and their close contacts for whom recent or ongoing cross-border travel affects case management, contact tracing, and source-case investigation. The second group consists of patients who acquired TB in Mexico or Central America, and their contacts in the United States, whose case management is less complicated by international travel, but who might migrate between jobs in the service, construction, and agricultural industries in defined patterns in the United States (Figure 3). This group might benefit from targeted testing and treatment for latent TB infection. For example, during the early 1990s, among Mexican-born persons seeking adjustment of their residency status in Denver, Colorado, an estimated 40% had tuberculin skin tests indicating that they had latent TB infection, compared with an estimated 4% of the U.S. population (36).

Work Group Proposals

CDC should

- assist state and local TB control programs in analyzing surveillance data and conducting studies to identify trends, opportunities, and knowledge gaps related to binational TB patients.
- advise policy makers, public health program personnel, researchers, funding organizations, and others regarding priorities for public health research on binational TB cases in the context of the national TB prevention and control program.
- assist researchers in minimizing duplication and encourage immediate, effective developments in applied public health research regarding TB.

State and local TB control programs should

- increase use of local data and experience to advise CDC and state and local authorities regarding the epidemiology of TB among binational populations, practical problems in TB control, and emerging situations that might require attention or action.
- evaluate the efficiency of TB prevention and control activities and update performance indicators as needed.
- in collaboration with health-care providers, define the contributions of subpopulations to TB morbidity in their jurisdictions. The role of congregate settings (e.g., correctional institutions, shelters, dormitories, migrant worker camps, and hospitals) in facilitating TB transmission among these populations should also be assessed.

Areas for Additional Research

- **Binational TB case surveillance.** Although national surveillance data have included ethnicity since 1980 and country of origin since 1993, these variables do not capture the information needed to determine whether a TB case could be classified as binational. Furthermore, data are not collected routinely regarding the movement of TB patients to, from, or within Mexico, except for the date of entry into the United States. Therefore, determining the problem's magnitude, contributions of different groups, or relative risk attributable to specific risk factors is not possible. Without this information, assessing the burden of TB disease by geographic region and targeting prevention and control efforts accordingly is inefficient.
- **Delayed treatment.** Rapid disease diagnosis and prompt initiation of treatment are critical in curbing TB transmission within the community. Anecdotal evidence based on

clinical experience implies that binational patients' disease is diagnosed and treated at more advanced stages of illness than that of other patients. Such patients might visit two or more health-care providers before treatment is started. Research is needed to determine the true frequency of these cases and, if elevated, to identify the risk factors.

- **Treatment completion.** Mobility of binational patients within the United States and bilaterally across the U.S.-Mexico border complicates the continuity of treatment and decreases the rate of treatment completion. Only limited data regarding the outcomes of binational cases and the factors that contribute to satisfactory outcomes have been published (23,37,38). Also unclear is the extent to which resources should be directed toward developing and evaluating methods to ensure that treatment is completed. Without this knowledge, methods are unreliable for determining a) which aspects of the clinical and public health management of binational TB cases are beneficial, b) which aspects should be encouraged, and c) which aspects should be improved, modified, or abandoned.
- **Drug resistance.** Limited data regarding drug resistance among Mexican TB patients in both countries have been published (18,39,40). Clinicians who serve TB patients from Mexico report high levels of drug resistance, but no clearly defined, population-based data have been compiled to determine the incidence or prevalence of drug-resistant TB among binational patients. Moreover, only recently has Mexico adopted standards for retreatment patients and started promoting directly observed therapy. Research is needed to determine levels of drug resistance and risk factors contributing to drug resistance among TB patients from Mexico.
- **Contact investigation.** Mexican policies and practices for contact tracing differ from those of the United States, and thorough contact tracing, testing, and treatment of latent infection might be difficult or impossible in foreign jurisdictions. Highly mobile patients might have contacts in multiple locations in the United States, complicating the identification, testing, and treatment of latently infected persons as well (Figure 4). Data are needed to quantify the extent to which these considerations affect binational populations (41,42). Information regarding the cost-effectiveness of contact tracing would enable efforts to be directed effectively.
- **Targeted testing.** Foreign-born residents and visitors from countries having a high incidence of TB, including Mexico and Central America, can be at risk for latent TB infection or active TB disease. With the exception of the required radiologic screening of applicants for immigrant visas and for adjustment of immigration status (43), no systematic procedures have been applied to test foreign-born persons for latent TB infection. Although certain approaches have been attempted at the local level, conclusive cost-outcome or cost-effectiveness data are limited (36,44,45). Therefore, how best to target binational populations for testing and treatment of latent infection is unknown as is reaching subgroups who might provide opportunities for TB prevention and ensuring completion of treatment (46). Historically, treatment-completion rates for latent TB infection have been lower than for active TB disease, making necessary the reassessment of existing strategies for treatment of latent TB infection. Evaluating which strategies are cost-effective will be critical.

