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Intensified Case-Finding for Latent Tuberculosis Infection among the Baltimore City Hispanic Population

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Abstract

Background—Foreign-born immigrants are at high risk for latent TB infection (LTBI). In conjunction with the Baltimore City Health Department (BCHD), student volunteers conducted intensified LTBI case-finding (ICF) using tuberculin skin testing (TST) in the Hispanic community from 2006-10. We sought to determine the yield of ICF and estimate the LTBI prevalence.

Design—retrospective cross-sectional study

Results—Among 478 individuals screened, 164 (34.3%) had a positive TST, 227 (47.5%) had a negative TST, and 87 (18.2%) did not return. Among those who completed screening, the prevalence of LTBI was 164/391 (41.9%, 95% CI 0.37-0.47). ICF referrals accounted for 4.4% of all LTBI referrals to BCHD and for 41% of referrals among Hispanics.

Conclusion—We found a high rate of undiagnosed LTBI within the Hispanic community. This student-run ICF program accounted for almost half of all LTBI cases among Hispanics. Community resources are needed to target this high-risk population.

BACKGROUND

Testing and treatment of persons at increased risk for latent tuberculosis infection (LTBI) is a core element of the tuberculosis (TB) elimination strategy in the United States (US) [1-4]. Foreign-born individuals, including those from Latin American countries, represent a high-risk group in whom LTBI is likely to be prevalent. In the United States, legal immigrants, refugees, and asylees receive TB testing prior to arrival in the country. However, undocumented immigrants and many foreign-born individuals without access to health care services fail to receive appropriate LTBI screening and treatment, and are at risk for developing active TB[5]. In Baltimore City, population of 620,961, the incidence of active TB was 5.2/100,000 persons in 2010, with the majority being in foreign-born individuals of whom approximately 10% are Latino[6, 7].

Currently, the Baltimore City Health Department TB control program (BCHD TB clinic) relies on passive case-finding of LTBI through community-based referrals. In Baltimore City, a wide range of community providers conducts LTBI screening per their routine practices. Individuals with suspected LTBI based on a positive tuberculin skin test (TST) or

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positive Interferon-gamma (IFN- γ) release assays (IGRAs) are referred to the BCHD TB clinic for further evaluation and treatment. This strategy, however, relies on high-risk individuals accessing the health care system for LTBI screening – a challenge given language barriers, transportation issues, work schedules and limited resources.

Within Baltimore City, the Hispanic community has been growing and currently represents 4.2% of the city's population [8]. During the past decade, the Hispanic population in Maryland has increased by 107% from 227,916 individuals in 2000 to 470,632 individuals in 2010, many of whom have come from TB endemic countries [8]. This community represents a population likely to have high rates of LTBI, but one that currently has limited interactions with the health care system. The prevalence of latent TB infection within the Hispanic community in Baltimore is currently unknown.

To date in Baltimore City, there have been few health-department directed resources directed specifically on LTBI screening with the Hispanic community. Beginning in 2006, a student-run community-service organization at Johns Hopkins University comprised of students from the Schools of Nursing, Medicine, and Public Health, under the guidance of faculty from the respective schools, began a program to conduct intensified-case-finding (ICF) of LTBI in the Baltimore City Hispanic community, through targeted screening programs. Volunteers, using TST, screened foreign-born individuals from Latin American countries in the community; individuals with a positive TST were referred to the BCHD TB program for further evaluation and treatment.

The objectives of this study are to determine the yield of a volunteer-based LTBI ICF program in Baltimore City, and to estimate the prevalence of LTBI in the Baltimore City Hispanic community. We additionally sought to determine the rates of adherence with BCHD TB clinical evaluation.

METHODS

Ethics Statement

The study was approved by Institutional Review Boards at the Johns Hopkins University School of Medicine (Baltimore, USA) and the Baltimore City Health Department.

Intensified Case-Finding program

Bienestar Baltimore is a student-run community service organization comprised of Spanish-speaking student volunteers from the Johns Hopkins University (JHU) Schools of Nursing, Medicine, and Public Health. In 2006, the organization began screening for LTBI among the Baltimore City Hispanic community under the supervision of volunteer JHU faculty. JHU students partnered with community organizations, which were serving the Baltimore City Hispanic community through health fairs, free health clinics, and ESL classes on evenings and weekends. In the past six years, Bienestar Baltimore participated in over 50 of these community health events. During each event, students provided basic TB education to attendees. Individuals who were >18 years, born in a Latin American country, and were Baltimore City residents were offered free LTBI screening with TST along with a TB symptom screen and risk factor assessment. Limited demographic information was collected for the purpose of submitting BCHD referrals and included name, address, telephone number, birth date, country of origin, and years in the U.S. LTBI testing was conducted using 0.1ml of purified protein derivative that was injected intradermally using the Mantoux method. Individuals were asked to return to the same location 48-72 hours later for TST measurement. Foreign-born individuals with TST induration > 10 mm were considered positive according to current guidelines[3, 9]. Individuals with a positive TST were referred to the BCHD TB clinic for further evaluation and treatment. Student volunteers provided

