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Higher Rates of Tuberculosis Among Class B1 Filipino Immigrants to Hawaii Compared to Nationwide, 2010-2014

Kristine M. Schmit^{1,2}, Richard Brostrom^{2,3}, Angela Largen³, Alexandra Pyan³, Zanju Wang⁴, Sundari Mase^{2,5}, Sapna Morris²

¹National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention, Division of Tuberculosis Elimination, Surveillance, Epidemiology, and Outbreak Investigations Branch, Centers for Disease Control and Prevention, GA, USA

²National Center for HIV/AIDS, Viral Hepatitis, STD, Prevention, Division of Tuberculosis Elimination, Field Services Branch, Centers for Disease Control Atlanta, GA, USA

³Hawaii TB Program, Hawaii State Department of Health, Honolulu, Hawaii, USA

⁴National Center for Emerging and Zoonotic Infectious Diseases, Division of Global Migration and Quarantine, Immigrant, Refugee and Migrant Health Branch, Centers for Disease Control and Prevention, Atlanta, GA, USA

⁵Present Address: World Health Organization - Country Office for India, New Delhi, India

Abstract

Background—Immigrants to the United States from countries with a high burden of tuberculosis (TB) who have abnormal chest radiographs but negative sputum cultures during pre-immigration screening (TB Class B1) have a high risk of being diagnosed with TB disease within 1 year of arrival.

Methods—Using 2010–2014 national surveillance data, we compared proportions of Class B1 Filipino immigrants who received a diagnosis of TB disease within 1 year of arrival to Hawaii to proportions in other U.S. states (not including Hawaii) using chi-squared tests.

Kristine M. Schmit, yxn0@cdc.gov.

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Dr. Mase was employed at CDC during part of her role with this manuscript and formerly affiliated with National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention, Division of Tuberculosis Elimination, Field Services Branch, Centers for Disease Control and Prevention, Atlanta, GA, USA.

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Results—In Hawaii, 40/1190 (3.4%) of Class B1 Filipino immigrants to Hawaii received a diagnosis of TB disease within 1 year of arrival compared with 220/16,035 (1.4%) nationwide ($P < .01$).

Conclusions—During 2010–2014, the percentage of recent Class B1 Filipino immigrants in Hawaii with TB disease diagnosed within 1 year of arrival was over twice that as nationwide.

Keywords

Tuberculosis; Immigration; Screening; Philippines; Hawaii

Background

According to the Centers for Disease Control and Prevention's (CDC) Division of Tuberculosis Elimination (DTBE), 9557 new tuberculosis (TB) cases were reported in the United States in 2015, with an incidence rate of 3.0 cases per 100,000 persons. In 2015, the TB rate among non-U.S.-born persons in the United States was approximately 13 times higher than among U.S.-born persons. Over half of the non-U.S.-born persons diagnosed with TB originated from five countries: Mexico (19.7%), the Philippines (12.9%), India (9.1%), Vietnam (8.2%), and China (6.7%) [1].

In 2015, Hawaii had the second highest incident TB caserate in the United States [1]. Immigration has a substantial impact on TB rates in Hawaii. In 2015, 65% (82/127) of all patients with TB in Hawaii were non-U.S.-born. Individuals born in the Philippines accounted for 81% (66/82) of the non-U.S.-born cases in Hawaii [1]. Rates of TB disease are extremely high in the Philippines, with an incidence caserate of 288/100,000 persons in 2014 [2].

Prior to coming to the United States, all immigrants and refugees are required to undergo a medical examination [3]. These examinations are based on technical instructions from CDC which in 2007 began implementing culture-based TB screening overseas. For U.S.-bound populations from the Philippines, all immigration screening is done at one site, St. Luke's Extension Clinic (SLEC) in Manila. Based on the results of this evaluation, immigrants are classified into TB categories as shown in Table 1 [3].

TB cases among non-U.S.-born persons in the United States are largely a result of reactivation of latent TB infection (LTBI) acquired in the country of origin [4–6]. However, several studies have also suggested a role of importation of subclinical TB disease. Immigrants who have abnormal chest radiographs but negative laboratory results on pre-immigration screening (Class B1) are at high risk for being diagnosed with TB disease within 1 year after arrival in the United States [6, 7].

According to a recent study, 40% of refugees and immigrants categorized as Class B1 using current pre-immigration screening guidelines were born in the Philippines [8]. Providers at the Hawaii TB program had noted what seemed to be a high proportion of TB cases among Class B1 immigrants from the Philippines but no formal assessment had been done. The primary objectives of this analysis were (1) to determine the number of Class B1 Filipino

immigrants to Hawaii during 2010–2014 who were diagnosed with TB disease within 1 year after arrival and (2) to compare these results to the reported TB cases from Class B1 Filipino immigrants arriving to other U.S. locations during the same time period.

