June 2006

The Development of Enhanced Surveillance to Understand Access to Care and Identify Missed Opportunities for Prevention of Tuberculosis in the Foreign-Born Residing in Connecticut

David Banach

The Development of Enhanced Surveillance to Understand Access to Care and Identify Missed Opportunities for Prevention of Tuberculosis in the Foreign-Born Residing in Connecticut

David Banach

B.A., Muhlenberg College, 2002

B.S., Muhlenberg College, 2002

A Thesis

Submitted in Partial Fulfillment of the Requirements for the Degree of Masters of Public Health at the University of Connecticut

2006

Approval Page

Masters of Public Health Thesis

The Development of Enhanced Surveillance to Understand Access to Care and Identify Missed Opportunities for Prevention of Tuberculosis in the Foreign-Born Residing in Connecticut

Presented by

David Banach, B.A., B.S.

Major Advisor _____
Judy Lewis

Associate Advisor _____
Marcia Trapé-Cardoso

Associate Advisor _____
James Hadler

University of Connecticut
2006

Acknowledgements

The author wishes to acknowledge the following individuals who provided much insight in to the development of the foreign born TB surveillance project and this thesis as well as guidance throughout its creation, implementation and evaluation:

Mark Lobato, MD. Medical Epidemiologist. U.S. Centers for Disease Control and Prevention, Division of Tuberculosis Elimination

Mukhtar Mohammed, MPH. Health Program Assistant. Connecticut Department of Public Health, TB Control Division and Refugee Health Program

James Hadler, M.D. M.P.H. State Epidemiologist. Connecticut Department of Public Health

Bill Teel, Ph.D. Epidemiologist. Office of Emergency Medical Services. Connecticut Department of Public Health

Special thanks to the Connecticut Department of Public Health TB Control Program which was instrumental in ensuring the implementation of the Enhanced TB Surveillance Project and provided consistent and very helpful feedback along the way.

Table of Contents

Thesis Overview

Despite the continuing decline of tuberculosis (TB) in the United States, rates of foreign born TB continue to increase. Targeted latent tuberculosis infection (LTBI) screening and treatment is an essential step towards the goal of decreasing foreign born tuberculosis in the United States. Despite this goal, limited progress has been made in understanding health care access as it relates to latent TB infection screening among the foreign born population that develops active tuberculosis after arrival to the United States. The goal of this thesis is to enhance current TB surveillance in order to examine these factors and evaluate their impact on LTBI screening and delays in TB case identification after arrival to the U.S.

This is the pilot evaluation of a new TB surveillance program implemented through the Connecticut Department of Public Health focusing on foreign born individuals who became TB cases following their arrival to the U.S. This enhanced surveillance was conducted through questionnaire administration inquiring into specific factors previously demonstrated to impact health care access and TB screening among the foreign born. Demographic data from each case including age, location of residence, date of arrival to U.S., TB risk factors and details of TB diagnosis were obtained from CDC surveillance. Information was also obtained from U.S. born TB cases over the same time to determine if general TB risk factors were relevant to the foreign born population.

Of 19 foreign-born individuals included in this evaluation, only eight reported any previous screening for LTBI prior to eventual TB case designation, which occurred an average 4.1 years after arrival. Those who reported prior LTBI screening were more likely to have a routine health provider, speak their native language with their provider,

have a documented immigration status, reside in a large city and less likely to have communication difficulties with their routine providers. Those previously screened were more likely to have health insurance, specifically private insurance. These factors were related to the length of time between arrival to the U.S. and TB case identification. When compared to U.S. born cases, foreign born cases were less likely to be homeless, use intravenous or non-intravenous drugs and consume excess alcohol. However, at this time none of these associations were found statistically significant ($p<0.05$), due to the small sample size included in this pilot evaluation. This analysis will be used to perform evaluation of the ongoing surveillance.

Issues regarding health care access play a role in LTBI screening among foreign born individuals after entry into the United States. In order to effectively address issues of foreign born TB, it is essential that public health authorities and TB control programs understand both the local epidemiology of TB among their foreign born population and the barriers to LTBI screening and treatment among these individuals. The current screening strategy depends having direct contact and effective communication between health care providers and foreign born individuals. Due to a variety of factors this often does not occur, resulting in missed opportunities for screening that would result in earlier detection and management of latent TB infection. Efforts must be made to ensure that these populations can access the health care system in a timely and regular manner in order to be screened appropriately. If this cannot occur, alternative methods for targeted LTBI screening through more proactive outreach strategies must be considered.

Background

History of Tuberculosis in the United States

As seen with other infectious diseases, there have been significant changes in the epidemiology of tuberculosis within the United States over the past two centuries. During the nineteenth century, TB remained a significant health burden, cited as one of the leading causes of mortality. With improved socioeconomic conditions as well as increased public health surveillance and prevention measures, TB-related morbidity and mortality markedly decreased. During the 1800's, the identification of the causative organism, *Mycobacterium tuberculosis*, and the initiation of public health programs designed to improve surveillance and control disease spread contributed to decreasing rates of disease burden within the United States. With the development of the chest radiograph and its use for population screening, as well as introduction of antibiotic therapy including streptomycin in 1947 and isoniazid and pyrazinamide in 1952, TB rates declined even further. Between 1930 and 1960 the mortality rate decreased by 92 percent from 71 to 6 deaths per 100,000 persons.[1]

With declining rates following the introduction of anti-mycobacterial therapy, experts believed that TB elimination would be a reasonable goal, and in 1959 the National TB Association began to formulate a plan to eventually eliminate the disease in the U.S. From the 1950's until the 1980's TB rates continued to decline from approximately 50 cases per 100,000 population to 9.3 cases per 100,000 in 1985. Subsequently, due to shifting commitments in public health programming and the emergence of HIV/AIDS,

federal funding for TB control programs began to decline and TB control programs developed in the early 20th century began to disintegrate.[2]

Consequently, the latter half of the 1980's saw a reversal in the incidence of TB cases detected in the United States. In 1986, there was a 2.6% increase in total number of newly identified TB cases.[1] With further epidemiologic investigation new high risk groups were being identified as significant contributors to this tuberculosis resurgence in the United States. Immunological compromise from HIV/AIDS, TB transmission in correctional facilities and institutional settings, and a significant concentration of TB cases among foreign born populations were identified as major factors contributing to the increased number of cases in the U.S.[3] In addition, the emergence of multidrug-resistant TB (ie. TB resistant to isoniazid and rifampin) was detected and documented; it was found particularly prevalent among HIV positive, incarcerated and homeless populations, as well as within nosocomial settings.[4,5] The increased number of incident TB cases as well as identification of definable high risk populations fueled the increased attention given to TB control efforts in the early 1990's. During this time federal funding was increased to educate clinicians and public health officials on TB reemergence, while also improving TB surveillance and control efforts at the local, statewide and national levels. Directly observed therapy became the recommended standard of care.

In 1992, TB incidence in the U.S. peaked at 26,673 cases (10.5 per 100,000 population). From 1993 to 2005, the total number of TB cases has declined. The rate of decline had averaged 6.9% between the 1993 and 2002, however, this rate of decline began to

decrease beginning in 2003. This has raised some concern of slowed progress in TB control efforts. In addition, despite the overall national rate of decline during this time period, TB incidence has actually increased among some subpopulations, particularly the foreign-born population residing in the United States.[6]

During 2004, 14,511 confirmed active TB cases (4.9 cases per 100,000 population) were reported in the U.S., representing a 3.3% decline in incidence from 2003. Slightly more than half (54%) of all TB cases detected were among foreign born individuals. The rate among the U.S. born population has reached an all-time low of 2.6 cases per 100,000 population. Although the overall annual TB rate in 2004 was the lowest since national reporting began, the rate of decline was also the smallest since 1993.[7]

Tuberculosis in the United States Foreign Born Population

The most recent World Health Organization reports estimate that approximately one third of the world's population is infected with *Mycobacterium tuberculosis*, the causative organism of tuberculosis. Recent data suggests that there are approximately 8 million new cases of active TB disease worldwide each year, causing an estimated 2 million deaths annually.[8] Most of the tuberculosis infections and disease related deaths occur primarily in developing nations. In contrast, developed nations have had relatively stable levels of infection among residents born in these countries. However, with increasing population mobility, developed nations with substantial levels of immigration have begun to appreciate the impact of foreign-born persons infected with tuberculosis on their incidence and prevalence rates. This impact been previously documented throughout

areas with substantial immigration including Western Europe, New Zealand, Canada and the United States. In each of these countries, while overall levels of TB disease have declined or remained nearly constant, rates of foreign born tuberculosis disease have increased.[6,9,10,11]

Studies specifically targeting the epidemiology of foreign born TB in the United States were first conducted in the early 1990's. At this time, the U.S. TB resurgence was being identified and the foreign born population was recognized as having a significant contribution to this increase. Among those individuals reported to have tuberculosis, the proportion who were classified as foreign born increased from 21.6% (4,925 cases) in 1986 to 29.6% (7,346 cases) in 1993. By 2004, this percentage had increased to 54% with a total of 7,806 cases of foreign born TB diagnosed in the United States. Between 1986 and 1989, the average annual active TB case rate in the foreign born population was 27.1 per 100,000 population. After 1989, the number of documented immigrants increased greatly, largely due to individuals changing their immigration status under provisions of the Immigration Reform and Control Act of 1986. This population was closely screened for TB during this adjustment, and from 1990 to 1993 the incidence rate of tuberculosis in the foreign born population increased to 33.6 per 100,000.[12] However, between 1993-2004, this case rate gradually declined. Most recently in 2004, it was 22.8 cases per 100,000 foreign born individuals residing in the U.S.

Figure 1. Trends in tuberculosis cases in foreign-born persons in the United States from 1986 to 2003.

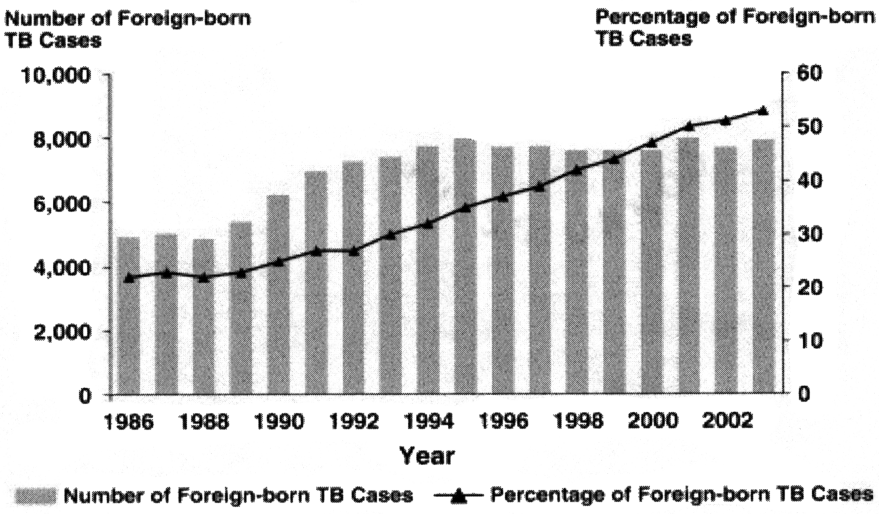
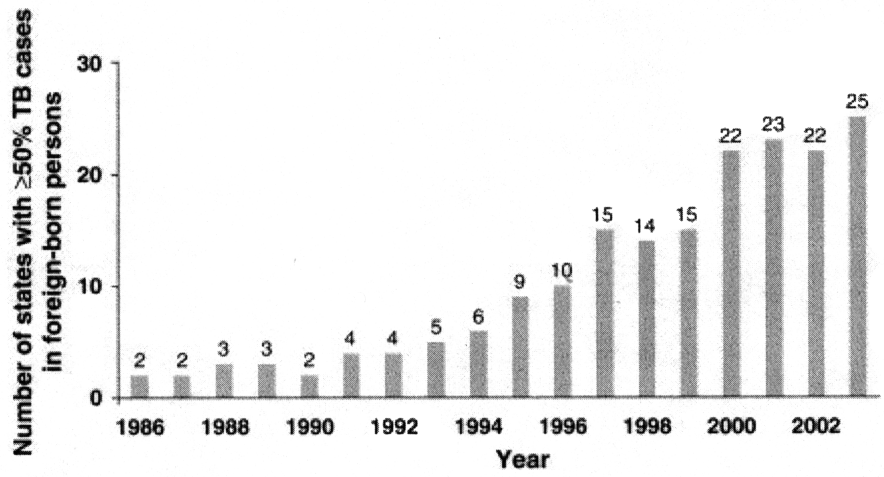


Figure 2. Number of states with 50% or more of tuberculosis cases in foreign-born persons in the United States from 1986 to 2003.



From Schneider E, Moore M, Castro KG. Epidemiology of Tuberculosis in the United States. *Clinics in Chest Medicine*. 2005 June. 26(2).

Additional factors were being analyzed to help characterize the foreign-born population subgroup with elevated TB incidence, including country of origin. The top five countries of origin during this period of immigration were Mexico, the Philippines, Vietnam, China and Korea, each of which has native TB rates 10 to 30 times greater than those of the United States.[13] In 2004, 25% of all foreign born individuals with TB originated from Mexico, 11% from the Philippines and 8% from Vietnam. However, recent data from the CDC indicates that the country of origin of foreign born individuals with TB varies greatly throughout the United States. In 2003, the most common birth country for reported foreign-born TB patients from California and Texas was Mexico; for New York it was China; for Florida it was Haiti; and, for New Jersey it was India.[1] In addition, the length of residence in the U.S. was strongly related to the rate of TB among foreign born individuals, with the highest rates occurring in the first five years after arrival, and over 29.6% diagnosed with tuberculosis within the first year of arrival.

Previous studies demonstrate that TB case rates were high in all age groups of foreign-born populations, including foreign-born children. Foreign-born persons with TB were less likely to have risk factors for TB found in the U.S. born, such as a history of homelessness, incarceration, or excess alcohol or injection drug history. In addition, estimates also show that less than 10% of TB cases within the foreign born population are associated with HIV coinfection.[6]

Another issue of significant concern with TB among the foreign-born residing in the United States is the elevated levels of drug resistant TB within this subpopulation. A

review of multidrug resistant TB cases in the U.S. revealed that rates of isoniazid and streptomycin resistance were higher for cases among foreign-born compared with US-born patients.[14]

Historically, most active TB cases among the foreign born have been attributed to a reactivation of previous infection as opposed to a newly acquired infection following arrival. This has been demonstrated in multiple previous studies, including major multicenter studies of TB among the foreign born residing in San Francisco and New York City.[15,16,17] Previous studies have shown that reactivation rates are highest within 2-5 years of immigration.[6] In addition, it has been shown that within the first few years of arrival to the U.S. TB incidence rates among foreign born populations are comparable with their countries of origin.[14] With time, the incidence of TB in foreign-born populations declines to approach rates equivalent to the U.S. born population, also supporting the notion that foreign born TB represents reactivation of previously, but recently acquired infection.[18] However, studies thus far have not clearly elicited consistent risk factors that increase the likelihood of TB reactivation specifically among foreign born individuals.