Work Group Proposals

CDC should

- work with state and local TB control programs to determine the extent to which reported TB morbidity in the United States originates in Mexico and Central America by focusing on geographic areas and populations that have high rates of binational TB cases.
- collaborate with state and local TB control programs to assess and quantify delays in completing treatment and factors that contribute to delays.
- work with state and local TB control programs to determine the magnitude and impact of mobility among binational patients on treatment completion and health outcomes.
- determine the epidemiology of drug-resistant TB among binational patients.

State and local TB control programs should

- collaborate with public health and social scientists to develop and evaluate innovative methods for tracing, testing, and treating contacts of binational patients. Studies should compare new strategies with past practices.
- in accordance with new CDC guidelines for targeted testing and treatment of latent infection (47), a) develop methods to identify persons at high risk for TB who would benefit from treatment of latent TB infection, if detected; b) test these persons for latent TB infection; and c) treat to completion latently infected persons. Identifying persons at risk for latent TB infection could be done on the basis of local epidemiologic profiles or other methods. Cost and outcomes or effectiveness of strategies should be assessed as an integral component of this research.

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* Unless otherwise noted, information in this section is based on national TB surveillance data reported by state programs to CDC's Division of Tuberculosis Elimination.

** Information regarding OpenEMED is available at <http://www.acl.lanl.gov/TeleMed> (accessed November 6, 2000).

BOX. Selected cooperative tuberculosis (TB) control activities along the U.S.-Mexico border, including binational projects, case-referral systems, and initiatives for TB surveillance and laboratory training

Texas-Mexico Border Projects

In 1991, the Texas Department of Health established three projects to provide case management for TB patients and their contacts who live or work in both the United States and Mexico. Projects include Project Juntos (serving El Paso-Ciudad Juarez and Las Cruces, New Mexico, West Texas, and Ojinaga in Chihuahua); Los Dos Laredos (Laredo-Nuevo Laredo area); and Grupo Sin Fronteras (lower Rio Grande Valley, including the Brownsville-Harlingen-McAllen area in Texas and the Matamoros-Reynosa area in Mexico). The three projects managed 884 binational TB patients and their contacts through 1998 and continue to provide laboratory support for diagnosis and case management through cooperative relationships among TB control programs on both sides of the border.

Arizona-Sonora Binational Projects

Three cross-border projects were established in 1996 by Arizona Department of Health Services in collaboration with the Sonora, Mexico, state health department. Serving Santa Cruz County-Nogales, Cochise County-Agua Prieta, and Yuma County-San Luis Rio Colorado, the projects monitor multidrug-resistant TB, provide directly observed therapy, conduct outreach for patients who have missed clinic visits and who frequently travel across the border, and provide Sonora with support from the Arizona State Laboratory Services.

California-Baja California Norte TB Committee

Since the mid-1980s, representatives from public and private TB control programs in San Diego, Los Angeles, and Imperial Counties, and Baja California Norte have been discussing management of binational cases, planning joint activities (e.g., binational training), providing outreach to practitioners and pharmacists, developing educational materials, and conducting media campaigns.>

Imperial-Mexicali Binational TB Projects

Two annual events, a farm worker health information fair in Calexico, California, and a binational TB symposium for health-care personnel in Mexicali, Baja California Norte, provide information regarding TB, tuberculin skin testing, and other health screenings. A

binational TB social marketing campaign focuses on recognizing TB symptoms and encourages early evaluation through radio and television announcements and billboards in the Imperial and Mexicali Valleys.