Methods

Definitions

We defined a Class B1 immigrant as: (1) an immigrant with history or exam suggestive of pulmonary tuberculosis on pre-immigration screening but three negative acid-fast bacilli (AFB) smears and cultures, or (2) an immigrant with history of tuberculosis with successful completion of directly observed therapy (DOT) through panel physician program prior to immigration, or (3) an immigrant diagnosed with extrapulmonary TB disease.

TB disease diagnosis in the United States was based on national standard definitions for case reporting as defined in the National Tuberculosis Indicators Project Companion for Data Managers [9]. Cases were considered laboratory confirmed if there was evidence of a positive culture (isolation of *Mycobacterium tuberculosis* complex from a clinical specimen), *or* a positive nucleic acid amplification (NAA) test (demonstration of *M. tuberculosis* complex from a clinical specimen by nucleic acid amplification test), *or* a positive smear (demonstration of AFB in a clinical specimen when a culture has not been or cannot be obtained or is falsely negative or contaminated). Cases were considered clinically confirmed if they met the following criteria: positive tuberculosis skin test or positive interferon gamma release assay for *M. tuberculosis*, *and* treatment with two or more anti-TB medications, *and* other signs and symptoms compatible with tuberculosis, such as abnormal chest radiograph, abnormal chest CT scan or other chest imaging study, *or* clinical evidence of current disease. When a TB case was diagnosed that did not meet the standard laboratory or clinical case definition, TB program officials had the option to verify the case based on provider diagnosis.

Data Collection

Data were obtained from the Electronic Disease Notification (EDN) database maintained by CDC's Division of Global Migration and Quarantine (DGMQ). EDN is a centralized electronic reporting system that notifies U.S. state and local health departments and screening clinics of the arrival of refugees and immigrants with health conditions requiring medical follow-up. EDN sends notifications to the receiving health departments for all refugees and immigrants with a TB classification. Receiving health departments are expected to enter the results of the post-arrival follow-up examination into the EDN system [10].

Statistical Analysis

Using data from 2010 to 2014, we identified Class B1 Filipino immigrants who received a diagnosis of TB disease within 1 year of arrival in Hawaii and nationwide. For the purposes of this study, "nationwide" refers to the other 49 U.S. states and the District of Columbia, not including Hawaii. We used chi-squared tests to compare proportions of incident TB disease, stratified by sex, age group, history of TB and diagnosis of diabetes mellitus, as

well as proportions of immigrants receiving various post-immigration evaluation tests. Tests of significance were 2-sided and P values < 0.05 were considered significant.

Ethics

This study proposal was reviewed at CDC and was determined to be a non-research activity because the work was limited to a program surveillance evaluation activity utilizing existing data. Ethics approval was obtained from the Institutional Review Board (IRB) for the Hawaii State Department of Health.

Results

Based on EDN data, 1787 Filipino immigrants with Class B1 status arrived in Hawaii during 2010–2014 and 21,386 arrived nationwide (excluding arrivals to Hawaii). The proportion of Class B1 Filipino immigrants who had successfully completed treatment for TB prior to immigration was equivalent among those immigrants to Hawaii (10.7%) compared with nationwide (10.7%).

Of the top ten states with the highest number of Class B1 Filipino immigrants during this time period, the proportion of TB disease diagnosed within the first year ranged from 0.3 to 3.4, with the proportion in Hawaii being the highest (Table 2). In Hawaii, 1190/1787 (66.6%) Class B1 Filipino immigrants were evaluated within 1 year of arrival compared with 16,035/21,386 (75.0%) nationwide ($P < .001$). Of Class B1 Filipino immigrants evaluated within 1 year of arrival, 98% of these immigrants to Hawaii were evaluated within 1 month of arrival compared to 6 months nationwide. There was a significantly larger proportion of males 540/1190 (45.4%) among the population of immigrants evaluated within 1 year in Hawaii compared with nationwide 6337/16,035 (39.5%) ($P < .001$) and a significantly smaller proportion of immigrants with a pre-arrival diagnosis of diabetes mellitus 80/1190 (6.7%) and 2013/16,035 (12.6%), respectively, ($P < .001$) and with a history of previous TB 347/1190 (29.2%) and 5346/16,035 (33.3%), respectively, ($P < .01$) (Table 3). Of those evaluated within 1 year of arrival, 40/1190 (3.4%) of immigrants in Hawaii received a diagnosis of TB disease compared with 220/16,035 (1.4%) nationwide ($P < .001$). There was a significantly larger proportion of males 26/40 (65.0%) among the population of immigrants evaluated within 1 year in Hawaii who were subsequently diagnosed with TB disease compared with nationwide 94/220 (42.7%) ($P < .01$) but proportions of immigrants less than 35 years of age, with history of previous TB, or with a pre-arrival diagnosis of diabetes mellitus were not significantly different between the two cohorts (Table 4).