Tuberculosis in the Connecticut Foreign Born population

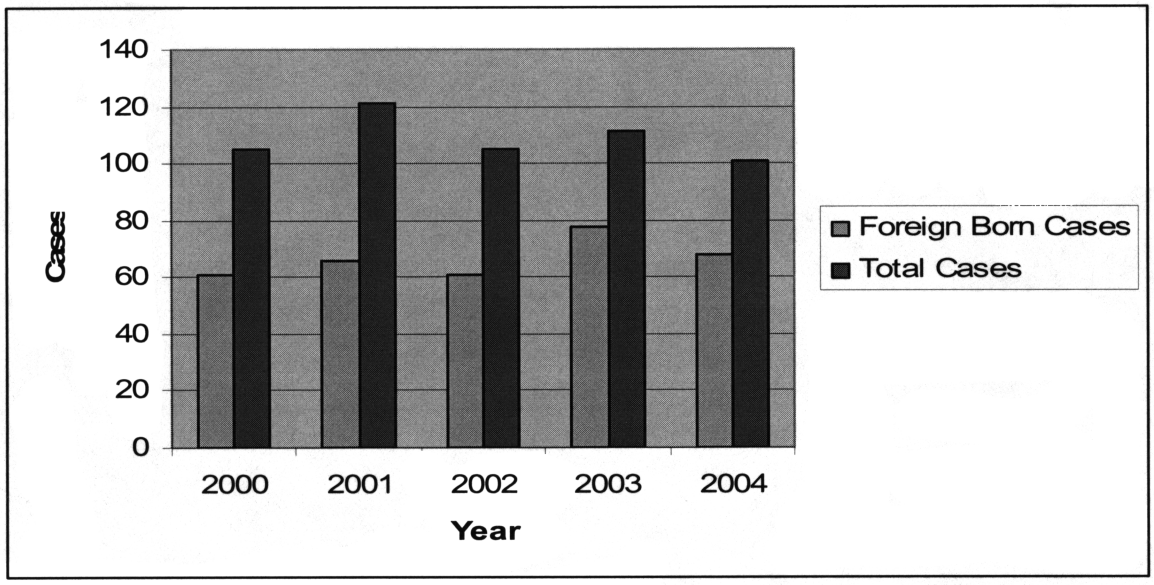
In Connecticut, TB is both physician and laboratory reportable within 12 and 48 hours of diagnosis, respectively. All reports are made directly to the Connecticut Department of Public Health in Hartford and to the local town of the individual's residence. Suspect

cases include any individual on whom anti-tuberculosis therapy is initiated pending a confirmatory diagnosis and anyone on whom a positive AFB sputum stain is obtained.

Data collected by the TB Control Program at the Connecticut Department of Public Health demonstrates that over the past decade, overall TB incidence in Connecticut has been progressively declining. In 1994, there were 147 reported and confirmed cases of TB and, in 2004, the incidence decreased to 101 cases. The average annual percentage decrease during this time was 3.2%. From 2000 to 2004, the annual TB case rate in Connecticut averaged 3.2 per 100,000 persons, significantly below the reported national average of 5.2 cases per 100,000 as reported in 2002.

Reflecting national epidemiologic trends of TB within the United States, one area of developing interest and attention is the increasing number of incident TB cases among the foreign born population residing in Connecticut. While recent data demonstrates that the overall rate of TB in Connecticut is decreasing, the number of foreign born cases has actually fluctuated greatly over the past 5 years.

Figure 3. Tuberculosis Cases in Connecticut by Origin, 2000-2004



Data from Connecticut Department of Public Health TB Statistics. Epidemiology of TB in Connecticut. http://www.dph.state.ct.us/BCH/infectiousdise/tbstatis.htm

The foreign born population residing in Connecticut is approximately 390,000 people, constituting 11% of the state's total population (3.4 million). Currently, the majority of TB cases identified in Connecticut are among the foreign born, and this percentage has continued to increase during the past 5 years. In 2001 the percentage of all TB cases among foreign-born individuals reached a low of 55%. In 2006, foreign-born cases account for approximately 75% of all cases. The case rate among foreign born persons over this same time period is 18.0 cases per 100,000, compared to the national average of 23.1 cases per 100,000 persons in this population. However, although the state's foreign born TB rate remains slightly below the national average, foreign born tuberculosis remains a significant public health issue in Connecticut.

Between 2000 and 2004, 334 foreign born cases of tuberculosis were identified in Connecticut. Of these, 47% were identified within the first five years after entering the United States. A total of 23% of these cases were diagnosed within their first year of arrival, predominantly through presentation with symptoms of active disease.

Table 1. Number of Years in the United States before TB Diagnosis in Foreign-born Persons Residing in Connecticut

	2000	2001	2002	2003	2004	Total
Years in U.S.	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 (28)	19 (28)	81 (24)
5-9	7 (11)	11 (17)	9 (15)	12 (18)	12 (18)	46 (14)
>9	11 (18)	14 (21)	7 (12)	17 (25)	17 (25)	62 (19)
Unknown	5 (8)	13 (20)	25 (41)	7 (10)	7 (10)	68 (20)
Total	61	66	61	78	68	334

Data from Connecticut Department of Public Health TB Statistics. Epidemiology of TB in Connecticut. http://www.dph.state.ct.us/BCH/infectiousdise/tbstatis.htm

This data illustrates that the majority of TB cases identified and diagnosed among the foreign born are found within the first 4 years of arrival to the United States. This demonstrates the importance of early, well targeted screening and management of LTBI among the foreign born population in order to work towards the goal of reducing the incidence of TB disease in this population.

U.S. Tuberculosis Surveillance and Case Reporting

Until the 1950's tuberculosis surveillance had been conducted solely on a local and regional level. However, in 1952, the United States Public Health Service TB Control Program initiated the first national surveillance system. Since this time, the system has undergone several changes and modifications. TB is a reportable disease in all 50 states and all cases that are verified and meet Center for Disease Control and Prevention surveillance case definition criteria are reported using the RVCT (Report of Verified Case of Tuberculosis) form. This form includes patient demographic, clinical and laboratory information from each case. The completed form is then sent to CDC to be included in the national TB surveillance database, TRIMS (Tuberculosis Registry Information System). Each year, the CDC publishes a report summarizing nationally collected data for the past year and recommendations for modifications of surveillance methods. Any additional surveillance information is collected at the individual state's discretion and is evaluated on a state-by-state basis to determine local epidemiology patterns. The Division of Tuberculosis Elimination within the CDC is the group primarily responsible for collecting and evaluating data reported by individual states regarding incident TB cases nationally.

Through epidemiologic investigation, states have been able to identify specific needs for TB screening in their high risk subpopulations. Some of the most common targets of screening include the foreign born population, children, individuals infected with HIV, those residing in correctional facilities and homeless shelters, and health care workers exposed to TB in the healthcare setting.

The Connecticut TB Control Program works in collaboration with health care providers and municipal health departments to conduct surveillance for TB disease and latent TB infection, promote screening, support and assure treatment for both latent TB infection and active disease, and oversee contact investigations. The state reviews specific risk factors for TB in each of the identified cases, and among foreign-born individuals, documents date of arrival to the U.S. and country of origin.

Tuberculosis Screening of the Foreign Born Population in the United States

Based on current policy, TB screening is required for two subsets of the foreign born population residing in the United States. The first category includes immigrants and refugees applying for permanent legal status, and the second consists of foreign-born individuals who entered the country on nonimmigrant visas and wish to apply for permanent residency status.[18] Immigrants and refugees who wish to enter the U.S. are screened in their home country, most often by local physicians selected by U.S. consuls in each respective nation. The screening procedure consists of initial chest radiologic screening for individuals older than age 15 followed by a sputum stain for acid-fast bacilli for people with radiographs consistent with active TB.

The four classification categories- A, B1, B2, and B3, are designated based on the results of the chest radiograph and sputum stain and these designations are placed on the visa forms that all immigrants and refugees carry with them to the United States. These visa forms are collected by the INS at international airports or border posts within the U.S.

The information is then transferred to a CDC quarantine station, where a form is completed and sent to the state destination for the arriving immigrant and a copy is sent to the CDC headquarters and to the individuals themselves.

Those who have sputum that is AFB (acid-fast bacilli staining) positive are designated class A (sputum positive), and must be treated before departure until sputum negative and are required to visit the health department at their U.S. destination. Those with negative smears but chest radiographs consistent with active (Class B1) or inactive (Class B2) TB disease are referred to health departments in their state of future residence for further evaluation within 30 days of their arrival to the United States, although this is on a voluntary basis. Those with radiographs showing calcified granulomas indicative of older, healed infection are designated Class B3, and are not referred for any further evaluation.

The current overseas screening process has been evaluated, although published data regarding their success from a retrospective viewpoint is rather limited. Two health departments, Hawaii and Seattle, have collected data showing that a substantial portion of persons for whom the initial diagnosis of TB was made within the first year after arrival to the U.S. had entered as immigrants or refugees. In Hawaii, 78% of the 124 foreign born persons with TB had been immigrants or refugees. In Seattle, 28 of the 48 individuals who had been in the U.S. for less that 1 year at the time of active TB diagnosis were immigrants and refugees. In these same locations, the sensitivity of the screening process was evaluated as well. In Hawaii, 95 (77%) of 124 immigrants for

whom active TB was diagnosed within 1 year had been classified as B1 (78 cases) or B2 (17 cases) or normal (29 cases) prior to arrival to the U.S.[19] Likewise, in Seattle the corresponding number was 19 (68%) of 28 immigrants.[20] Based on the relatively short period between arrival to the U.S. and diagnosis with TB, it is speculated that the post-immigration diagnosis is the result of a problem with overseas classification rather than the development of new, active TB acquired after the overseas radiograph screening.

The studies from Hawaii and Seattle demonstrate that many of the new TB cases in the foreign born occur among immigrants and refugees who participate in an overseas screening process, but are misclassified. However, some data shows that a large percentage of the foreign born population diagnosed with TB within one year of arrival to the U.S. are unidentified prior to immigration. In Los Angeles County during 1993, 261 cases of TB were diagnosed among the foreign born population within one year of arrival to the U.S. Of these, 64 (25%) were classified as B1, 30 cases (11%) were classified as B2 and 167 (64%) were not identified by overseas screening.[21]

Attempts have been made to further assess characteristics of subpopulations who are diagnosed with TB within one year of arrival and are missed through the current immigration/refugee screening process. A study in San Diego county showed that those individuals with active TB screening detected through the immigration screening process were more likely to be Asian-Pacific Islanders, born in the Philippines, while other recently arrived undetected, foreign-born TB patients were more likely to be Hispanic and born in Mexico. In fact, only 3% of Mexican-born TB patients residing in the U.S.

for less than 1 year were discovered through the immigrant screening process. TB patients identified through immigration screening were less likely to have cavities visualized on chest radiographs and positive sputum AFB smears[22].

The population of foreign born individuals undergoing screening applying for adjustment of their immigration status has also been studied, showing a relatively high prevalence of both TB infection and disease among this group. The Denver, Colorado department of health reviewed its data regarding this population over a one year period. The results showed that of 4,840 individuals tested, 2,039 (42%) had PPD tests greater than 10 mm while 273 had evidence of TB infection by chest radiograph and 16 had sputum cultures obtained, 4 of which cultured *M. tuberculosis*.[23]

In 1998, the CDC's Working Group on Tuberculosis Among Foreign-Born Persons published recommendations for the prevention and control of tuberculosis among foreign born persons. These recommendations call for specific actions to be taken by federal agencies, state and local TB control programs, and health care providers.

The Working Group made the following recommendations:
To tailor TB-control efforts to local needs, TB-control programs should develop epidemiologic profiles to identify groups of foreign-born persons in their jurisdictions who are at high risk for TB....Based on local epidemiologic profiles, selective screening should be conducted among populations identified as being at high risk for TB. Screening should target groups of persons who are at the highest risk for TB infection

and disease, accessible for screening, and likely to complete preventive therapy. TB-control programs should direct efforts towards identifying impediments to TB diagnosis and care among local foreign-born populations, devising strategies to address these barriers, and maximizing activities to ensure completion of treatment.

> - from Recommendations for Prevention and Control of Tuberculosis Among Foreign-Born Persons Report of the Working Group on Tuberculosis Among Foreign-Born Persons. *MMWR Recommendations and Reports* 1998 47(RR16);1-26.

Latent Tuberculosis Infection: The Role and Challenges of Testing and Management in the Foreign Born Population

Latent Tuberculosis Infection

When an individual is exposed to the tuberculosis bacteria- *Mycobacteria tuberculosis,* the body's immune system immediately activates a T-cell mediated response which allows the body to fight the bacteria and prevent multiplication and disease progression. In most cases of tuberculosis infection, the body's immune system can adequately fight and suppress the infection through this mechanism, causing the infection to remain quiet or latent, contained in the body's tissues. Once this has occurred, the body retains the T-cells directed against the TB organism. The tuberculin skin test (TST), the Mantoux skin test, is a standardized killed extract of cultured TB also known as purified protein derivative, (PPD). It is injected into the skin intradermally. The resulting reaction reflects a person's immune response to *M. tuberculosis*. An immunologic response called a delayed-type (Type IV) hypersensitivity, seen as an induration following administration of the allergenic tuberculin protein, indicates previous exposure to the organism with

subsequent latent tuberculosis infection (LTBI). The reaction usually begins 5-6 hours after injection and reaches a maximum at 48-72 hours, at which time it is evaluated by a health care provider. Based on the sensitivity and specificity of the test different cut off points have been recommended as defining a positive reaction. For instance, individuals who are immunosuppressed though medications or HIV are considered LTBI positive with a 5 mm induration, while individuals with specific health issues and/or social characteristics (including foreign born status) that place them at a high risk for TB have a test cut off of 10 mm induration. Those individuals with no documented risk factors have a cut-off of 15 mm.

Although latent TB is not an active disease and cannot be transmitted to others, the main risk is that those individuals who harbor latent infection can progress to symptomatic, active disease at any time, most commonly occurring when an individual becomes immunocompromised for any reason. If an individual does test positive for latent infection, additional evaluation including a chest x ray must be performed to assess for active disease. In latent infection the chest x-ray is usually normal, but may show abnormalities suggesting previous infection with TB such as dense pulmonary nodules or fibrotic scarring.

Treatment of Latent TB Infection

Much work has gone into developing new manageable LTBI treatment regimens, the current recommended treatment for latent infection is daily isoniazid (INH) for 9 months, a course that has been deemed optimal in decreasing the risk for reactivation to active

disease. Compliance with this therapy has become a major barrier to treatment and although a 9 month regimen is currently preferred, the 6 month regimen of INH has been shown to provide substantial protection and may be cost-effective in specific circumstances. Alternative therapy regimens with shorter duration of therapy, most notably 2 months of rifampin and pyrazinamide have been shown to be effective, as has 4 months of rifampin alone[24]. Regardless of the treatment decision, all cases of active disease are reported to public health authorities and require multiple anti-mycobacterial drug therapy and careful monitoring of treatment. Other regimens are currently under investigation and it is anticipated that the future will hold significant improvements in LTBI treatment, resulting in decreased toxicity and shorter lengths of therapy.