ongoing case-management for individuals identified with LTBI by assisting with appointment reminders and acting as liaisons with the BCHD TB program.

LTBI evaluation at BCHD

Per routine care, all individuals referred for *M. tuberculosis* infection evaluation are interviewed by a BCHD TB clinic staff member for demographic information, medical history, and signs and symptoms of active TB; a chest x-ray and liver chemistries are obtained, and HIV testing is offered. Beginning in 2010, BCHD also performed a Quantiferon-Gold-In-Tube (QFT) test on individuals referred for a positive TST, and utilized both test results to determine the diagnosis of LTBI. Individuals with discordant QFT and TST results are diagnosed with LTBI based on clinical judgment and individualized assessment that included assessment of risk factors, BCG status, country of origin and degree of TST induration. Patients with signs or symptoms of active TB are evaluated further by sputum smear microscopy, culture, and other testing as indicated. Individuals diagnosed with LTBI are given treatment in accordance with published guidelines, with medications dispensed on a monthly basis after monthly follow-up BCHD TB clinic visits including toxicity assessment[3].

Study Design

We conducted a retrospective cross-sectional study to evaluate the yield of a student-run ICF program and to determine the prevalence of LTBI in the Baltimore City Hispanic population. Data was obtained using the Bienestar electronic database and the BCHD TB Program electronic database (Microsoft Access 2003) and through chart reviews. All individuals evaluated by the Bienestar LTBI ICF program between 2006 and 2010 were included.

Statistical Analysis

All data from Bienestar and BCHD records were double entered by independent study staff. Period prevalence of LTBI was defined as the proportion of screened individuals with a positive TST result. Categorical data were compared using Chi square (χ^2). Data were analyzed using STATA (version 10.1, StataCorp, College Station, Texas).

RESULTS

Study Population

Table 1 reports demographic characteristics of individuals evaluated by the ICF program. 478 foreign-born Hispanic individuals were screened for *M. tuberculosis infection* in Baltimore City from 2006 to 2010 at community health centers and various health fairs. Individuals were young adults with a mean age of 34.0 years (SD 10.8), with a mean time in the US of 4.75 years (SD 4.4), and were predominantly male (n = 302, 63.45%). Overall, 14 countries of origin were represented, with the most from Mexico (n = 129, 27.0%) and El Salvador (n = 77, 16.1%).

Yield of an intensified case-finding program and LTBI prevalence

Among 478 individuals that received TB screening, 164 (34.3%) had a positive TST, 227 (47.5%) had a negative TST, and 87 (18.2%) individuals did not return to have their TST read (Table 1). There were no differences in the mean age or gender comparing those that did and did not return for TST reading, nor were there differences in age or gender between those with positive and negative TST (Table 1). Overall, the period prevalence of LTBI over the five-year span was 164/478 (34.3%, 95% CI 0.30-0.39) when all screened individuals were considered; the prevalence estimate would rise to 164/391 (41.9%, 95% CI 0.37-0.47)

if those who failed to return to have their TST read were excluded. Excluding those without full TST data, the yearly prevalence estimates approached significance and were 46/108 (42.6%) for 2006, 36/90 (40.0%) for 2007, 16/54 (29.6%) for 2008, 19/53 (35.8%) for 2009, and 46/84 (54.8%) for 2010 ($p=0.057$). The percent positive by country of origin differed significantly, with specific country results shown in Table 1 ($p<.001$).

During the study period, the Baltimore City Health Department received 3740 referrals for LTBI evaluation. Among these 3740 referrals, 402 were identified as Hispanic (10.7%), 655 (17.5%) were Asian, 1053 (28.2%) were Black, 189 (5.1%) were white, and 1436 (38.4%) were listed as other/unknown. Among these 402 referrals whose race was listed as Hispanic, 164 (40.8%) referrals were generated by the student-run ICF program. Overall, referrals from the student-run ICF program accounted for 4.4% of all LTBI referrals to the BCHD TB program. No cases of active TB were found by the ICF program.