Table 5 shows the results of post-immigration screening in Hawaii and nationwide. The proportion of Class B1 Filipino immigrants with laboratory confirmed smear-positive TB disease among all Class B1 Filipino immigrants evaluated within 1 year was significantly higher in Hawaii 24/1190 (2.0%) compared with 121/16,035 (0.8%) nationwide ($P < .001$). The Hawaii TB program obtained a repeat chest radiograph for 1119/1190 (94.0%) of Class B1 Filipino immigrants compared to 14,322/16,035 (89.3%) nationwide ($P < .001$) but obtained repeat sputum samples from only 287/1190 (24.1%) of these immigrants compared to 9153/16,035 (57.1%) nationwide ($P < .001$). However, the proportion of these sputum samples that was AFB smear or culture-positive was significantly higher in Hawaii 24/287

(8.4%) compared to 121/9153 (1.3%) nationwide ($P = .02$). There were no significant differences among the two populations regarding how the diagnosis of TB was made (TB diagnosis type), as TB diagnosis was confirmed by culture in 24/40 (60%) in Hawaii compared to 12–20 (55.0%) nationwide ($P = .56$).

Discussion

Our analysis shows a significantly higher incidence of TB disease for Class B1 Filipino immigrants to Hawaii than to the rest of the nation during 2010–2014. Previous studies have shown that after implementation of culture-based overseas screening, frequency of TB disease diagnosed postarrival among Filipino Class B1 immigrants decreased dramatically from approximately 4% before 2007 to a range of 0.9–1.4% following the change in screening algorithm [6,11]. These percentages are more consistent with the findings nationally than those seen in Hawaii. Reasons for the discrepancy between the proportion of Filipino Class B1 immigrants diagnosed with TB disease within 1 year of arrival in Hawaii versus the rest of the nation is unclear. One notable finding in our analysis is the significantly higher proportion of males with TB disease in Hawaii compared to nationwide. Nearly two-thirds of TB cases diagnosed among Class B1 Filipino immigrants in Hawaii occurred in men, compared to under half of cases nationwide. Given the higher rates of TB in males compared to females worldwide, the significantly larger proportion of males among Class B1 Filipino immigrants to Hawaii as compared to nationwide likely contributed to the discrepancy in TB rates [12].

Another possible explanation for the significant difference in TB rates observed in Hawaii versus other U.S. locations is that there may be differences in the population of immigrants from the Philippines who settle in Hawaii as opposed to other jurisdictions. These differences may relate to the region of the Philippines from which the person is emigrating and the type of occupation in which these immigrants are engaged, leading to regional differences in the background rate of LTBI among immigrants seeking arrival to Hawaii versus the rest of the nation. Despite identical evaluations within a single immigration processing center, and despite all cases being documented as culture-negative prior to leaving the Philippines, it may be possible that differences in background TB prevalence could have some effect on rates of LTBI and the future risk of TB disease after arrival. Future discussions with public health practitioners in the Philippines are planned to investigate these possibilities further such as reviewing records to determine from which regions of the Philippines those immigrants subsequently diagnosed with TB emigrated.

Another potential explanation centers around the type of post-immigration workup done in Hawaii compared with that done in other jurisdictions in the United States. Our results revealed that the Hawaii TB program routinely orders chest radiographs more often than the national average. Importantly, this approach did not result in a significantly higher number of culture-negative TB cases (i.e., diagnosis based on chest radiograph or symptoms without positive sputum AFB smear or culture results). Despite maintaining a high index of suspicion, the Hawaii TB program ordered far fewer sputum samples than other programs nationwide, yet these sputum samples were over seven times as likely to be positive. Considering all Class B1 Filipino immigrants evaluated within 1 year of arrival, the

proportion of laboratory confirmed smear-positive TB cases was significantly higher in Hawaii than nationwide.

Our study had some important limitations. First, our analysis was restricted by the limited demographic data available in EDN that did not include complete data for other risk factors for TB that may have substantially affected rates of TB disease. Additionally, we did not have access to materials outlining operating procedures for post-immigration workup in other jurisdictions for comparison.

Conclusions

The ratio of TB disease cases in non-U.S.-born persons versus U.S.-born persons continues to increase in the United States. This study reveals a significant difference in the rate of TB disease during the first year after arrival to the United States among Class B1 immigrants from the Philippines, depending upon whether they arrived in Hawaii or other jurisdictions nationwide. While the specific reasons for the disparity are not yet fully understood, the very high rate of TB diagnosed among newly arriving B1 immigrants from the Philippines reinforces the need for all TB programs to carefully evaluate each immigrant arriving from a high-risk country, minimize the loss to follow-up, maintain a very high index of suspicion for TB, and provide effective treatment for both TB disease and LTBI in this group.