CURE-TB

CURE-TB, operated by the San Diego County TB control program since 1994, is a joint U.S.-Mexico referral system designed to improve the continuity of care for patients with active TB disease and their contacts who are at high risk. The project provides education and assistance to patients who move between Mexico and the United States during the course of their treatment. The system also notifies providers in both countries of a patient's arrival in their communities and facilitates the exchange of patients' clinical information. During 1997–2000, CURE-TB referred 250 active TB patients and 372 contacts for testing and treatment. In 1999, 80% of the active TB patients referred had completed or continued their treatment.

TB Net

Based in Austin, Texas, and operated by the Migrant Clinicians Network,* TB Net assists persons who have difficulty gaining access to medical services and facilitates coordinated treatment by multiple providers. The program provides patients with a portable medical record and referrals to nearby TB clinics and provides health-care practitioners with a centralized repository of medical information. During 1996–March 2000, TB Net assisted 139 persons with active TB disease and 522 persons with latent TB infection.

National TB Genotyping and Surveillance Network

Organized in 1996 by health officers from the four U.S. and six Mexican border states and representatives from nongovernmental organizations, Ten Against TB is designed to strengthen binational collaboration, enhance laboratory capacity, improve and coordinate epidemiologic studies, optimize case management, and promote public and health-care provider awareness regarding TB.

Ten Against TB

In collaboration with Mexico's national public health laboratory program, CDC and the Association of Public Health Laboratories provide training in the border area. Participants include staff from the six Mexican border states, four U.S. border states, and the National Laboratory Training Network. In addition to providing training in culture methods, CDC and Mexico are collaborating on national proficiency testing for >500 laboratories that perform acid-fast bacilli microscopy in Mexico's Secretaria de Salud system. That program involves onsite assessment combined with slide proficiency tests to determine technical ability.

U.S.-Mexico Border TB Laboratorian Binational Training Project

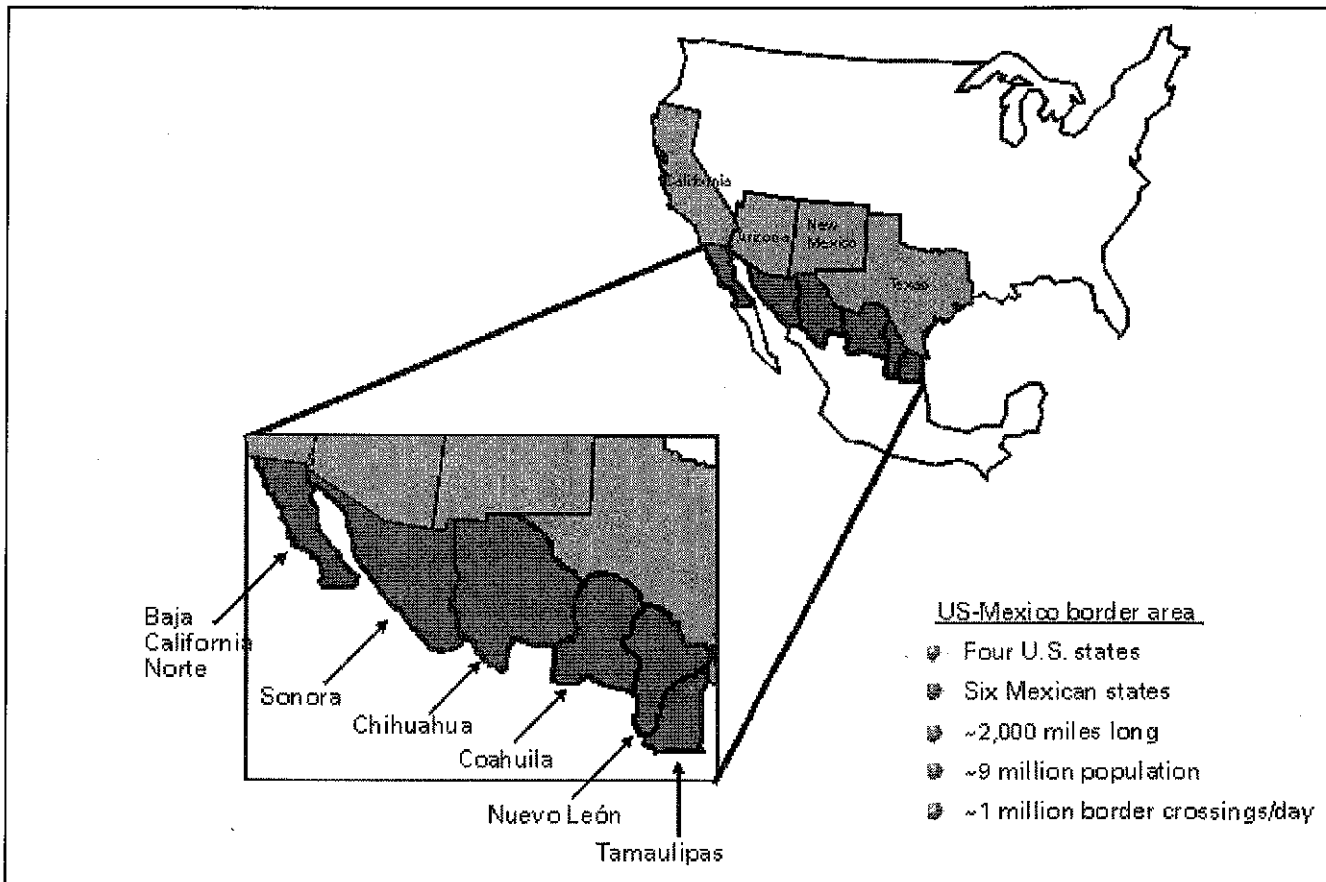
Binational Training Project The U.S. Health Resources and Services Administration, the Pan American Health Organization, the U.S.-Mexico Border Health