Targeted LTBI Screening Strategies

The detection and treatment of latent tuberculosis infection stands as arguably the single, most important intervention strategy in the elimination of tuberculosis in the United States. Through early detection and appropriate treatment of latent infection, active TB disease and thereby infection transmission is preventable. Recent estimates state that approximately 10 million people in the United States have LTBI. Reducing TB rates among the foreign born population as well as the U.S. born population can not be achieved unless this is effectively addressed.

The identification and treatment of LTBI is a practice that has been shown to be effective in clinical trials, although the true impact of this practice on the overall incidence of TB has yet to be demonstrated. From a theoretical standpoint, widespread, universal LTBI

screening and treatment should be very effective way to decrease progression to active disease and transmission of the TB organism to others. However, through smaller scale attempts, numerous barriers to this screening approach have been identified including poor adherence to LTBI treatment, perceived and actual toxicity of isoniazid therapy and difficulty of acceptance of this intervention by both health care providers and patients.

Thus, organizations such as the CDC, American Thoracic Society and Infectious Diseases Society of America have published guidelines and outlined strategies to carefully target LTBI screening and treatment among particularly high risk populations.[25] In fact, treatment of latent TB infection remains an essential element of the TB elimination strategy outlined by the U.S. Public Health Service Advisory Council on the Elimination of Tuberculosis.[26] The recommended approach involves identifying and testing individuals in subpopulations at high risk for progression of latent TB to active disease including those with medical risk factors such as HIV infection, diabetes and chronic renal failure. Targeted testing also focuses upon individuals with epidemiologic risk factors for *M. tuberculosis* infection including injection drug users and individuals who reside in institutional settings such as correctional facilities, long term care facilities and homeless shelters. Another identified high risk group consists of individuals emigrating from nations with a high prevalence of TB, and as the largest of these groups, it remains the top priority for targeted LTBI screening.

This approach places a large responsibility on TB-control agencies to identify subpopulations of high TB risk within their jurisdictions through understanding the local

epidemiology of TB, and developing testing initiatives to deliver care to individuals within these groups. The epidemiologic profile should include an assessment of the risk for LTBI as well as barriers that may exist to LTBI screening and treatment. The foreign born population represents a group that falls into the high risk category, however, at this time an understanding of individual immigrant groups' health care practices and barriers to early and effective latent TB screening and management remains very limited. Understanding both the local epidemiology of TB in foreign born populations as well as barriers and factors that influence the timeliness of TB testing can provide information of utmost importance in developing targeted and more effective screening interventions.

Special Issues Regarding TB Screening and Control in Foreign Born Populations

The U.S. foreign born population has several unique issues which have been demonstrated to have direct impact on tuberculosis screening, diagnosis and management. It is hypothesized that a more detailed understanding of these factors will allow for more targeted and earlier screening, allowing for decreased infection transmission of infection, with the expectations of declining incidence of infection with the goal of eventual elimination of tuberculosis in the United States. Through evaluation of the epidemiology of foreign born TB and more detailed surveillance, risk factors that impact tuberculosis screening and delayed diagnosis can be better understood, and appropriate interventions can be designed and implemented.

Health Care Access Issues

Immigrants have less access to health care and lower health care use than do their U.S. born counterparts, as reflected in their overall health care expenditures. In 1998, immigrants accounted for $39.5 billion in health care expenditures, with per capita health expenditures 55% lower than those of U.S. born persons after adjustment for insurance status and income.[27]

Among the foreign born population, delays in seeking care and accessing the U.S. health care system are common, and occur for a variety of reasons including:

1. Financial barriers and a lack of health insurance
2. Lack of routine health care
3. Language and cultural barriers between patients and providers
4. Inadequate understanding of the nature of preventive health care and the role of regular disease screening
5. Concerns regarding the effects of diagnosis on various aspects of life including employment, interactions with family and friends and fears of deportment

Financial Barriers and Lack of Health Insurance

The foreign born population represents a disproportionately large share of the U.S. population living without any form of health insurance. Details regarding this disparity and its impact on the public health are still being investigated. A study of residents of Los Angeles showed that uninsured rates for the foreign-born are 24 percent higher than those of U.S. born individuals. Differences within the foreign-born population are even

greater with rates of uninsured as high as 68 percent for undocumented immigrants compared to 23 percent for citizen immigrants. The same study also elicited factors contributing to a lack of insurance, largely socioeconomic status proxies including lower education, household income and total assets.[28]

Previous studies have demonstrated that from 1989 to 1991, the foreign-born population was twice as likely as the US-born population to lack any form of health insurance (26.2% vs. 13.0%). A major nationwide study showed that the highest rate of uninsured status among foreign born populations, 40.8%, was found among foreign-born Hispanics. This same study demonstrated that persons who had lived in the United States for less than 15 years were 1.5 to 4.7 times more likely to be uninsured than were US-born Caucasian residents.[29]

The uninsured are much less likely to use services than are the privately insured, and they pay for a larger proportion of their medical care expenses out of pocket.[30] Both of these trends have been documented within foreign born populations residing in the United States.[26] The lack of health insurance is a major issue, precluding appropriate access to health care for preventive health services and delaying seeking care when medically necessary. With infectious diseases such as TB and HIV disproportionately affecting uninsured populations including immigrants, lack of health insurance and decreased ability to pay for health care can have significant adverse public health consequences.

Lack of Routine Health Care

Previous studies have shown that immigrants to the United States have overall less contact with the health care system and most lack routine sources of health care. This lack of routine care serves as a significant barrier for the provision of preventive health care screening and appropriate health maintenance guidance among the foreign born population. TB screening among this population falls under the realm of primary and, in some cases, secondary prevention. Without routine care, tuberculin skin testing is often delayed or not performed at all. Previous studies have demonstrated that individuals of Hispanic origin are less likely to have a usual place of care and a usual provider, relative to their non-Hispanic counterparts living in the same geographical area.[31] Studies among African born U.S. residents in comparison to U.S. born African-Americans have shown that despite comparable general health status, foreign born populations receive appropriate primary care and routine preventive screening procedures, such as mammography and pap smears, at much lower rates.[32]

More specifically, studies have demonstrated that individuals who lack routine health care and develop active TB are more likely to delay seeing a physician following the onset of symptoms.[33] It is hypothesized, although not yet demonstrated, that those individuals without routine health care are less likely to receive appropriate LTBI screening and treatment. However, at this point, the impact of routine health care on LTBI screening and management, particularly among the foreign-born, has not been very well studied.

Language and Cultural Barriers between Foreign Born Persons and U.S. Health Care Providers

Access to quality health care involves ensuring that communication between all parties involved, particularly patients and providers, is effective. Services must be provided in a manner that is both linguistically and culturally appropriate, without discrimination. A study of racial and ethnic minority patients within the San Francisco Bay area showed that there was much concern that physicians and health care staff lacked knowledge of, and sensitivity to, challenges facing these groups. Stereotyping, lack of culturally appropriate information materials, and intolerance of patients with limited English speaking abilities were all cited as significant factors which would adversely impact patients' abilities to seek needed care.[34]

Language barriers have been studied as they pertain to health care access among individuals eventually diagnosed with TB. A study of 184 New York City TB patients identified substantial patient delays (median, 25 days) in seeking care following the onset of tuberculosis symptoms. The reported delay was longer (median, 51 days) among patients whose primary language was not English.[35] While this study focused on active TB disease, language issues that delay health care access among the foreign born can be applied to TB screening among populations with high rates of TB.

Provider-patient communication has been demonstrated to have significant implications with regard to LTBI screening and treatment. It has been demonstrated that being

interviewed by a health-care provider with the same native language as the immigrant patient was significantly associated with completion of screening for LTBI.[36]

In addition, adherence with isoniazid (INH), the medication of choice for latent TB infection, is a major issue precluding successful management of LTBI. In the entire U.S. population, completion rates for treatment with 9 months of INH therapy, the consensus recommendation for treatment of latent TB infection, are generally quite low (around 30%) and these rates are significantly lower among foreign born populations. With regard to completion of any LTBI therapy, communication is of the utmost importance, specifically understanding the benefits of therapy, describing the numerous potential side effects of the medications, and managing these side effects appropriately. It has been documented that individuals with LTBI of Latino background who described themselves as bicultural were more likely to complete their INH therapy than those who identified themselves solely as Hispanic.[37]

Concerns regarding the effects of diagnosis on various aspects of life including employment, interactions with family and friends and fears of deportation

Although the United States is considered by many as one of the most welcoming nations with regard to immigration policies, foreign born individuals residing in the U.S. still harbor concerns regarding employment, developing relationships with others and fears of deportation. Specifically, undocumented persons- (illegal border crossers and those on visitor status visas) might delay diagnosis and treatment because of fear of discovery and possible deportation. In a study of Latina and Asian immigrant women, these fears of

deportation constituted a significant, documented barrier that precludes early and routine access to health care among this population.[38] Other studies have also demonstrated that fears of immigration authorities have a major impact in delaying care seeking among symptomatic individuals eventually diagnosed with tuberculosis.[34] In a study of foreign born immigrants to San Francisco who developed TB disease, being a refugee was identified as an independent predictor of failure to seek further medical evaluation in the United States.[39]

Even though a relatively small percentage of immigrants feared that going to see a physician would lead to trouble with immigration authorities, those who had symptoms consistent with TB but who also harbored fears regarding immigration issues delayed seeking care for more than 2 months on average. This delay poses a major public health concern, allowing for opportunities to spread infection during this time. A 2001 study in Texas explored tuberculosis characteristics in the foreign born population by immigration classification status, dividing foreign born residents into 2 categories: permanent residents, nonimmigrant visitors and undocumented residents. Results showed significant differences between these subpopulations in multidrug resistance, HIV status and hospitalization course. Compared with other immigrants, more nonimmigrant visitors were multi-drug-resistant, HIV-positive, hospitalized, and had lengthier hospitalizations.[40] The details about underlying differences in TB risk factors and manifestations of TB disease between different immigrant populations have yet to be fully appreciated, but are likely related to U.S. health care access and different barriers to appropriate TB screening and treatment.

Fears among a particularly vulnerable population, the foreign born, represent a major barrier to timely and consistent access to health care, and thus adequate and appropriate screening for TB. The extent of these barriers with regard to TB screening needs to be further examined in order to design culturally appropriate and timely interventions among foreign-born U.S. populations. The programs that will be the most successful are those that are able to provide diagnosis, treatment, and long-term follow-up with practitioners and staff who are aware of the cultural context of TB.

Evaluation of General Risk Factors for Tuberculosis Infection among the Foreign Born Population Residing in Connecticut

Homelessness, intravenous drug use, and excessive alcohol consumption have all been demonstrated as risk factors for increased exposure to *M. tuberculosis* and increased likelihood of developing active tuberculosis among the general population.

Homelessness

Previous studies have demonstrated that there is a significantly elevated risk of exposure to *M. tuberculosis* and an increased rate of infection transmission among the homeless population.[41] Research shows that homeless adults have a higher rate of asymptomatic TB infection, active disease and multidrug resistant TB.[42] Homelessness has also been associated with delays in accessing the health care system among patients who develop active tuberculosis.[34] However, despite extensive efforts to target homeless individuals, few studies have evaluated factors that influence the timing of TB testing among the

homeless. In addition, one subpopulation that has been neglected is the foreign-born U.S. residing homeless population, as no comprehensive studies have evaluated the impact of this subgroup on TB transmission. As discussed earlier, foreign born individuals who arrive in the United States are at higher risk of harboring latent infection than their U.S. born counterparts. When these individuals are unable to secure housing and are forced to reside in shelters, migrant farm worker housing barracks and other close quarters, the risk for reactivation and transmission may be significant. Studying the relationship between homelessness and latent TB infection screening may have particular value with regard to the foreign born population, as it may help identify a population at high risk for both acquisition of infection (by foreign born status) and disease transmission (through homelessness).

Alcohol Consumption and Drug Use

The relationship between alcohol consumption and tuberculosis is complicated, and at this time, poorly understood but many believe that the two are associated.[43,44] Those who suffer from chronic alcohol and drug abuse use are more likely to delay presentation to health care providers both for preventive screening and following the onset of symptoms. In addition, this population is less likely to complete an appropriate course of anti-TB therapy. Previous studies have demonstrated an increased risk of LTBI among chronic alcohol consumers, however, these two variables have not been examined thoroughly while controlling for interacting comorbidities. In addition, the data is conflicting, as some studies have shown no relationship between the development of active TB and drug and alcohol use.[45]

Research examining the relationship between TB and alcohol consumption among the foreign born U.S. population is particularly scant. One study among Vietnamese immigrants demonstrated elevated rates of LTBI and elevated rates of excessive alcohol consumption but was unable to identify significant correlations between the two variables.[46] Additionally, the impact of substance abuse on LTBI screening patterns within both the U.S. born population and the foreign born population has not been examined. Understanding the influence of substance abuse, including drug use and chronic alcohol consumption among the foreign born TB population will allow more targeted screening interventions for this high risk group.

Objectives

Understanding the Epidemiology of Foreign Born Tuberculosis in Connecticut

Based on the recommendations from the American Thoracic Society, the CDC and the Infectious Diseases Society of America, one of the most critical initial steps in reaching the goal of TB control among the foreign born is to understand the epidemiology at the local level. Identifying the spectrum of TB morbidity, the status of TB control within communities, and the changes in these over time allows for specific strategies, appropriate resource allocation and more targeted screening and infection management interventions. While some other metropolitan regions have been able to perform detailed surveillance of their foreign born populations, extensive evaluation of the foreign-born TB population has not yet been performed in Connecticut.

Studies performed in other cities suggest that foreign born individuals with TB may not share the same risk factors as their U.S. born counterparts, however, the local epidemiology may vary depending on social, cultural, and economic factors. In addition to reviewing the demographic data collected from the foreign born population with TB, information regarding previously documented risk factors for TB including homelessness, IV drug use, non-IV drug use and alcohol abuse should be evaluated. This information will assist public health authorities in Connecticut in better understanding characteristics of the foreign born population who develops TB disease, providing the background for designing appropriate interventions in education, screening and treatment for this population.

Purpose and Uses of the Enhanced Surveillance

It is hypothesized that language, culture, and financial barriers are associated with missed opportunities and delayed screening for latent TB infection resulting in the harboring of LTBI and subsequent development of active TB. These same factors compound, and are most likely responsible for, delayed diagnosis of active TB cases among foreign born individuals.

