World TB Day March 24, 2006. *Actions for life: towards a world free of tuberculosis*

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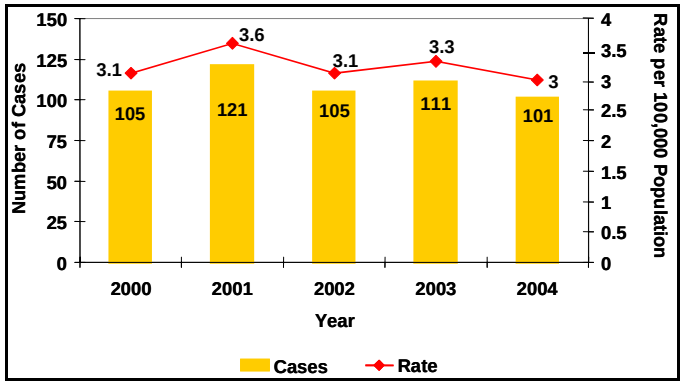
The Changing Epidemiology of Tuberculosis in Connecticut, 2000-2004

Tuberculosis (TB), which is caused by the organism *Mycobacterium tuberculosis*, remains a serious infectious disease in Connecticut (1). Transmission of *M. tuberculosis* occurs with inhalation of droplet nuclei produced by a person with contagious pulmonary/laryngeal TB. In the United States (US), TB is reportable by both physicians and laboratories. This report reviews the epidemiology of TB in Connecticut and ongoing activities of the Connecticut Department of Public Health's (DPH) Tuberculosis Control Program.

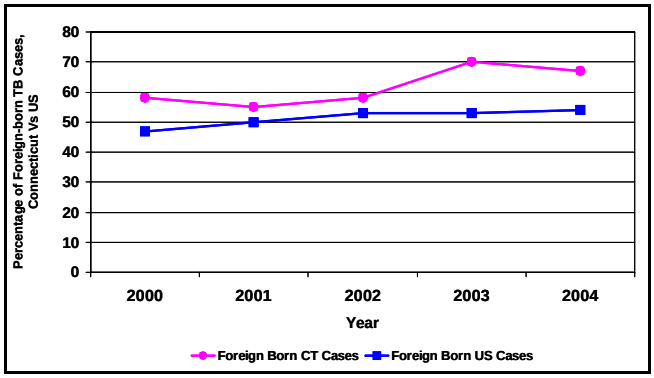
During 2000–2004, 543 TB cases were reported to the DPH for an average of 109 cases per year (Figure 1). The annual rate ranged from a high of 3.6 cases per 100,000 population in 2001 to a low of 3.0 cases per 100,000 population in 2004. Overall, the annual TB rate declined 3.2% from 2000 to 2004. This rate meets the interim national goal of 3.5 cases per 100,000 population but is still short of the Healthy People 2010 goal of <1 case per 100,000 population. Tuberculosis was reported in all age groups, with the most cases (n=186) reported in persons aged 25–44 years. Of these cases, 28 (15%) tested positive for infection with human immunodeficiency virus (HIV). Cases were reported in all race/ethnic groups except Native Americans and Hawaiians/Pacific Islanders.

Figure 1: Tuberculosis Case Rates and Number of Cases, Connecticut, 2000-2004



Of the 543 cases, 62% (334) were in foreign-born persons representing 62 countries. Of these, 46% were reported in nationals from India (41), Ecuador (35), Haiti (29), Peru (25), and Mexico (22). The percentage of cases in foreign-born persons ranged from a low of 55% in 2001 to a high of 70% in 2003 (Figure 2). The increasing proportion of TB cases among foreign-born individuals is consistent with and precedes a similar national trend (2). The number of foreign-born TB patients has increased 12% over the previous 5-year period.