Association, the U.S.-Mexico Binational Commission, the U.S.-Mexico Border Health Commission, the Border XXI Program, state and local health departments, and universities collaborate on diverse projects to enhance TB control efforts along the U.S.-Mexico border.

* Information regarding the Migrant Clinicians Network is available at <http://www.migrantclinician.org> (accessed November 21, 2000).
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Figure 1

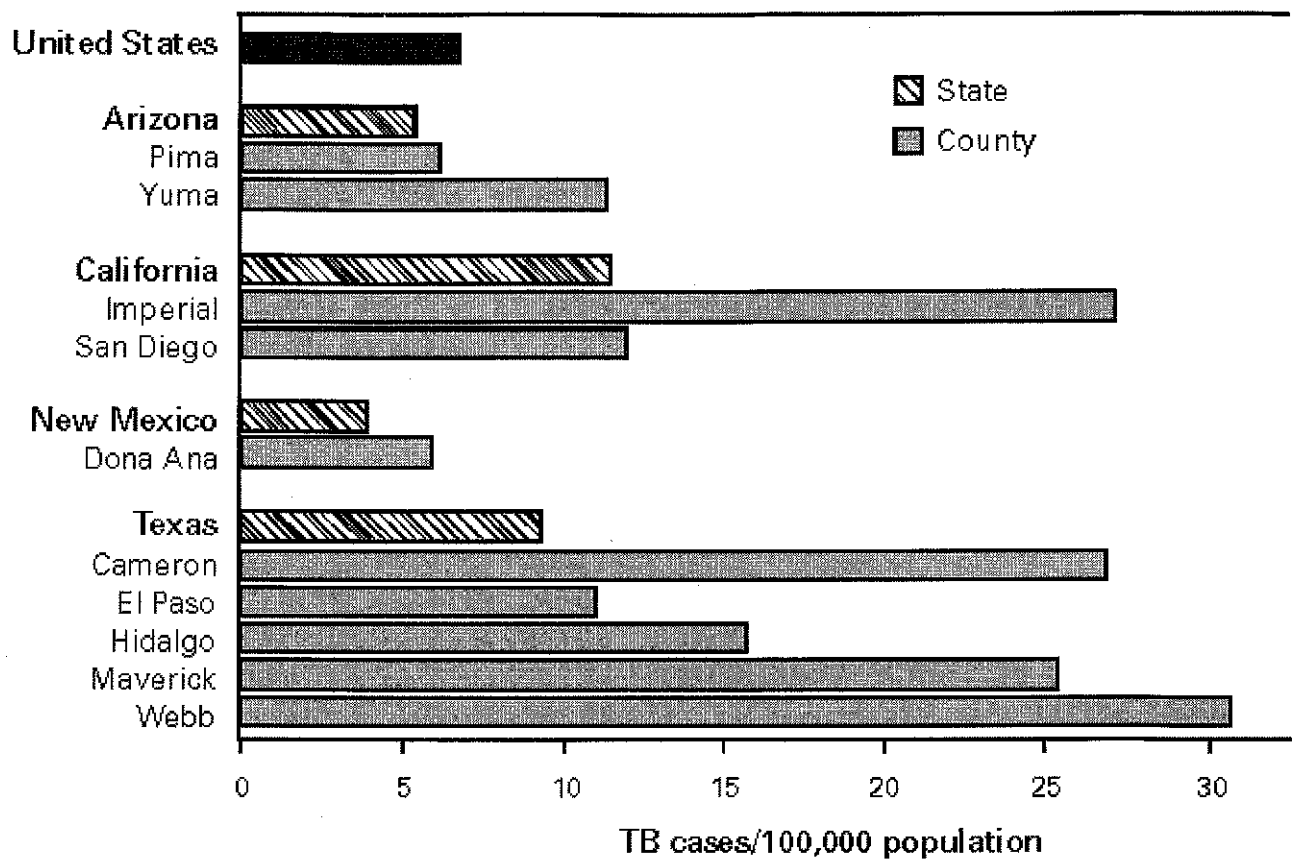
FIGURE 1. U.S.-Mexico border states



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Figure 2

FIGURE 2. Tuberculosis (TB) rates in U.S. states and counties* bordering Mexico