Until recently, controversy regarding foreign born TB cases revolved around distinguishing whether cases among the foreign born represented newly acquired infection or reactivation of previously acquired infection. Newly developed surveillance techniques using molecular epidemiologic methods including restriction fragment length polymorphism (RFLP) fingerprinting and molecular PCR have consistently demonstrated

that less clustering of *M. tuberculosis* specimens occurs from foreign-born patients than from U.S.-born patients.[47,48] This has been interpreted as evidence that the majority of cases of TB among foreign-born persons occur as a result of activation of latent infection rather than newly acquired infection. In a landmark study conducted in New York City and published in the New England Journal of Medicine, researchers used RFLP's to fingerprint 546 isolates of *M. tuberculosis*, about half of which belonged to a clustered group (thus likely transmitted). The remainder were unique isolates, interpreted as reactivation of previously acquired infection. Analysis showed that people born outside the United States were much less likely to be in the clustered group (odds ratio 0.47) and therefore represented reactivation of previously acquired strains.[46] Thus, the foreign born infections were acquired abroad and the development of TB disease after entry in the U.S. was the result of reactivated infection.

With earlier, more targeted latent TB infection screening and appropriate management of LTBI, progression to active, transmissible TB infection is preventable. The design and implementation of the enhanced TB surveillance program is the initial attempt of the Connecticut Department of Public Health to explore health care access issues among those foreign born individuals who eventually do progress to active TB. Enhanced surveillance can provide insight to delays and barriers to latent TB infection screening.

Through the enhanced surveillance, general health practices among this population will be evaluated, including exploring the initial contact of foreign-born individuals with the U.S. health care system following immigration. Understanding more about this

experience, as well as general health ideas and practices among this community will provide insights to identifying opportunities for earlier screening for latent TB infection and for initiation of preventive therapy. The results of this surveillance will be used to develop targeted prevention strategies eventually leading to a reduction in the number of incident TB cases throughout the state.

The goal of this project is to create a new, enhanced, ongoing surveillance in order to learn more about the foreign born population residing in CT that eventually develops active tuberculosis. Specific characteristics will be examined with regard to their influence on delaying the evaluation and diagnosis of tuberculosis and their impact on latent tuberculosis screening within the foreign born population.

Enhanced Surveillance Objectives:

1. To explore demographic characteristics of active TB cases reported to the state of Connecticut focusing on country of origin, location of residence and period of time between arrival to CT and diagnosis of active TB infection;
2. To identify health care access points for foreign born individuals with tuberculosis infection;
3. Identify barriers to health care access including language, financial, co-morbid conditions and cultural issues and evaluate their impact on screening for and treatment of latent TB infection;

4. To develop specific goals to address identified risk factors for TB among the foreign born population residing in Connecticut, and create improved screening strategies for this population.

The new, enhanced foreign-born surveillance database will be ongoing, with continuing implementation beyond the initial evaluation presented in this thesis. It is anticipated that the database will be reviewed on a semi-annual basis, using the same statistical evaluation used in this report. These results will be continuously evaluated by the TB Control Program at the Connecticut Department of Public Health in order to learn more about the foreign born population that develops TB. The goals are to develop specific initiatives to implement earlier and well targeted screening of this population.

Methodology

Epidemiology of Foreign Born TB cases

Data used in the enhanced surveillance includes information from all TB cases reported in the state of Connecticut between January, 2005 and March, 2006. It was collected from Connecticut Department of Public Health records and surveillance databases, using the TB-86 Tuberculosis case report form, which is the initial intake form issued by the Connecticut Department of Public Health based on CDC case reporting guidelines (see Appendix B). These forms are used in the initial surveillance interview of any individual with suspected tuberculosis. Data includes demographic data such as date of birth, ethnicity, country of origin, date of immigration, place of residence, history of drug and alcohol use and housing status. In addition, details regarding the location of TB infection

(pulmonary vs. extrapulmonary) and chest x ray results were also obtained from this data and evaluated in order to identify differences between the U.S. born and foreign born populations. The data obtained from the reports is entered into the TRIMS (Tuberculosis Registry Information System) database maintained by the CDC as a Report of Verified Case of Tuberculosis (RVCT- see Appendix C). Information from both the RVCT and the new, foreign born surveillance was merged, allowing for the creation of a new database used in the data analysis.

For the purpose of this thesis, all patient identification was removed, including name, home address, social security number, and date of birth. In addition, HIV status, which is collected in routine surveillance was not included in this evaluation for fear of subject identification in conjunction with TB status and other demographic information. In subsequent evaluations of the foreign born TB surveillance performed by the DPH, the role of HIV status will be further examined.

Foreign Born Surveillance

Data Collection Instrument (see Appendix A)

The enhanced prospective surveillance incorporates existing data collected by local health departments which has been supplemented by in-person interviews of foreign-born persons living in Connecticut who are suspected of, or diagnosed with, TB. A structured interview and questionnaire asked about the individual's access to and experience with health care and any TB prevention that may have been offered. Epidemiologic data collected for each person described the means of diagnosis (through screening for latent

disease or presentation of symptoms consistent with active TB disease), time from arrival to disease onset, diagnosis and initiation of treatment, immigration status, country of origin, migration within the U.S., and access and barriers to care (including insurance coverage and cultural barriers). This information was obtained pertaining to any regular contact that each individual has had with the U.S. health care system including details regarding the location of this contact, the reason for contact, as well as issues pertaining to access and barriers to care, i.e., insurance and language issues.

Conduct of interview

The interviewer was the public health staff member who had usual contact with TB patients and suspect patients. These include public health nurses and tuberculosis epidemiologists within the Connecticut TB Control and Refugee Health programs. The staff member arranges for an interview either at the health department, at the patient's home, or at another place (e.g., hospital) where privacy can be assured. If the patient agrees to an interview, the staff member is the individual who determines whether an interpreter or bi-lingual interviewer will be needed.

Those who say they speak English "very well" or "well" were interviewed in English; all others have been interviewed with the assistance of an interpreter or by a bilingual interviewer. The supplemental interview time is approximately 15 minutes. All interviewers administering the questionnaire are familiar with procedures of confidentiality and human subjects' rights and have been trained according to guidelines

established at the Department of Public Health. If the interviewer is not fluent in the participant's language, an interpreter is used.

Effort was made to ensure that the enhanced surveillance was conducted at the time of the initial TB intake interview by the public health official assigned to each suspected case. When this was not possible, the surveillance was administered on a subsequent follow up encounter. All data obtained from the surveillance was immediately returned to the Connecticut Department of Public Health TB Control Program and was entered into a central database

Surveillance Population

The enhanced surveillance initiative applies to incident TB suspect cases in foreign-born persons residing in Connecticut at the time of the medical evaluation that lead to their TB diagnosis.

Definitions:

Case of Tuberculosis

A case of TB is defined as one that meets CDC requirements for a Reported Verified Case of Tuberculosis (RVCT) or health reporting requirements for a suspected or confirmed case of active tuberculosis. Cases are identified by either laboratory or clinical criteria. Laboratory criteria include isolation of *M. tuberculosis* complex from a clinical specimen, demonstration of *M. tuberculosis* organisms from a nucleic acid amplification test or demonstration of acid-fast staining bacilli in a clinical specimen in which culture

could not be obtained. Clinical criteria for case definition include evidence of TB infection based on a positive skin test AND signs and symptoms consistent with active TB OR clinical evidence of current TB disease including an abnormal or unstable chest radiograph AND current treatment with two or more anti TB medications.

Foreign born

This term applies to all individuals born outside the United States. For purposes of this surveillance initiative, persons born in the Freely Association States (the Marshall Islands, the Federated States of Micronesia, and Palau/Trust Territories of the Pacific) and American Samoa, Guam, and the Northern Marianas Islands are considered foreign born. Persons born in the U.S. territories of Puerto Rico and the U.S. Virgin Islands will be considered American-born and will not be included in the surveillance.

Inclusion criteria

The inclusion criteria for the new, enhanced surveillance was as follows:

- Any reported suspect or verified case of TB
- Born in a country outside the United States
- Started on therapy or reported on or after September 1, 2005

Exclusion criteria

The exclusion criteria for the new, enhanced surveillance was as follows:

- Children <18 years of age
- Prisoners incarcerated at the time of the interview

IRB Information

IRB review

The surveillance protocol, data collection instruments, and informed consent documents were submitted for review and approval to the University of Connecticut Health Center Institutional Review Board. Approval for this evaluation was obtained on 12/14/2005; IRB # 06-121-1. Formal IRB approval by the Department of Public Health was not required as this new data will be collected and evaluated as standard public health surveillance.

Informed consent

The enhanced TB surveillance serves an extension of the current standard surveillance that is conducted by local health jurisdictions. Local health districts share TB surveillance information with the state TB Control Program. The enhanced surveillance is covered under the same assurances of confidentiality as the standard surveillance. As this is a surveillance effort, informed consent is waived.

Monitoring and Confidentiality of Subjects

The Connecticut TB Control Program monitored the data collection to ensure that each interviewer adhered to the protocol and that all applicable laws and regulations regarding human subjects research have been followed.

Confidentiality is very important for public health surveillance to protect the identity of those who have information collected for public health purposes. All surveillance information is confidential and is available only to authorized users. All individuals involved in the process of data collection, data handling, or data dissemination have been instructed in their responsibility to protect the data prior to the initiation of data collection. Each individual has signed a form indicating that they are knowledgeable and will abide by the confidentiality policies and procedures for that site and has attended training to educate them on the requirements of HIPAA by which they must abide.

Statistical Analysis

Microsoft Access® was used for the purpose of data collection and storage, and analysis of the data was performed using Stata® version 8.0 software.

Binomial logistic regression modeling was used to determine associations between different variables and foreign born status when compared to the U.S. born individuals during the study period. For any given variable, an odds ratio of greater than 1 is associated with foreign born status.

Using ordered logistic regression modeling techniques, different data variables, from the new foreign born surveillance and from the TB-86 forms were examined to identify relationships and factors that were associated with a longer period of time between arrival to the United States and TB diagnosis. An odds ratio greater than 1 is associated with

increased time between immigration and TB diagnosis while an odds ratio of less than 1 is associated with decreased time between immigration and diagnosis.

Through binomial logistic regression modeling, variables from the foreign born surveillance were evaluated to identify their relationship with previous tuberculin skin testing prior to the workup yielding diagnosis of tuberculosis. Odds ratios have been used to represent the odds of having previously been tested for latent tuberculosis infection prior to the workup leading to an actual TB diagnosis. For example, an odds ratio of greater than 1 demonstrates that a factor is associated with previous LTBI screening.

Results

Descriptive Data

Table 2. Frequencies of demographics and general variables and TB Risk Factors- all Foreign Born TB Cases in Connecticut from 1/05 –3/06 (n=64)

Age	Mean 39.07 years, range (20-81)
Sex	Male 34 (53.1%) Female 30 (46.9%)
Country of Origin	India- 12 cases (18.75) Peru- 5 cases (7.81) Bosnia, Vietnam- 4 cases each (6.25) Brazil, Columbia, Ecuador, Philippines, Poland- 3 cases each (4.68) 16 nations- 1-2 cases each
Previous Diagnosis of TB	Yes 2 (3.12) No 62 (96.88)
Size of current City or Town of Origin	Small (population < 20,000) 4 (6.25) Medium (population 20,000-50,000) 14 (21.87) Large (population 50,000-100,000) 18 (28.13) X-Large (population > 100,000) 28 (43.75)
TB Test at Diagnosis	Positive 42 (65.625) Negative 6 (9.37) Not Done 16 (25)
Major Site of Disease	Pulmonary 42 (65.63) Extrapulmonary 28 (43.75)
Chest X Ray at Diagnosis	Normal10 (15.62) Abnormal 53 (82.81) Not Done 1 (1.5)
Chest X Ray Abnormality	Cavitary 11 (17.18) Noncavitary consistent with TB 35 (54.68) Noncavitry not consistent with TB 7 (10.94)
Excessive Alcohol Use in Past Year	Yes 5 (7.81) No 58 (90.63) Unknown 1 (1.5)
IV Drug Use in Past Year	No 62 (96.88) Unknown 2 (3.12)
Non-IV Drug Use in Past Year	Yes 1 (1.56) No 61 (95.3) Unknown 2 (3.12)
Homelessness in Past Year	Yes 1 (1.5) No 63 (98.5)
Time between arrival to United States and TB Diagnosis	Less than 1 year 10 (15.63) 1-3 years 13 (20.31) greater than 3 years 41 (64.06)

Table 3. Health care access variables evaluated in Foreign Born Enhanced Surveillance- includes only those individuals who completed the surveillance (n= 19)

Mean Age	32.42 years
Interpreter Used	Yes 8 (42.10 %) No 11 (57.89)
Routine Health Care Provider	Yes 9 (47.37) No 10 (52.63)
Language used with Routine Provider	Native language 4 (21.05) English 12 (63.16) Interpreter 2 (10.53)
Location of Routine Health Services	Public Clinic/Community Health Center 5 (25.32) Private Physician 6 (31.58) Specialist Physician 1 (5.26) Emergency Dept 2 (10.53) Other 6 (31.58)
Communication Difficulties with Routine Provider	Yes 3 (15.79) No 14 (73.68) At times 1 (5.26)
Any form of Health Insurance at time of TB diagnosis	Yes 8 (42.10) No 10 (52.63)
Type of Health Insurance	Private 5 (25.32) Medicaid 1 (5.26) Medicare 2 (10.53)
Previous LTBI screening	Yes 8 (42.10) No 10 (52.63) Don't Remember 1 (5.26)
Immigration Status at Arrival	Immigrant 4 (21.05) Refugee 5 (25.32) Student/Family Visa 3 (15.79) Visitor 1 (5.26) Temporary 1 (5.26) Undocumented 5 (25.32)
Immigration Status at Diagnosis	Citizen 3 (15.79) Immigrant 4 (21.05) Refugee 3 (15.79) Undocumented 7 (36.84) Other/Unsure 1 (5.26) Student/Family Visa 1 (5.26)
Change in Immigration Status between Arrival and Diagnosis	Yes 9 (47.37) No 10 (52.63)

Interview

During the surveillance period (December, 2005 – April, 2006) 19 subjects met the inclusion criteria and were included in the analysis. Surveillance was conducted through an interpreter in eight cases, with the remaining interviews conducted in English or the participant's native language.

Access to Health Care

Of the group included in the surveillance, only nine individuals reported having a routine health care provider. In nearly all cases this provider was physician, although two reported receiving their primary care from a nurse or nurse practitioner. With regard to the location of their main health care provider, six reported receiving their primary care services from a private physician, five from a community health center or public clinic and two from the Emergency Department at a local hospital. A small number saw a specialist provider, most commonly an Infectious Disease physician for their routine care services.

Twelve individuals reported that they communicate with their regular health care providers in English, four in their native language, and two report always using an interpreter. When asked about their experience communicating problems with their providers, three individuals reported having significant communication problems while 14 reported that there were no problems.

Eight people reported having some form of insurance and ten reported no insurance coverage at the time of TB evaluation. The type of health insurance varied greatly and included private insurance (5), Medicaid (1) and Medicare (2).