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Table 1

TB classifications based on CDC immigration requirements: technical Instructions for tuberculosis screening and treatment using cultures and directly observed therapy

TB classification	Examination findings
No TB classification	Normal tuberculosis screening examinations
Class A TB with waiver	Tuberculosis disease with waiver to immigrate or resettle while on TB treatment
Class B1 TB, pulmonary	
No treatment	History or exam suggestive of pulmonary tuberculosis, abnormal chest radiograph, or known HIV infection but negative AFB sputum smears and cultures
Completed treatment	Pulmonary tuberculosis disease with successful completion of directly observed therapy through panel physician program prior to immigration
Class B1 TB, extrapulmonary	Extrapulmonary tuberculosis disease
Class B2 TB, latent TB infection evaluation	Reactive TST or positive IGRA but otherwise negative evaluation for tuberculosis
Class B3 TB, contact evaluation	Recent contact of a known tuberculosis case

CDC immigration requirements: Technical instructions for tuberculosis screening and treatment using cultures and directly observed therapy. Atlanta: Centers for Disease Control and Prevention; 2009. Began implementation of cultured-based TB screening in 2007

Table 2

Active TB among Class B1 Filipino immigrants diagnosed within 1 year of arrival—U.S. jurisdictions with highest numbers of Class B1 Filipino immigrants, 2010–2014

Jurisdiction	Total B1 immigrants from Philippines	Total B1 immigrants evaluated within first year of arrival	Active TB cases reported	Percent evaluated and diagnosed with active TB
Hawaii	1787	1190	40	3.4
Virginia	533	377	12	3.2
Florida	884	688	13	1.9
Illinois	980	711	12	1.7
Nevada	843	788	12	1.4
California	9879	7588	106	1.4
New York	603	352	5	1.4
Washington	952	837	9	1.1
Texas	1146	828	9	1.1
New Jersey	727	604	2	0.3

Characteristics of Class B1 Immigrants from the Philippines to Hawaii and the United States evaluated within 1 year of arrival, 2010–2014

Table 3

	Hawaii N (%) total N=1190	United states (without Hawaii) N (%) total N= 16,035	P value
Diagnosed with TB Disease	40 (3.4)	220 (1.4)	< 0.001
Age 35 years	197 (16.5)	2379 (14.8)	0.11
Sex (male)	540 (45.4)	6337 (39.5)	< 0.001
Previous TB	347 (29.2)	5346 (33.3)	<0.01
Diabetes mellitus	80 (6.7)	2013 (12.6)	< 0.001

Table 4

Characteristics of Class B1 immigrants from the Philippines to Hawaii and the United States diagnosed with TB disease within 1 year of arrival, 2010–2014

Variable	Hawaii N (%) total N = 40	United States (without Hawaii) N (%) total N = 220	P value
Age 35 years	10 (25.0)	57 (25.9%)	0.90
Sex (male)	26 (65.0)	94 (42.7)	<0.01
Previous TB	9 (22.5)	49 (22.3)	0.90
Diabetes mellitus	1 (2.5)	31 (14.1)	0.07*

*
Fischer exact P value

Table 5

Results of post-immigration screening of Class B1 immigrants from the Philippines to Hawaii and nationwide, 2010–2014

TB evaluation results	Hawaii N (%)	United States (without Hawaii) N (%)	P value
Number of B1 Immigrants from the Philippines arriving between Jan 1, 2010 and Dec 31, 2014	1787	21,386	
Number of B1s evaluated within 1 year	1190 (66.6)	16,035 (73.4)	< 0.001
Number of B1s evaluated within 1 year with repeat chest radiograph	1119 (94.0)	14,322 (89.3)	< 0.001
Number of B1s evaluated within 1 year with repeat sputum sample	287 (24.1)	9153 (57.1)	< 0.001
Number of B1s evaluated within 1 year with diagnosis of TB disease	40 (3.4)	220 (1.4)	< 0.001
Laboratory confirmed cases	24 (60)	121 (55.0)	0.56
Clinically confirmed cases *	16 (40)	74 (33.6)	0.23
Provider diagnosis (not clinically or laboratory confirmed) *	0	25 (11.4)	0.02
Number of positive AFB smear or culture <i>in those with repeat sputum sample</i>	13 (4.5)	213 (2.3)	0.02

* Based on national standard definitions for case reporting as defined in the National Tuberculosis Indicators Project Companion for Data Managers.⁹