Figure 2: Percentage of Foreign Born Cases in the United States and Connecticut, 2000-2004



Of the 334 foreign-born TB patients reported during 2000–2004, 47% entered the US within 5 years prior to diagnosis (Table 1). Of these, 23% were diagnosed within 1 year after arrival. This suggests that many of these individuals are not receiving adequate screening for TB and/or treatment for latent infection before and after entry into the US.

Programmatic Response of the TB Control Program

In response to the changing epidemiology of TB in Connecticut, the DPH has revised or initiated the following programmatic activities aimed at increasing awareness about prevention and treatment guidelines:

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Table 1: Number of years in the United States before TB diagnosis in foreign-born persons.

Years in U.S	Year					
	2000	2001	2002	2003	2004	Total
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
< 1	18 (30)	15 (23)	10 (16)	21 (27)	13 (19)	77 (23)
1-4	20 (33)	13 (20)	10 (16)	19 (24)	19 (28)	81 (24)
5-9	7 (11)	11 (17)	9 (15)	7 (9)	12 (18)	46 (14)
≥ 10	11 (18)	14 (21)	7 (12)	13 (17)	17 (25)	62 (19)
Unknown	5 (8)	13 (20)	25 (41)	18 (23)	7 (10)	68 (20)
Total	61	66	61	78	68	334

- Enhanced surveillance among foreign-born persons with TB or suspected of having TB
- Pediatric follow-up (for both TB and latent TB infection)
- Revised policy reflecting the need to test and treat persons with a positive tuberculin skin test, regardless of previous bacille Calmette-Guérin (BCG) vaccination (3)
- Revised screening guidelines for Connecticut schools (in cooperation with the School Health Committee of the Connecticut Chapter of the American Academy of Pediatrics) (4), and
- Development and dissemination of educational and prevention material in various languages (in partnership with the Refugee Health Program).

In Connecticut, emphasis has been placed on enhancing TB surveillance among foreign-born persons because this population accounts for the majority of reported cases. This activity was planned with assistance from a regional consultant of the Centers for Disease Control and Prevention (CDC). One area of focus in the regional approach to TB prevention is to develop strategies aimed at reducing cases in areas where the incidence is relatively low.

Enhanced surveillance of foreign-born TB patients involves collecting information that may assist the DPH in targeting prevention resources in this high-risk population. The following information is collected:

- Type of health care provider
- Difficulties surrounding health care access, language, and communication, and
- History of previous testing and treatment for latent TB infection.

These data may suggest policies related to TB standards of care that should be modified, such as expanding directly observed therapy (DOT) and strengthening provider education.

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Editorial Note:

From 2000–2004, for the US as well as for Connecticut, the overall incidence of TB declined; however, the percentage in foreign-born persons increased. In Connecticut, the highest percentage of TB cases were in foreign-born persons originating from Asia, South America, and the Caribbean. Nationally, the majority of foreign-born patients were from Mexico (1).

United States immigration laws require immigrants seeking permanent residence and refugees to be evaluated for TB in their country of origin. Persons found to have infectious TB disease must be rendered noninfectious before entering the US. In Connecticut, many foreign-born persons with TB do not belong to these immigrant groups and were not tested before entry. After arrival, immigrants who have noninfectious or inactive TB disease are required to report to the local health authority within 30 days for further evaluation and possible treatment. It is necessary for health care providers to integrate TB prevention into the routine care of persons from countries with a high TB prevalence. As more information becomes available on behaviors and barriers related to health care for persons from countries with a high TB prevalence, effective prevention practices can be put into effect.