Previous LTBI Screening

Investigation into previous LTBI screening was conducted in order to identify patterns of screening among foreign born individuals who are eventually suspected and/or diagnosed with active TB disease. Only eight of the 19 individuals (42.10%) reported any LTBI screening since arrival to the United States. The reasons for previous LTBI screening included presenting with symptoms consistent with TB, possible contact with individuals diagnosed with TB and routine screening for college entrance or employment. LTBI surveillance based solely on risk factors (including foreign born status) without any specific TB contacts occurred in only six cases.

Immigration Status

Immigration status, both on arrival in the U.S. and at the time of TB case designation, was evaluated, as was any change in immigration status. The breakdown of immigration status on entry to the U.S. was as follows: Immigrant (4), Refugee (5), Student/Family Visa (3), Visitor (1), Temporary (1) and Undocumented (5). Nine individuals in the study (47.3%) reported a change in immigration status between arrival to the United States and the time of designation as a TB case.

TB Diagnosis/Workup

Table 4. TB Evaluation Data from Foreign Born Enhanced Surveillance (n= 19)

Reason for TB evaluation	Referred for Screening 4 (21.05 %) Symptoms 11 (57.89) Other Medical Condition 4 (21.05)
If cough, length of cough	Less than 1 week 2 (16.67) One week-Three Months 8 (66.67) Greater than 3 months 2 (16.67)
Location of TB evaluation/diagnosis	Community Clinic 2 (10.53) Specialist, non Pulmonary 1 (5.26) ED 9 (47.37) TB Clinic 3 (15.79)
Language spoken during evaluation	English 14 (73.68) English through Interpreter 5 (26.32)
Communication problems during evaluation	Yes 1 (5.26) No 16 (84.21) At times 2 (10.53)

The conditions that led to the evaluation and eventual workup of suspected tuberculosis included reported seeking care and being evaluated with any symptoms suggestive of TB (11), the most common of which was cough. The duration of cough prior to presentation to a health care provider varied, but when present most frequently lasted between one week and three months (6).

The location where TB was investigated varied, and included local Emergency Departments, community health centers and private physician offices. The Emergency Department was the most common location of TB workup and diagnosis (7 cases).

Communication with healthcare providers was again explored, as details regarding the language of communication and any communication difficulties at the time of TB evaluation were identified. Language of communication during the TB evaluation was

most commonly English (14), and with a translator in the patient's native language (5). Only one individual reported any significant communication difficulties during these encounters.

Demographic Data

The mean age of the enhanced surveillance cohort was 32.4 years (range 20-63). Fourteen towns and cities in Connecticut were represented. The cohort participants originated from 15 different nations with the most commonly represented nations being Peru (3). In the cohort of foreign born individuals included in the enhanced surveillance one person was homeless during the past year, one reported a history of non-IV drug use in the past year, and five reported excess alcohol use during the past year.

Data Analysis

The analysis included in this evaluation represents a pilot evaluation of the surveillance, serving as an illustration of how the foreign born TB surveillance data will be analyzed in future evaluations. While the sample size in this pilot evaluation (n= 19) is too small to yield particularly significant results, it is included in this thesis primarily for illustrative purposes. Based on the data collected, preliminary conclusions will be presented although statistical significance of the results has yet to be attained.

Predictors of prior latent TB infection screening

Data from the foreign born surveillance and the TB-86 form was used to identify factors that predicted previous latent TB screening (through TB skin testing) among the

population that eventually developed tuberculosis. Only 42 percent of patients included in the sample had reported previous TB screening prior to the eventual diagnosis.

Table 5. Demographic, social and clinical characteristics and their association with previous LTBI screening prior to TB diagnosis (n = 19)

Characteristic	Odds Ratio for Previous LTBI testing prior to TB Diagnosis (95% CI)
Having a regular health care provider	2.92 p 0.27 (0.44 – 19.23)
Speaking native language with regular health care provider	6.0 p 0.16 (0.49 – 73.46)
Reporting Communication problems with regular health care provider	0.85 p 0.85 (0.16 – 4.61)
Having any form of health insurance	4.4 p 0.13 (0.63 – 31.29)
Having Private health care insurance	2.7 p 0.35 (0.33 – 21.98)
Having a Documented immigration status on at time of TB evaluation	8.4 p 0.08 (0.76 – 93.34)
Excess Alcohol Use in the Past Year	1.43 p 0.81 (.076 – 16.90)
Residence in the U.S. for > 3 years	1.71 p 0.60 (0.22 – 12.89)
Live in a large city- population > 50,000	2.65 p 0.45 (0.22 – 31.35)

Those individuals who reported prior LTBI screening were more likely to have a routine health provider (OR 2.92), speak their native language with their provider (OR 6.0), have a documented immigration status (OR 8.4), reside in a large city (OR 2.65) and less likely to have communication difficulties with their routine providers (OR 0.85). In addition, those previously screened were more likely to have health insurance (OR 4.4), more specifically private insurance (OR 2.7). Although the magnitude of the associations may be large and potentially important, all calculated p values were less than 0.05, most likely due to inadequate power from small sample size. Thus, no substantial conclusions can be drawn from this pilot evaluation. Nonetheless, this serves as an illustration of the analysis that will be performed on an ongoing basis of the foreign born surveillance.

Time between arrival to the United States and TB Diagnosis

For the purpose of this analysis and future data collection, the time between arrival to the United States and TB diagnosis was divided into three different categorical intervals. The first group included individuals who were diagnosed with TB within the first year of arrival in the United States. The second group was diagnosed between 1-3 years after arrival while the third group was diagnosed greater than 3 years after arrival. As shown earlier, of the 64 total cases of foreign-born TB included, 10 were diagnosed within the first year of arrival to the United States, 13 diagnosed between years 1-3, and 41 were diagnosed after 3 years of residing in the U.S.

Table 6. Demographic, social and clinical characteristics and their association with increased time between arrival to the U.S. and TB Diagnosis

Characteristic	Odds Ratio for increased time between arrival to U.S. and TB Diagnosis with p value and (95% CI)
Total Foreign Born Cases in Connecticut- January, 2005-December, 2005 (n=64)	
Live in a large city- population > 50,000	0.72 p 0.56 (.24 - 2.20)
Previously Diagnosed with TB	0.81 p 0.87 (.07 - 9.99)
Excess alcohol use within the past year	0.81 p 0.81 (.13 - 4.93)
Pulmonary TB as Major Site of Disease	0.65 p 0.44 (.21 - 1.97)
Had a TB skin test at time of TB evaluation	0.60 p 0.39 (.19 - 1.93)
Foreign Born Cases included in Enhanced Surveillance- December, 2005- April, 2006 (n= 19)	
Having a regular health care provider	1.69 p 0.61 (.23 – 12.31)
Speaking native language with regular health care provider	1.82 p 0.63 (.16 - 21.04)
Reporting Communication problems with regular health care provider	0.41 p 0.32 (.07 - 2.39)
Having any form of health insurance	1.24 p 0.83 (.17 - 9.17)
Having Private health care insurance	1.81 p 0.63 (.16 - 21.05)
Having a Documented immigration status on entry to U.S.	2.57 p 0.39 (.29 – 22.34)
Having a Documented immigration status on at time of TB evaluation	0.81 p 0.84 (.11 – 5.95)
Had a Change in Immigration status since arrival	9.04 p 0.07 (.81 – 100.91)
Homelessness in the past year	0.81 p 0.83 (.12 – 5.60)
IV Drug Use in the past year	0.50 p 0.38 (.11 – 2.31)
Have had previous LTBI screening	1.69 p 0.61 (.23 – 12.31)

Note: STATA ordinal logistic regression uses the proportional odds model. This is essentially the equivalent of two simultaneous logistic regression models, one comparing long duration of time (> 3 years) with a combination of short (< 1 year) and middle (1-3 years) durations, and a second comparing short duration of time with a combination of long and middle duration. Odds ratios represent the likelihood that an individual with a characteristic (ex. routine health care) has a longer time interval between arrival to the U.S. and TB diagnosis.

These factors, including those regarding health care access- routine health care provider, communication with health care provider, insurance status, and immigration status were not correlated with the length of time between arrival to the U.S. and TB case identification. Of particular note, those individuals who were in the U.S. longer were

more likely to have a change in immigration status since arrival (OR 9.04) and were more likely to have had previous LTBI screening (OR 1.69). They were also less likely to report communication problems with their health providers (OR 0.41). Again, despite this associations, none reached a p value <0.05 level of significance, most likely due to small sample size. This analysis serves as a basis for the evaluation of future data collected in the ongoing surveillance.

General TB Risk Factors among Foreign Born TB cases in Connecticut

Data collected from all TB cases in Connecticut was analyzed to assess whether risk factors associated with developing TB disease were different between the U.S. born and foreign-born groups.

Table 7. Demographic, Social and Clinical Characteristics and their association with Foreign Born Status- all TB cases in Connecticut, 2005 (n=95)

Characteristic	U.S. Born Patients (N = 31)	Patients of Foreign Born Status (N= 64)	Odds Ratio for Foreign Born Status (95% CI)
Homelessness during past year	4	1	0.11 p 0.05 (.01 -1.06)
IV Drug Use within the past year	4	0	N/A
Non-IV Drug Use within the past year	4	1	0.11 p 0.05 (.01 - 1.06)
Excess alcohol use within the past year	3	5	0.83 p 0.81 (.19 - 3.73)
Pulmonary TB as Major Site of Disease	23	41	0.73 p 0.51 (.29 - 1.85)
Had a TB skin test at time of evaluation	13	47	4.29 p<0.05 (1.74 -10.62)
Live in a large city- population > 50,000	21	45	1.31 p 0.562 (.53 - 3.26)

This table shows the odds ratios for foreign born compared to U.S. born status having various clinical, social and demographic characteristics among all individuals who were

reported to the Department of Public Health as TB cases. Characteristics associated with increased likelihood of foreign born status were having a TB skin test at the time of diagnosis (OR 4.29, $p<0.05$) and living in a city with a population greater than 50,000 persons (OR 1.31). In contrast, factors not associated with foreign born status included homelessness (OR 0.11, $p=0.05$), IV Drug use (no foreign born cases), Non-IV drug use (OR 0.11, $p=0.05$), excess alcohol use (OR 0.83) and pulmonary disease as the major site of infection (OR 0.73). These characteristics were all more prevalent among U.S. born TB cases in Connecticut.

Limitations of the Pilot Evaluation

It is important to recognize that this study represents a pilot evaluation of the enhanced foreign born TB surveillance system instituted by the Connecticut Department of Public Health TB Control Program. This evaluation is based on a small number of individuals who have completed the enhanced surveillance and thus conclusions are limited. As evidenced by the values indicative of statistical significance, very few correlations and risk factors identified are particularly strong, as the power of the evaluation is limited by the small sample size. It is anticipated that stronger associations will be demonstrated when the system has been operational for a longer period of time and more data is collected. In addition, some characteristics worthy of investigation such as country of origin, could not be sufficiently studied in this pilot evaluation due to an insufficient number of cases. These will be examined in future review of the foreign born surveillance data.

Other issues must be considered when evaluating the new surveillance that relate to the quality and accuracy of the information collected. Since the enhanced foreign born surveillance is a new addition to current surveillance administered by DPH staff in the TB control program, there is much variability in how the actual surveillance is administered. While each of the staff members conducting the surveillance was informed of the project and trained regarding the new surveillance instrument, the conduct of the survey has not yet been evaluated or monitored by the surveillance coordinators or the Connecticut Department of Public Health supervisors. In ongoing surveillance consistency among surveyors is essential and thus it is recommended that each individual administering the survey be monitored for quality assurance purposes.

Second, since the survey was newly introduced to the TB control program, there was inconsistency in its use with all foreign born cases reported to the DPH during the evaluation period. For example, public health nurses in Southern Connecticut were less involved in the surveillance development and introduction, and consequently had lower rates of administering the foreign born surveillance when indicated by the protocol. Thus cases around the greater Hartford area, with Department of Public Health staff in close geographical proximity, may have been disproportionately represented during the initial pilot evaluation period. With further education and awareness of the DPH staff, the new survey instrument will become implemented as part of routine surveillance and it is anticipated that these discrepancies will no longer exist.

Finally, when reviewing this evaluation of the foreign born surveillance, it is most important to consider that this represents the initial pilot evaluation of an ongoing surveillance project to provide insight into characteristics of the foreign born population with TB residing in Connecticut. It is anticipated that this surveillance will continue into the future and will be evaluated continuously for quality control by members of the TB Control Program at DPH. Formal data review by the program will occur on a regular basis in a similar manner with the same analysis as performed in this evaluation with the goals of designing and implementing new TB screening initiatives based on the information and results elicited.

Discussion

This thesis is the initial evaluation of three separate but related components designed to provide a more in-depth understanding of risk factors associated with TB, missed and delayed LTBI screening opportunities, and details regarding the medical evaluation leading to TB diagnoses among the foreign born population residing in Connecticut. Data was collected from the nationwide surveillance compiled in the CDC TRIMS database, as well as the new enhanced foreign born TB surveillance developed by the author and the TB Control Program at the Connecticut Department of Public Health.

The data from the foreign born surveillance provides some insight into the demographic characteristics of the population, specifically focusing on issues related to limitations and barriers to health care access for this vulnerable and underserved population. The results show that only a small percentage of this population has any source of regular health care

and less than half of this group has any form of health insurance. Among those with regular providers, less than 25% of this population speak to providers in their native languages and some report that this communication is fraught with difficulties.

It is worthwhile to note that in nearly 90% of cases included in the enhanced surveillance, the actual workup leading to the diagnosis of TB disease did not occur in a primary care setting. Most commonly the workup occurred in a hospital Emergency Department. Surprisingly, language differences between patient and providers (25 % of cases) and communication difficulties (5.26%) were reported in relatively few of these clinical encounters. In this evaluation of the enhanced surveillance, details regarding events leading up to these encounters including referrals and involvement of routine health care providers, factors influencing decisions to pursue evaluation and overall satisfaction were not assessed.

One important goal in the evaluation was to examine the characteristics of the foreign born population that went on to develop active tuberculosis, focusing on factors that may have influenced whether or not an individual had been previously screened for latent TB infection. As mentioned earlier, one of the keys to reducing and eliminating the disease burden of foreign-born TB is early and effective screening and treatment of LTBI. When LTBI is diagnosed and effectively treated, active, infectious tuberculosis disease is prevented.

What may be noteworthy is the impact that health care access issues appear to have on

latent TB infection screening among the foreign born population that eventually develops TB disease. Those individuals who reported any LBTI screening prior to the workup that led to their definition as a case of TB were more likely to have a regular health care provider, speak their native language with their provider, have any form of health insurance, and have had a documented immigration status of any form (as opposed to undocumented or visitor status) on arrival to the United States. Those individuals who reported being screened for LTBI prior to the evaluation resulting in diagnosis were also more likely to have private insurance, and slightly less likely to report communication problems with their routine health care providers. In addition, those individuals who were screened for LTBI were more likely to reside in cities of >50,000 population. Previous LTBI screening was not associated with homelessness, excess alcohol use or duration of time in the U.S. Although these findings were not supported with the necessary statistical significance, their identification in the small sample included in this pilot evaluation suggests that they are worthy of further exploration. It is anticipated that as the surveillance continues and the sample size increases these findings will become significant and serve as the basis for stronger conclusions and recommendations.