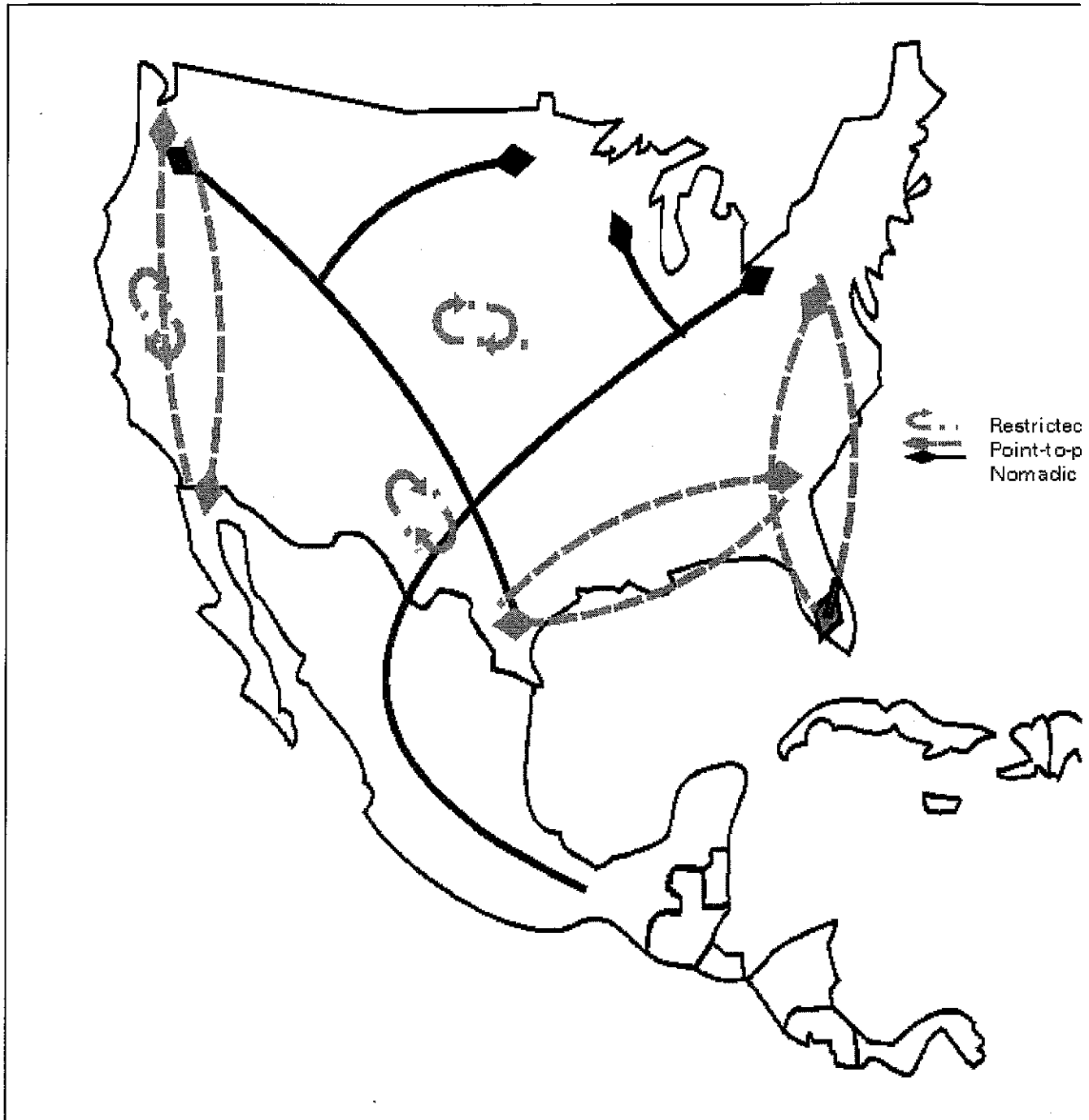


* Only border counties with ≥ 10 TB cases/100,000 were included.

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Figure 3

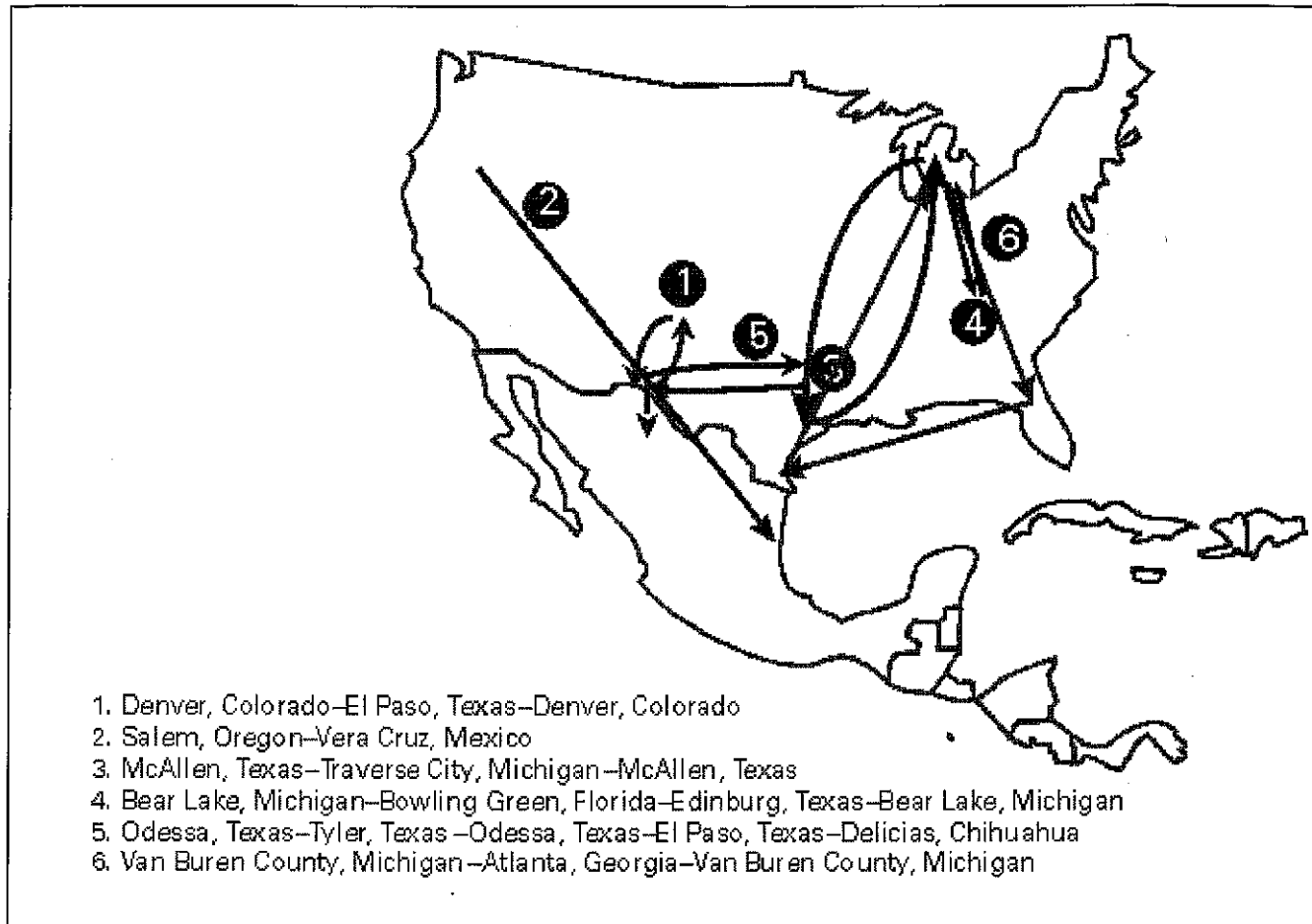
FIGURE 3. Migration patterns in the United States among workers originating in Mexico