In Connecticut, the local health department is responsible for ensuring the quality and completeness of TB-related services. Resources available through local health authorities include language-appropriate educational materials, culturally sensitive providers, clinical interpreter services, DOT, and contact investigation to identify and evaluate individuals potentially exposed to infectious TB. Case management is necessary for successful completion of therapy and requires a coordinated effort between the

state and local health department, health care provider, and patient. The DPH conducts surveillance, analyzes data, supports and ensures treatment completion including use of DOT for all patients, oversees contact investigations, promotes prevention activities, and evaluates relevant outcomes of its activities in collaboration with health care providers and municipal health departments. The State laboratory confirms the diagnosis of TB by growing *M.* tuberculosis on culture, and tests the drug susceptibility pattern for each positive culture. The patient is responsible for taking the full course of TB drugs and for providing information on potentially exposed persons and venues of exposure. Health care providers should begin each new patient on a four-drug regimen of isoniazid, rifampin, pyrazinamide, and ethambutol, which may be modified once drug susceptibilities are known (5).

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Molecular Genotyping of *Mycobacterium tuberculosis*

After more than a decade of use, molecular genotyping of *Mycobacterium tuberculosis* isolates is now a standard public health tool. Genotyping has been used in a variety of settings, including defining strains prevalent in the population, detecting outbreaks in institutions and the community, evaluating the completeness of contact investigations, and determining laboratory contamination (1-5).

In 2005, the Centers for Disease Control and Prevention (CDC) launched the Genotyping TB Program, making laboratory capacity available to state health departments interested in genotyping *M. tuberculosis* isolates. In New England, the six state health laboratories are routinely forwarding all culture-positive isolates from patients with pulmonary TB to one of the program's reference laboratories for genotyping. To accelerate the decline of TB in New England, the state health departments coordinate cross-jurisdictional investigations to prevent the transmission of TB across state lines. In this report, we describe one recent outbreak of TB in Fairfield County, Connecticut. This outbreak would not have been detected without the use of molecular genotyping.

Connecticut TB Outbreak

Since 2005, universal genotyping of pulmonary TB isolates has detected five clusters in Connecticut. One cluster, with cases diagnosed February 2004–May 2005, consisted of four Hispanic males from one city in Fairfield County (Table 1). Risk factors included HIV infection (2), unemployment (2), and incarceration (2).

Table 1: Fairfield County, Connecticut TB Cluster, February 2004-May 2005

Age groups (Yrs)	Occupation	Country of Birth	Date of entry into U.S.	HIV Status	TB risk factors
15-24	Restaurant	Mexico	Unknown	Negative	Foreign born
25-44	Painter	Mexico	Post-2000	Negative	Foreign born
25-44	Unemployed	Mexico	Pre-2000	Positive	Foreign born; History incarceration; Excess alcohol.
25-44	Unemployed	U.S.	Not applicable	Positive	History incarceration

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Editorial Comment:

In Connecticut, molecular genotyping is radically transforming TB control practices. Two methods based on polymerase chain reaction (PCR) are initially used. The first, spoligotyping, is a method for simultaneous detection and typing of *M. tuberculosis* strains. The second, mycobacterial interspersed repetitive unit-variable-number tandem repeat analysis (MIRU-VNTR) analysis, is a typing method that determines the number of repeated mycobacterial interspersed units at 12 independent loci (6). These methods provide faster turnaround times and produce digital results that make comparisons easier. A non-PCR technique, restriction fragment length polymorphism (RFLP), continues to be used to further define suspected outbreak strains. The population-based application of genotyping has revealed unsuspected transmission patterns that might not have been identified using conventional

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epidemiological techniques. Originally seven persons were identified in the Fairfield County cluster. Genotyping, using RFLP, showed that three strains were not identical to the dominant strain infecting the other four patients.

In response to this newly recognized cluster of four related TB cases, the DPH attempted a more intensive epidemiologic investigation with limited results, since two of the individuals had returned to Mexico. At this time, genotyping results are pending from another case potentially involved in this outbreak.

As more knowledge is gained about the use of molecular techniques and earlier detection of clusters, further investigations will continue to reveal previously unrecognized epidemiologic links between cases and define new settings where transmission occurred (7). We believe that the addition of molecular genotyping as a public health tool will augment TB control and accelerate the reduction of cases in Connecticut and the United States.

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