Another dependent outcome variable examined was the time between arrival to the United States and eventual TB case identification. As discussed earlier, previous studies have demonstrated that nearly all cases of tuberculosis among the foreign born population are the result of reactivation of a previously acquired infection. Thus the time between arrival to the United States and TB diagnosis represents an extremely important interval in which appropriate screening intervention may detect latent infection. If latent

infection is detected and treated appropriately, the development of symptoms and TB disease is preventable, providing benefit to the infected individual and minimizing the risk of transmission.

Therefore, variables that are associated with an increased duration of time until case identification should be carefully evaluated and addressed in developing screening interventions that target foreign born populations. In this analysis, the total foreign born population was divided into three groups- diagnosis within one year of arrival to the U.S. (3 cases), diagnosis between 1 and 3 years (3), and diagnosis more than three years after arrival (13). Associations between those individuals who spent a longer time in the U.S. prior to diagnosis and specific factors regarding health care access issues were examined. No strong relationships could be elicited, however based on calculated odds ratios alone individuals with a longer duration of time between arrival to the U.S and eventual designation as TB case may have been slightly more likely to have a routine health provider, speak their native language with the routine provider, have health insurance, and have a documented status upon entry to the U.S. However, each these associations were minimal and none were statistically significant ($p < 0.05$) with the sample included in this pilot evaluation.

The final goal of this thesis was to evaluate general TB risk factors previously demonstrated in U.S. born populations to identify whether or not these risk factors apply to the foreign born population in Connecticut. The data evaluated in this analysis shows that four major risk factors for TB- homelessness, intravenous drug use, non-IV drug use

and excess alcohol use are not associated with foreign born TB. In fact, it was shown that the foreign born population with TB residing in Connecticut is less likely to have these risk factors that their U.S. born counterparts also residing in the state, a finding that is consistent with previous studies of foreign born populations with tuberculosis disease.[46,49]

Implications and Recommendations

General Comments

Although this study serves as the pilot evaluation of the new surveillance program initiated by the Connecticut Department of Public Health, the results raise several important health care access issues regarding LTBI screening and TB risk factors among the foreign born population residing in Connecticut. Enhancing the statewide surveillance system will provide more data about where the foreign born population receives its health care and insight into the barriers that this population faces. Consequently, LTBI screening initiatives can be targeted towards specific needs of this group.

As hypothesized, communication between health care providers and patients was shown to be associated with latent TB infection screening among the foreign born. Those individuals who communicated with their providers through an interpreter and not in their native language, as well as those who reported communication difficulties with their health care provider were less likely to be screened for LTBI. Health departments and TB control programs need to recognize that these language and communication barriers

preclude effective LTBI screening, and consequently must address these factors in designing effective interventions. Efforts must be made to ensure that communication between providers and patients is effective, particularly in the setting of LTBI screening. It is essential that public health officials work with health care providers, particularly those that have significant interaction with foreign born populations, to ensure that the importance of LTBI screening is effectively communicated. It is essential that individuals receive health care, particularly preventive screening interventions, in a language that they can understand. Prior to their arrival in the U.S. many foreign born individuals may not have received preventive care, including health screenings. Thus, a special effort must be made to explain LTBI to patients in a manner and language that is understandable. By improving communication and decreasing language and cultural barriers, LTBI screening rates will increase and the incidence of TB disease will decrease. It is essential that local and state public health authorities including health departments and TB control programs work with providers serving foreign born patients to ensure that the recommendations for LTBI screening are being followed, and of equal importance, are communicated to patients in a manner that is understandable.

Location of current residence was associated with previous LTBI screening. Individuals who had been previously screened were more likely to reside in large cities. This may be explained by the greater familiarity of providers practicing in urban settings with foreign born health and screening issues. Those clinicians who practice in urban areas may be more knowledgeable and adherent to the current screening guidelines, and therefore more likely to screen foreign born individuals appropriately. It is essential that all clinicians

and especially those who care for foreign born individuals know and follow appropriate screening guidelines and recommendations. Through providing continuing medical education (CME) programs TB control programs at the local and statewide level should take responsibility for ensuring clinical competency with regard to TB screening and monitoring.

LTBI screening was associated with time spent in the U.S. prior to diagnosis, as those who received prior screening were more likely to have resided in the U.S. for a longer period of time. This finding should be further explored in future studies. In addition, the data shows that foreign born individuals who had more general TB risk factors including previous IV drug use, homelessness and excessive alcohol use may more likely to be identified as a TB case in a shorter period of time. This finding may provide support for the notion that the public health system, and specifically TB screening, targets those individuals with these traditional risk factors, with less attention given to the risk factor of being foreign born.

Finally, it was recognized that the foreign born population that develops active TB disease after arrival to the U.S. does not necessarily share the same TB risk factors as those U.S. born individuals who become TB cases. This has been demonstrated in multiple previous studies, and may be due to numerous different social, cultural, and economic factors. However, demonstration of differences between the two groups may suggest that the current screening methods, particularly the nationwide TRIMS surveillance conducted by the CDC, may be inadequate in assessing the foreign born

population. Another, separate database may be warranted, one that specifically focuses on the foreign born population and their specific risk factors in order to explore them on a larger scale.

Although omitted from this study due to the small sample size of the pilot evaluation, an important additional component of the enhanced surveillance that has been instituted by the Connecticut Department of Public Health involves acquiring specific information about where foreign born individuals included in the sample actually receive their health care. When the surveillance is conducted specific information is collected regarding the details of their regular health care, including the primary provider's name or the name and location of the community health center or public health clinic. This information was not evaluated as part of this study, however, it remains an invaluable component of the enhanced surveillance program. Individuals from the Connecticut TB Control Program will continue to collect the detailed information regarding which providers care for foreign born patients with high TB risk. Once a provider database is assembled, TB control program staff will directly target specific providers and/or health centers to provide education, guidance and support for their LTBI screening and treatment efforts.

Individuals with Previous LTBI Screening

Those individuals identified in the surveillance with TB disease who report being previously tested for LTBI infection constitute an interesting population worthy of further comment. A percentage of individuals included in the surveillance (42.1%) were previously screened for latent TB infection, and some (5 cases) were treated for LTBI

prior to their eventual identification as a case of TB disease. Three individuals reported previous LTBI screening, but were not prescribed any therapy following the test either due to a negative test or a contraindication to therapy. The surveillance did not indicate the specifics of their LTBI treatment regimen but did inquire as to whether or not the individual actually received medication and completed therapy. Thus two important issues arise and both have clinical and public health implications. Why did those individuals who reported previous LTBI infection and who were treated with INH eventually develop TB disease? What were the circumstances regarding the individuals who were previously identified LTBI and not treated for LTBI who eventually developed TB disease?

With regard to the population that has been previously treated for LTBI but eventually developed TB disease, several possibilities should be entertained. First, it must be reiterated that while LTBI treatment with any approved medication regimen has been shown to be highly effective, no regimen is 100% effective in preventing the development of TB disease. In addition, adherence difficulties with LTBI treatment must be acknowledged; people with LTBI are not clinically ill and may not be motivated to complete the necessary nine months of isoniazid therapy. This again emphasizes the importance of discussing all different regimens of LTBI therapy and through effective communication between the patient and the health care provider, the ideal regimen can be selected, maximizing the likelihood of adherence.

Finally, foreign-born populations come from a variety of socio-economic backgrounds, and those without any form of health insurance may harbor concerns regarding the acquisition and completion of the recommended therapy. Although programs are in place to supply for LTBI therapy at no cost to those who cannot pay, these programs are often unrecognized by both patients and health care providers. One individual included in the enhanced surveillance cited an inability to pay as the main reason for not completing prescribed LTBI therapy. This underscores the importance of provider and public education regarding the availability of LTBI therapy to those who need it.

Based on the reasons outlined above, clinicians must recognize that even those individuals who report being previously treated for LTBI should still be considered at risk for progression to TB disease and should be carefully evaluated based on all appropriate risk factors.

Individuals who report being previously tested but never treated for LTBI and who eventually develop TB disease constitute another group that raise other important concerns regarding LTBI screening and management. While recently acquired infection during the time period between LTBI screening and presentation of TB disease is possible, this is less likely based on the current understanding of the epidemiology of foreign born TB. One alternative explanation is that, despite a positive tuberculin skin test, the health care provider who evaluated the test result made the decision not to treat for LTBI. Perhaps, the provider had misguided beliefs regarding false positive tuberculin skin tests following Bacillus of Calmette and Guerin (BCG) vaccine administration. In

this case it is important to emphasize that those individuals with positive TB skin tests should be evaluated for TB disease and treated for LTBI infection. In addition, LTBI therapy with INH is generally not administered to individuals who have had previous INH hepatitis or other serious adverse reactions to INH, or who have active hepatitis or end-stage liver disease. Under these circumstances other therapies may be recommended although the clinician must decide the overall risk-benefit of treating that individual.

It is essential that both clinicians and public health authorities understand that simply because an individual reports previous LTBI screening and/or treatment he or she cannot be ruled out for the possibility of TB disease. Inquiring about whether or not a test has been performed is not sufficient. It is critical to learn more about the circumstances of previous TB testing, the outcome of the test and details regarding LTBI treatment before making a clinical judgment of any individual's risk for TB disease.

Future Directions, Goals, and Initiatives in Foreign Born TB Control

Current U.S. policy requires that individuals planning to permanently immigrate to the United States be screened for tuberculosis disease prior to departure. However, until the last decade little to no attention has been given to the foreign born population arriving in the U.S. with latent TB infection. These cases currently constitute the majority of the TB burden in most states. Recent data shows that individuals who arrive to the U.S. with latent infection are at risk for reactivation of disease and represent a significant public health risk.

The pilot evaluation of the enhanced surveillance suggests that there are factors regarding health care access among foreign born individuals residing in the U.S. that may affect the likelihood of LTBI screening. Despite the relatively low prevalence of routine health care among the sample cohort, having a routine health provider was associated with previous LTBI screening among the foreign born. Similarly, individuals who lacked health insurance were less likely to have any form of LTBI screening prior to their eventual diagnosis. Since the analysis is still in its infancy and the sample size is currently quite small the true significance of these results is still unclear. Nonetheless, observations made thus far emphasize the importance of ensuring that all foreign born individuals, regardless of social, economic, or immigration status, have some way to access the U.S. health care system, or at a minimum, public health officials who can provide LTBI screening. Individuals who are reluctant to seek health care or unable to pay for screening services represent a particularly vulnerable population, and one that is at high risk for developing TB disease. It is essential that this population be screened for LTBI, and treated appropriately. If this group cannot be accessed at health care facilities and traditional health care access points, alternative means must be designed to target this group. This may include conducting LTBI screening at alternative locations through formal, public health outreach programs. Some urban centers such as San Francisco and New York City as well as the state of Washington have instituted programs based in immigrant communities that provide culturally sensitive and language specific outreach, screening and LTBI treatment services to high risk foreign born populations.

Health department and health care provider collaboration to expand and target LTBI screening has been shown to effectively decrease the prevalence of TB disease among the foreign born as well as transmission rates to U.S. born individuals. Proactive and collaborative TB screening outreach programs should be considered by Connecticut's public health authorities.

For numerous reasons cited previously, the foreign born population can often be particularly difficult to access, and subsequent limited health care access can have significant implications with regard to LTBI screening. Thus, innovative, alternative strategies must be developed in order to reach those individuals being missed by current LTBI testing. Some strategies targeting LTBI screening towards subgroups of the foreign born populations such as migrant farm workers and those enrolled in school have been successful, yet their implementation and evaluation are still in early stages. Since a large proportion of the foreign born population is employed by a small number of employers and industries, employment based screening has been proposed as a possible means to reach the foreign born for TB screening. Public health authorities may provide incentives to employers to ensure that their foreign born employees undergo LTBI screening and management prior to beginning employment. In certain types of employment where TB disease could pose a major public health risk, LTBI screening could be a mandated requirement for employment, similar to the current standard for school entry. Additionally, recent data suggests that foreign born students who enter the U.S. on temporary visas represent a high risk and often under-screened population. Three individuals evaluated in the pilot evaluation of the enhanced surveillance fell into this

category. Public health outreach efforts may be required to identify these students and ensure that they are adequately screened prior to enrollment in any educational program. This approach has been met with much success in several states, although at this point in time remains implemented on a state-by-state basis.

Previous epidemiologic studies as well as ATS, CDC and IDSA guidelines have reiterated that progress towards eliminating TB in the United States and reducing TB among foreign born persons living in the U.S. cannot be achieved without effective targeted testing and treatment of latent TB infection. While widespread LTBI screening and treatment has been proposed, there are far too many barriers and costs precluding its administration in the U.S at this juncture in time. However, groups that are at particularly high risk for latent TB infection and its progression to transmissible TB disease must be a top priority for screening and treatment. The foreign born population falls into this category.

Given the changing epidemiology of foreign born TB as well as variation in immigration patterns throughout the U.S., the responsibility for screening high risk individuals and understanding the local epidemiology of foreign born TB must be addressed by public health authorities at the local, regional and national levels. Local health departments and specifically designated TB control programs must understand the local epidemiology of foreign born tuberculosis, TB risk factors, and access to LTBI screening among their foreign born population. In addition, health departments must be held responsible for collecting and evaluating this information with the goal of understanding how to

effectively reach, administer screening, and provide LTBI treatment for this population. However, health departments frequently have difficulty accessing the high risk foreign-born population. Thus, communication and collaboration with local health care providers, specifically in sites serving the foreign born population including community health centers, Emergency Departments and private practices known to care for foreign born individuals, is critical for the successful implementation of any new LTBI screening strategies.

Although the enhanced foreign born surveillance program addresses some specific issues regarding health care access and the foreign born population's risk for the development of TB disease, there are many other factors which have yet to be evaluated and their impact on LTBI screening and treatment remains poorly understood. These factors include the often lengthy referral times for screening, long waiting times in public health clinics and Emergency Departments, distance of screening sites from patient's homes, and attitudes of clinic staff towards foreign born patients of different backgrounds and immigration status, each of which is mentioned in the ATS/CDC LTBI targeted testing recommendations.[24] In future studies it will be essential to further examine the impact of these and other contributing factors on LTBI surveillance and treatment and how to overcome any barriers they pose in LTBI screening and management in foreign born populations.