Source: Adapted from Migrant Clinicians Network. Austin, TX: Migrant Clinicians 2000. Available at <<http://www.migrantclinician.org>>. Accessed November 21, 2000.

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Figure 4

FIGURE 4. Movement of selected TB cases enrolled in TB Net, 1997-1998

Source: Migrant Clinician Network. Austin, TX: Migrant Clinicians Network, 2000. Available at <http://www.migrantclinician.org>. Accessed November 21, 2000.

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Table 1

TABLE 1. Tuberculosis (TB) rates and proportion of cases among Hispanic and born persons in states and border counties — California* and Texas,† 1998

Characteristic	United States [§]	California [§]	Texas	California border counties†
Percentage of U.S. TB cases	—	21	10	2.1
TB case rate/100,000 population	6.8	11.8	9.2	13.0
TB cases among Hispanics (%)	22	36	48	56
TB case-patients born in Mexico (%)	10	22	22	35

* California border counties include Imperial and San Diego.

† Texas border counties include Brewster, Cameron, El Paso, Hidalgo, Hudspeth, Jeff Davis, Kinney, Presidio, Starr, Terrell, Val Verde, Webb, and Zapata.

§ Source: CDC. Reported tuberculosis in the United States, 1998. Atlanta, GA: US Department of Human Services, CDC, National Center for HIV, TB, and STD Prevention; August 1999. Available www.cdc.gov/nchstp/tb. Accessed November 1, 2000.

¶ Source: California Department of Health Services, unpublished data, 1998.

** Source: Texas Department of Health, unpublished data, 1998.

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Table 2**TABLE 2. Tuberculosis (TB) cases reported to CDC from Arizona, California, New Mexico, and Texas, 1993–1998***

Characteristic	Mexican-born TB patients		U.S.-born TB patients
	Number	%	Number
Sex	8,661	—	19,351
Male	5,580	64.4	13,128
Female	3,078	35.5	6,211
Age (years)			
0–14	677	7.8	2,441
15–24	1,291	14.9	1,126
25–44	3,450	39.8	6,814
45–64	1,908	22.0	5,165
≥65	1,334	15.4	3,801
Site of disease			
Pulmonary	6,572	75.9	14,800
Extrapulmonary	1,410	16.3	2,984
Both	677	7.8	1,554
Sputum bacteriology†	6,740	—	14,497
Smear positive	3,456	51.3	6,664
Culture positive	5,074	75.3	10,848
Chest radiograph‡	7,249	—	16,354
Normal	444	6.1	510

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