Conclusion

Understanding and effectively addressing TB in the foreign born population remains one of the major impediments to successful control and eventual elimination of TB in the United States. Based on current strategies targeted LTBI screening remains at the forefront of public health efforts in early identification and treatment of TB infection among the foreign born. Currently there are numerous barriers that preclude effective, targeted testing and treatment of latent TB infection in this population. Once these barriers, particularly those preventing LTBI screening, are recognized, understood and addressed, TB control strategies will be more effective and successful. The enhanced surveillance of TB among the foreign-born implemented by the Connecticut Department of Public Health is an attempt to understand these barriers in order to design improved LTBI screening interventions. This thesis describes the background, design, pilot evaluation and preliminary results of this surveillance, and offers recommendations for further study and improved LTBI screening strategies. Only after LTBI screening programs focusing on the foreign born population are effectively designed, targeted and implemented can true progress be achieved towards TB control in Connecticut and throughout the United States.

References

[1] Schneider E, Moore M, Castro K. Epidemiology of Tuberculosis in the United States. *Clinics in Chest Medicine*, 2005;26:183-195.

[2] Brown RE, Miller B, Taylor WR, et al. Health-care expenditures for tuberculosis in the United States. *Archives of Internal Medicine* 1995;155:1595-1600.

[3] Cantwell MF, Snider DE, Cauthen GM, Onorato IM. Epidemiology of tuberculosis in the United States, 1985 through 1992. *JAMA* 1994;272(7):535-539.

[4] Neville K, Bromberg A, Bromberg R, Bonk S, et al. The Third Epidemic- Multidrug Resistant Tuberculosis. *Chest* 1994 105(1) 45-48.

[5] Beck-Sague C, Dooley SW, Hutton MD, et al. Hospital outbreak of multidrug-resistant Mycobacterium tuberculosis infections. Factors in transmission to staff and HIV-infected patients. *JAMA* 1992;268(10) 1280-1286.

[6] Talbot, E, Moore M, McCray E, Binkin N. Tuberculosis among Foreign-Born Persons in the United States, 1993-1998. *JAMA* 2000;284:2894-2900.

[7] U.S. Centers for Disease and Prevention, Division of Tuberculosis Elimination. Trends in Tuberculosis-United States, 2004. *MMWR*. 2005;54(10):245-249.

[8] Dye C, Scheele S, Dolin P, Pathania V, Raviglione MC, for the WHO Global Surveillance and Monitoring Project. Global burden of tuberculosis: estimated incidence, prevalence and mortality by country. *JAMA*. 1999;282:677-686.

[9] U.S. Centers for Disease Control and Prevention. Tuberculosis- Western Europe, 1974-1991. *MMWR*. 1993;42:628-631.

[10] Stehr-Green JK. Tuberculosis in New Zealand, 1985-90. *New Zealand Medical Journal* 1992;105:301-303.

[11] Orr PH, Manfreda J, Hershfield ES. Tuberculosis surveillance in immigrants to Manitoba. *Canadian Medical Association Journal*. 1990;142:453-458.

[12] McKenna MT, McCray E and Onorato I. The Epidemiology of Tuberculosis Among Foreign Born Persons in the United States, 1986-1993. *New England Journal of Medicine*. 1995; 332(16):1071-1076.

[13] Raviglione MC, Snider DE Jr., Kochi A. Global epidemiology of tuberculosis: morbidity and mortality of a worldwide epidemic. *JAMA* 1995;273:220-226.

[14] Moore M. Trends in Drug-Resistant Tuberculosis in the United States, 1993-1996. *JAMA*. 1997;278(10):833-837.

[15] Chin DP, DeRiemer K, Small PM, et al. Differences in Contributing Factors to Tuberculosis Incidence in U.S. born and Foreign-born Persons. *American Journal of Respiratory and Critical Care Medicine*. 1998. 158:1797-1803.

[16] Zuber, PL et al. Long-term risk of tuberculosis among foreign-born persons in the United States. *JAMA*, 1997 Jul 23-30;278(4):304-7.

[17] Tornieporth, NG et al. Tuberculosis among foreign-born persons in New York City, 1992-1994: implications for tuberculosis control. *International Journal of Tuberculosis and Lung Disease*. 1997 Dec;1(6):528-35.

[18] Report of the Working Group on Tuberculosis Among Foreign Born Persons. Recommendations for Prevention and Control of Tuberculosis Among Foreign Born Persons. *MMWR*. 1998 47:RR-16.

[19] Zuber PL, Binkin NJ, Ignacio AC et al. Tuberculosis screening for immigrants and refugees. Diagnostic outcomes in the state of Hawaii. *American Journal of Respiratory and Critical Care Medicine.* 1996 Jul;154(1):151-5

[20] Binkin NJ, Zuber PL, Wells, CD, et al. Overseas Screening for Tuberculosis in Immigrants and Refugees to the United States. *Clinical Infectious Diseases* 1996;23:1226-1232.
[21]U.S. Centers for Disease Control and Prevention. Tuberculosis among foreign-born persons who had recently arrived in the United States- Hawaii, 1992-1993 and Los Angeles County, 1993. *MMWR*. 1995;33:703-707.

[22] LoBue PA, Moser KS. Screening of Immigrants and Refugees for Pulmonary Tuberculosis in San Diego County, California. *Chest* 2004;126:1777-1782.

[23] Blum RN, Polish LB, Tapy JM, Catlin BJ, et al. Results of screening for tuberculosis in foreign-born persons applying for adjustment of immigration status. *Chest* 1993;103:1670-1674.

[24] Targeted tuberculin testing and treatment of latent tuberculosis infection. This official statement of the American Thoracic Society was adopted by the ATS Board of Directors, July 1999. *American Journal of Respiratory and Critical Care Medicine* 2000 Apr;161(4 Pt 2):S221-47.

[25] Taylor Z, Nolan CM, et al. Controlling Tuberculosis in the United States: Recommendations from the American Thoracic Society, CDC and the Infectious Diseases Society of America. *MMWR*. 2005 Nov 4;54(RR-12):1-81.

[26] Advisory Council on the Elimination of Tuberculosis. Tuberculosis elimination revisited: obstacles, opportunities and a renewed commitment. *MMWR* 48 (RR-9):1-13.

[27] Mohanty SA, Woolhandler S, Himmelstein DU, et al. Health Care Expenditures of Immigrants in the United States: A Nationally Representative Analysis. *American Journal of Public Health* 2005;96(8):1431-1438.

[28] Goldman DP, Smith JP, Sood N. Legal Status and Health Insurance among Immigrants. *Health Affairs* 2005;24(6):1640-1653.

[29] Thamer M. et al. Health insurance coverage among foreign born US residents. *American Journal of Public Health* 1997;87(1):96-102.

[30] Taylor AK, Cohen JW, Machlin SR. Being uninsured in 1996 compared to 1987: how has the experience of the uninsured changed over time? *Health Services Research* 2001:36(6):16-31.

[31] Rohrer JE, Kruse G, et al. Hispanic ethnicity, rural residence, and regular source of care. *Journal of Community Health.* 2004 Feb;29(1):1-13.

[32] Siegel, JE. Et al. Health and Health Care Status of African-Born Residents of Metropolitan Washington, D.C. *Journal of Immigrant Health*. 2001 Oct; 3(4):213-224.

[33] Asch S, Leake B, et al. Why do symptomatic patients delay obtaining care for tuberculosis? *American Journal of Respiratory and Critical Care.* 1998 Apr;157(4 Pt 1):1244-8.

[34] Barr D and Wanat SF. Listening to Patients: Cultural and Linguistic Barriers to Health Care Access. *Clinical Research and Methods*. 2005;37(3):199-204

[35] Sherman LF, Fujiwara PI, et al. Patient and health care system delays in the diagnosis and treatment of tuberculosis. *The International Journal of Tuberculosis and Lung Disease.* 1999 Dec;3(12):1088-95.

[36] Carvalho AC, Saleri N et al. Completion of screening for latent tuberculosis infection among immigrants. *Epidemiology and Infections*. 2005 Feb;133(1):179-85.

[37] Hovell M. et al. Predictors to adherence to treatment of Latent Tuberculosis Infection in high-risk Latino adolescents: a behavioral epidemiological analysis. *Social Science and Medicine*. 2003 April. 56(8): 1789-17986.

[38] Bauer, HM et al. Barriers to health care for abused Latina and Asian immigrant women. *Journal of Health care for the Poor and Underserved.* 2000 Feb;11(1):33-44.

[39] DeRiemer K, Chin DP, Schecter GF, et al. Tuberculosis among immigrants and refugees. *Archives of Internal Medicine*. 1998 Apr 13;158(7):753-60.

[40] Weis SE, Moonan PK et al. Tuberculosis in the foreign-born population of Tarrant county, Texas by immigration status. *American Journal of Respiratory and Critical Care Medicine*. 2001 Sep ;164(6):953-7.

[41] Barnes PF, el Hajj H, Preston-Martin S, et al. Transmission of tuberculosis among the urban homeless. *JAMA*. 1996;275:305-307.

[42] Haddad MB, Wilson TW, et al. Tuberculosis and Homelessness in the United States, 1994-2003. *JAMA*. 2005;293:2762-2766

[43] Woeltje KF, Kilo CM, et al. Tuberculin Skin testing of Hospitalized patients. *Infection Control Hospital Epidemiology*. 1997 Aug;18(8):561-5

[44] Friedman LN, Sullivan GM. Tuberculosis screening in alcoholics and drug addicts. The American Review of Respiratory Disease. 1987 Nov;136(5):1188-92.

[45] Moss AR, Hahn JA, et al. Tuberculosis in the Homeless. *American Journal of Respiratory and Critical Care Medicine*, Volume 162, Number 2, August 2000, 460-464.

[46] Nelson KR, Bui H, et al. Screening in special populations: a "case study" of recent Vietnamese immigrants. *American Journal of Medicine.* 1997 May;102(5):435-40.

[47] Geng E, Kreiswirth B, Driver C, Li J, Burzynski J, DellaLatta P, et al. Changes in the transmission of tuberculosis in New York City from 1990 to 1999. *New England Journal of Medicine* 2002;346(19):1453-8.

[48] Jasmer RM, Hahn JA, Small PM, et al. A molecular epidemiologic analysis of tuberculosis trends in San Francisco, 1991--1997. *Annals of Intern Medicine* 1999;130:971--8.

[49] Chin DP, DeRiemer K, Small PM, et al. Differences in Contributing Factors to Tuberculosis Incidence in U.S. born and Foreign-born Persons. *American Journal of Respiratory and Critical Care Medicine*. 1998. 158:1797-1803.

Appendix A-Tuberculosis in the Foreign Born Surveillance Form

Patient Name_____ Health District_____ State ID ___ ___ ___ ___ ___
Native language _____
Was an interpreter used?
☐ No
☐ Yes

Questions related to patient's <u>most recent</u> ROUTINE health care BEFORE their TB diagnosis. If no routine provider, questions pertain to first provider after U.S. entry.

1. Do you have a health provider whom you usually see for health care?
☐ No
☐ Yes
☐ In past, no longer

2. After entering the U.S. and BEFORE your TB diagnosis did you receive a skin test?
☐ No [GO to Q. 7]
☐ Yes Year: ___ ___ ___ ___
☐ Don't remember

3. At the time of the TB skin test, what was the reason for seeing the provider?
☐ Contact to a TB case
☐ Routine Care
☐ Gynecological care/Pregnancy
☐ Injury
☐ Ill
☐ Was told by family member or friend to go
☐ Required for employment
☐ Other (describe) _____

4. If you had a positive skin test result, were you offered treatment for TB infection?
☐ Negative TST [GO to Q. 7]
☐ No [GO to Q. 7]
☐ Yes
☐ Don't remember

5. Did you take the INH?
☐ No
☐ Yes [GO to Q. 7]
☐ Don't remember [GO to Q. 7]

6. If you did not take the medicine for TB treatment, why not?
☐ Did not think it would help
☐ Had BCG vaccination
☐ Do not believe in drugs (pills)
☐ My provider told me it was not necessary
☐ Other (describe) _____

7. Where do/did you USUALLY go for health care?

☐ Public Health Clinic (Name:_____ Town:_____)
☐ Private Doctor's Office (Name:_____ Town: _____)
☐ Traditional/Spiritual healer (Name:_____ Town: _____)
☐ Specialist Doctor (type: _____)
☐ Emergency Department (Town: _____)
☐ Other _____
☐ No usual health care

8. What type of health care provider did you USUALLY see?

☐ Doctor
☐ Nurse
☐ Nurse Practitioner or Physician Assistant
☐ Other _____
☐ Don't know/remember

9. What language did you use to speak with the provider you usually see?

☐ English
☐ English using an interpreter
☐ Your native language

10. Did you have a problem communicating with the provider you usually see?

☐ No
☐ Yes
☐ At times

Questions related to when the patient was DIAGNOSED with TB.

11. When you were first diagnosed with TB, did you have health insurance or coverage?

☐ No [GO to Q. 13]
☐ Yes
☐ Unknown

12. What type of health insurance or health coverage did you have?

☐ Private Health Insurance
☐ Medicare
☐ Medicaid
☐ No Insurance
☐ Other (describe) _____

13. What is the main reason that you went to the provider who told you that you had TB?

☐ Referred by another doctor/health care provider
☐ Symptoms
☐ Other medical condition (not TB)
☐ Routine exam
☐ Immigration Screening/Exam
☐ Other _____

14. If you had cough, how long was it before you saw a doctor or nurse?

☐ No cough
☐ Less than 1 week
☐ 1 week – 1 month
☐ Greater than 1 month – 3 months
☐ Greater than 3 months

15. Where did you find out that you had tuberculosis?

☐ Community Health Clinic
☐ Private Doctor's office
☐ Specialist Doctor (type: _____)
☐ Emergency Department (location _____)
☐ Tuberculosis Clinic

16. What language did the doctor or nurse use when he or she told you that you had TB?

☐ English
☐ English using an interpreter
☐ Your native language

17. Did you have a language problem communicating with this provider?

☐ No
☐ Yes
☐ At times

18. What was/is your immigration status when you *first* entered the U.S. and *currently*?

First	**Current**	
☐1	☐1	Undocumented
☐2	☐2	Immigrant/Permanent resident
☐3	☐3	Refugee
☐4	☐4	Asylee
☐5	☐5	U.S. citizen
☐6	☐6	Spouse/minor child of legal permanent resident (visa type V)
☐7	☐7	Fiancée or minor children of U.S. citizen (visa type K)
☐8	☐8	Student/student family visa (visa type F or M)
☐9	☐9	Work visa or family member of someone with work visa (visa type H)
☐10	☐10	Visitor (for business or pleasure) (visa type B1 or B2)
☐11	☐11	Temporary resident/visitor (unknown visa type) *[Probe]*
☐12	☐12	Other *(Specify)* _____
☐99	☐99	Refused to answer

Comments:

Appendix B- Connecticut TB-86 Form- Tuberculosis Surveillance Report

State of CT Department of Public Health
Tuberculosis Control Program
410 Capitol Avenue, MS #11TUB
P.O Box 340308
Hartford, CT 06134-0308

TUBERCULOSIS SURVEILLANCE REPORT
TB-86 FORM
COMPLETE FOR ALL TB CASES, TB CASE SUSPECTS AND INFECTIONS

Voice (860) 509-7722 Fax: (860) 509-7743

CASE NUMBER *(For Office Use Only)*

PATIENT'S NAME: (LAST)	(FIRST)	SEX ☐ M ☐ F	DATE OF BIRTH MM DD YYYY
STREET ADDRESS.	CITY:	STATE	ZIP	HOME TELEPHONE:
SSN:	REASON FOR REPORT ☐ CASE ☐ SUSPECT CASE ☐ LATENT TB INFECTION	CONTACT TO KNOWN CASE? ☐ YES ☐ NO ☐ UNKNOWN	IF YES, NAME SOURCE CASE:	REPORTED AT DEATH? ☐ YES ☐ NO	DATE OF DEATH: MM DD YYYY
RACE ☐ WHITE ☐ BLACK ☐ ASIAN ☐ AMERICAN INDIAN/ALASKAN NATIVE	ETHNIC ORIGIN: ☐ HISPANIC ☐ NON-HISPANIC	COUNTRY OF BIRTH	US ENTRY DATE. MM YYYY	IF NOT US, REFUGEE? ☐ YES ☐ NO	HISTORY OF BCG VACCINE AND DATE? ☐ YES ☐ NO ☐ UNKNOWN MM YYYY
DIRECTLY OBSERVED RX BY: ☐ STATE HEALTH ☐ OTHER ☐ LOCAL HEALTH/VNA	MANTOUX TEST: ☐ POSITIVE ☐ NOT DONE ☐ NEGATIVE ☐ UNKNOWN	DATE OF MANTOUX MM DD YYYY	MM OF INDURATION.	HISTORY OF NEGATIVE PPD? ☐ YES ☐ NO	DATE OF LAST NEGATIVE PPD MM YYYY	DOES PATIENT HAVE HEALTH INSURANCE? ☐ YES ☐ NO

SITE OF DISEASE (PLEASE CHECK AT LEAST ONE SITE)

☐ PULMONARY ☐ LYMPHATIC; CERVICAL ☐ LYMPHATIC, UNKNOWN ☐ BONE AND /OR JOINT ☐ MILIARY ☐ PERITONEAL
☐ PLEURAL ☐ LYMPHATIC; OTHER ☐ LYMPHATIC; INTRATHORACIC ☐ GENITOURINARY ☐ MENINGEAL ☐ OTHER SPECIFY _____

BACTERIOLOGY RESULTS

#	DATE COLLECTED	SPECIMEN TYPE	SMEAR	CULTURE
1.	MM DD YYYY	☐ SPUTUM ☐ FLUID TYPE OF FLUID _____ ☐ TISSUE TYPE OF TISSUE _____	☐ PENDING ☐ POSITIVE ☐ NEGATIVE	☐ PENDING ☐ (+) MTB ☐ NEGATIVE ☐ ATYPICAL SPECIES _____
2.	MM DD YYYY	☐ SPUTUM ☐ FLUID TYPE OF FLUID _____ ☐ TISSUE TYPE OF TISSUE _____	☐ PENDING ☐ POSITIVE ☐ NEGATIVE	☐ PENDING ☐ (+) MTB ☐ NEGATIVE ☐ ATYPICAL SPECIES _____

TB HISTORY

PREVIOUS TB? ☐ YES ☐ NO IF YES, YEAR:
MORE THAN 1 PREVIOUS EPISODE? ☐ YES ☐ NO
CLASSIFICATION OF PREVIOUS TB? ☐ DISEASE ☐ INFECTION ☐ BOTH

HIV STATUS (AS REQUIRED BY PUBLIC HEALTH CODE 19a-36-a7)

☐ NEGATIVE ☐ REFUSED
☐ POSITIVE ☐ NOT OFFERED
☐ INDETERMINATE ☐ UNKNOWN
☐ TEST DONE, RESULTS UNKNOWN

HIV STATUS BASED ON.
☐ MEDICAL DOCUMENTATION
☐ PATIENT HISTORY
☐ UNKNOWN
TEST DATE:

OTHER MEDICAL/CLINICAL PROBLEMS

RISK FACTORS

OCCUPATIONS IN PAST 24 MONTHS (CHECK ALL THAT APPLY)
☐ HEALTH CARE WORKER ☐ NOT EMPLOYED
☐ CORRECTIONAL EMPLOYEE ☐ STUDENT
☐ MIGRATORY AGRICULTURAL WORKER ☐ UNKNOWN
☐ OTHER SPECIFY _____
MOST RECENT EMPLOYER/SCHOOL NAME.
EMPLOYER/SCHOOL ADDRESS

WHEN DIAGNOSED WAS PATIENT IN CORRECTIONS? ☐ YES ☐ NO
IF YES, TYPE OF FACILITY:
☐ FEDERAL PRISON
☐ STATE PRISON
☐ LOCAL JAIL
☐ JUVENILE CORRECTIONAL FACILITY
☐ OTHER CORRECTIONAL FACILITY
☐ UNKNOWN

WHEN DIAGNOSED WAS PATIENT IN LONG-TERM CARE FACILITY? ☐ YES ☐ NO
IF YES, TYPE OF FACILITY
☐ NURSING HOME
☐ HOSPITAL-BASED FACILITY
☐ RESIDENTIAL FACILITY
☐ ALCOHOL/DRUG TREATMENT FACILITY
☐ MENTAL HEALTH RESIDENTIAL FACILITY
☐ OTHER LONG-TERM CARE FACILITY
☐ UNKNOWN

WITHIN THE PAST YEAR HAS THE PATIENT?
BEEN HOMELESS? ☐ YES ☐ NO ☐ UNKNOWN
USED INJECTION DRUGS? ☐ YES ☐ NO ☐ UNKNOWN
USED NON-INJECTION DRUGS? ☐ YES ☐ NO ☐ UNKNOWN
USED EXCESS ALCOHOL? ☐ YES ☐ NO ☐ UNKNOWN

XRAY / CAT SCAN

INITIAL XRAY DATE: MM DD YYYY
INITIAL RESULTS ☐ NORMAL ☐ NOT DONE ☐ ABNORMAL ☐ UNKNOWN
IF ABNORMAL
☐ CAVITARY
☐ NONCAVITARY CONSISTENT WITH TB DISEASE
☐ NONCAVITARY, NOT CONSISTENT WITH TB DISEASE
CAT SCAN DATE; MM DD YYYY
CAT SCAN RESULTS. ☐ NORMAL ☐ NOT DONE ☐ ABNORMAL ☐ UNKNOWN

TREATMENT

RX START DATE. MM DD YYYY
INITIAL REGIMEN
☐ INH _____ MO
☐ RIF _____ MO
☐ PZA _____ G
☐ EMB _____ MO
☐ B6 _____ MO
☐ OTHER _____ MO
EXPECTED THERAPY DURATION:
DISCHARGE/TREATMENT PLAN SENT TO STATE/LOCAL HEALTH? ☐ YES ☐ NO

MEDICAL SUPERVISION

WAS PATIENT HOSPITALIZED? ☐ YES ☐ NO	DATE ADMITTED. MM DD YYYY	DATE DISCHARGED: MM DD YYYY	CHART NO

HOSPITAL | TELEPHONE
ATTENDING PHYSICIAN. | BEEPER/PAGER NO :
PHYSICIAN FOR CONTINUING TB SUPERVISION:
FACILITY | FAX:
ADDRESS. | TELEPHONE:
PERSON COMPLETING THIS REPORT: | TELEPHONE | DATE OF THIS REPORT MM DD YYYY

MAIL WHITE TO STATE HEALTH DEPARTMENT, YELLOW TO LOCAL HEALTH DEPARTMENT, PINK TO PATIENT'S FILE REVISED 8/04

Appendix C- CDC Intake Form for a Report of Verified Case of Tuberculosis

Patient's Name: _____ (Last) (First) (M I)

Street Address: _____ (Number Street, City State) Zip Code)

REPORT OF VERIFIED CASE OF TUBERCULOSIS

DEPARTMENT OF HEALTH & HUMAN SERVICES
PUBLIC HEALTH SERVICE
CENTERS FOR DISEASE CONTROL AND PREVENTION (CDC)
ATLANTA, GEORGIA 30333

FORM APPROVED OMB NO 0920-0026 Exp Date 09/30/2005

REPORT OF VERIFIED CASE OF TUBERCULOSIS

SOUNDEX

1. State Reporting:
Specify: _____
Alpha State Code

2.
State Case Number:
City/County Case Number:

3. Date Submitted: Mo Day Yr
By:

4. Address for Case Counting:
City
Within City Limits 1 Yes 2 No
County
Zip Code

5. Month-Year Reported: Mo Yr

6. Month-Year Counted: Mo Yr

7. Date of Birth: Mo Day Yr

8. Sex:
1 Male
2 Female

9. Ethnicity: (Select one)
1 Hispanic or Latino
2 Not Hispanic or Latino

10. Race: (Select one or more)
1 American Indian or Alaska Native
2 Asian Specify (Optional) _____
3 Black or African American
4 Native Hawaiian or Other Pacific Islander Specify (Optional) _____
5 White

11. Country of Origin:
If U S., check here
If not U S , enter country code (see list)

12. Month-Year Arrived in U.S.: Mo Yr

13. Status at Diagnosis of TB:
1 Alive 2 Dead

14. Previous Diagnosis of Tuberculosis:
1 Yes
2 No
Yr
If yes, list year of previous diagnosis
1 If more than one previous episode, check here

15. Major Site of Disease:
00 Pulmonary
10 Pleural
21 Lymphatic Cervical
22 Lymphatic Intrathoracic
23 Lymphatic Other
29 Lymphatic Unknown
30 Bone and/or Joint
40 Genitourinary
50 Miliary
60 Meningeal
70 Peritoneal
80 Other*
90 Site not Stated
*If site is "Other", enter anatomic code (see list)

16. Additional Site of Disease:
00 Pulmonary
10 Pleural
21 Lymphatic: Cervical
22 Lymphatic Intrathoracic
23 Lymphatic. Other
29 Lymphatic Unknown
30 Bone and/or Joint
40 Genitourinary
50 Miliary
60 Meningeal
70 Peritoneal
80 Other*
*If site is "Other", enter anatomic code (see list)
If more than one additional site, check here 88

17. Sputum Smear:
1 Positive 3 Not Done
2 Negative 9 Unknown

18. Sputum Culture:
1 Positive 3 Not Done
2 Negative 9 Unknown

19. Microscopic Exam of Tissue and Other Body Fluids:
1 Positive 3 Not Done
2 Negative 9 Unknown
If positive, enter anatomic code(s) (see list)

20. Culture of Tissue and Other Body Fluids:
1 Positive 3 Not Done
2 Negative 9 Unknown
If positive, enter anatomic code(s) (see list)

21. Chest X-Ray:
1 Normal 2 Abnormal 3 Not Done 9 Unknown
If Abnormal (check one) 1 Cavitary 2 Noncavitary Consistent with TB 3 Noncavitary Not Consistent with TB
If Abnormal (check one) 1 Stable 3 Improving 2 Worsening 9 Unknown

22. Tuberculin (Mantoux) Skin Test at Diagnosis:
1 Positive 3 Not Done
2 Negative 9 Unknown
Millimeters (mm) of Induration
If Negative, was patient anergic? 1 Yes 2 No 9 Unknown

REPORT OF VERIFIED CASE OF TUBERCULOSIS

23. HIV Status: 0 ☐ Negative 3 ☐ Refused 9 ☐ Unknown
1 ☐ Positive 4 ☐ Not Offered
2 ☐ Indeterminate 5 ☐ Test Done, Results Unknown

If Positive, Based on: 1 ☐ Medical Documentation 2 ☐ Patient History 9 ☐ Unknown

If Positive, List: CDC AIDS Patient Number ☐☐☐☐☐☐☐ (If AIDS Reported before 1993)
State HIV/AIDS Patient Number ☐☐☐☐☐☐☐☐☐ (If AIDS Reported 1993 or Later)
City/County HIV/AIDS Patient Number ☐☐☐☐☐☐☐☐☐ (If AIDS Reported 1993 or Later)

24. Homeless Within Past Year:
0 ☐ No
1 ☐ Yes
9 ☐ Unknown

25. Resident of Correctional Facility at Time of Diagnosis: 0 ☐ No 1 ☐ Yes 9 ☐ Unknown

If Yes, 1 ☐ Federal Prison 3 ☐ Local Jail 5 ☐ Other Correctional Facility
2 ☐ State Prison 4 ☐ Juvenile Correctional Facility 9 ☐ Unknown

26. Resident of Long-Term Care Facility at Time of Diagnosis: 0 ☐ No 1 ☐ Yes 9 ☐ Unknown

If Yes, 1 ☐ Nursing Home 4 ☐ Mental Health Residential Facility 6 ☐ Other Long-Term Care Facility
2 ☐ Hospital-Based Facility 5 ☐ Alcohol or Drug Treatment Facility 9 ☐ Unknown
3 ☐ Residential Facility

27. Initial Drug Regimen:

	NO	YES	UNK		NO	YES	UNK		NO	YES	UNK
Isoniazid	0 ☐	1 ☐	9 ☐	Ethionamide	0 ☐	1 ☐	9 ☐	Amikacin	0 ☐	1 ☐	9 ☐
Rifampin	0 ☐	1 ☐	9 ☐	Kanamycin	0 ☐	1 ☐	9 ☐	Rifabutine	0 ☐	1 ☐	9 ☐
Pyrazinamide	0 ☐	1 ☐	9 ☐	Cycloserine	0 ☐	1 ☐	9 ☐	Ciprofloxacin	0 ☐	1 ☐	9 ☐
Ethambutol	0 ☐	1 ☐	9 ☐	Capreomycin	0 ☐	1 ☐	9 ☐	Ofloxacin	0 ☐	1 ☐	9 ☐
Streptomycin	0 ☐	1 ☐	9 ☐	Para-Amino Salicylic Acid	0 ☐	1 ☐	9 ☐	Other	0 ☐	1 ☐	9 ☐

28. Date Therapy Started: Mo ☐☐ Day ☐☐ Yr ☐☐

29. Injecting Drug Use Within Past Year: 0 ☐ No 1 ☐ Yes 9 ☐ Unknown

30. Non-Injecting Drug Use Within Past Year: 0 ☐ No 1 ☐ Yes 9 ☐ Unknown

31. Excess Alcohol Use Within Past Year: 0 ☐ No 1 ☐ Yes 9 ☐ Unknown

32. Occupation *(Check all that apply within the past 24 months).*
1 ☐ Health Care Worker 3 ☐ Migratory Agricultural Worker 5 ☐ Not Employed within Past 24 Months
2 ☐ Correctional Employee 4 ☐ Other Occupation 9 ☐ Unknown

Comments:

CDC 72.9A REV 01/2003 **1st Copy** REPORT OF VERIFIED CASE OF TUBERCULOSIS Page 2 of 2