LTBI Diagnosis and Evaluation

Overall, 164 individuals with a positive TST were referred from the ICF program to the BCHD TB clinic for further evaluation and consideration for treatment; among these 164 individuals, 11(7%) were later identified to live in a surrounding Maryland county and were referred to the appropriate local health department. Adherence to an initial BCHD TB clinic evaluation visit was similar when comparing referrals from the student-run ICF program and other referral sources. Of the 153 individuals with a positive TST that were eligible for BCHD evaluation, 109 (71%) came for an initial evaluation appointment at the BCHD TB clinic, of whom 101 (93%) were deemed by BCHD to have LTBI infection (based on additional BCHD testing that included QFT [after March 2010], CXR, risk factor assessment, and symptom review). In comparison, 2315/3576 (65%) of individuals from other referral sources adhered to an initial BCHD TB clinic visit ($p=0.099$), of whom 1988/2315(86%) were determined to have LTBI (Table 2). The proportion of individuals with LTBI who initiated treatment was slightly higher among those referred by the ICF program compared to those referred by community sources (84/101 [83%] vs 1484/1988 [75%], respectively; $p=0.054$). The proportion of individuals that completed LTBI treatment was not significantly different between those referred by the ICF program compared to other sources (53/84 [63%] vs 966/1484 [65%], respectively; $p=0.364$).

Discussion

Within the United States, foreign-born individuals account for 60% of all active TB cases, with almost one-third occurring in individuals of Hispanic ethnicity[10, 11]. In Maryland, Hispanics accounted for 19% of the 220 active TB cases in 2010[10]. As a strategy for TB elimination, current US guidelines recommend targeted testing of high-risk populations, including those from countries of origin with high rates of TB infection[3]. Within Baltimore City, there is a growing population of individuals from Latin American countries where TB is endemic, but there was limited prior data on the prevalence of TB infection in this community. Our study revealed that the estimated prevalence of LTBI among foreign-born Hispanics in Baltimore City among those that completed screening as part of an ICF program was high and approached 40% between 2006 and 2010.

The Baltimore City Health Department's TB program has largely relied on community-based referrals to identify individuals with LTBI. With a Hispanic population of almost 30,000 individuals, many of whom are likely foreign-born, our results suggest there may be a large number of undiagnosed LTBI cases in Baltimore City. Despite this potentially large population of individuals with increased risk of *M. tuberculosis* infection, there were less than 500 LTBI referrals among Hispanics to the Baltimore City Health Department TB program. One reason for this finding may be that foreign-born Hispanics in Baltimore have

limited access to health care systems, particularly those that are migrant workers. Additionally, fear of deportation among individuals who were undocumented may also be an explanation for low participation. Overall, the yield of this intensive case-finding program was low in terms of absolute numbers of Hispanic individuals diagnosed with LTBI despite extensive outreach efforts and greater than 1000 person-hours of time donated per year by student volunteers. Some of the challenges encountered by the ICF program included a relatively high rate of failure to return for TST readings, and a large number of individuals declining TST screening despite educational efforts at health fairs. Nonetheless, this study showed that within Baltimore City, nearly 41% of all identified cases of LTBI in the Hispanic community were the result of these ICF activities by a student-run volunteer organization. Our findings suggest that intensive efforts are needed in order to identify individuals with *M. tuberculosis* infection within the Hispanic community.

We additionally found that adherence to TB evaluation and treatment within Baltimore City is suboptimal, with less than three-quarters of individuals with a positive TST result completing an initial Health Department visit for follow-up. Moreover, among those diagnosed with LTBI, only two-thirds ultimately completed LTBI treatment. Nonetheless, we found that rates of adherence with evaluation and treatment among those identified through the ICF program were comparable to that of individuals referred from other more established community sources. These findings suggest that outreach activities conducted by a student-run volunteer ICF program can lead to successful diagnosis and treatment of LTBI in hard to reach communities.

Our study had several limitations. Data on the number of individuals educated regarding TB infection at the ICF outreach events or who declined screening were not systematically recorded. As such, we could not report on the effect of the significant educational component of the ICF program. Our study also only addresses the prevalence of LTBI among foreign-born individuals that came to an ICF health fair and therefore has a selection bias. Individuals attending health fairs may be healthier or more concerned about their health status leading to either underestimation or overestimation of prevalence estimates. On the other hand, ICF activities were generally implemented at local community centers and were done in conjunction with events serving the Hispanic community, such that the population tested was likely to be representative of the general Hispanic community in Baltimore City. We additionally had limited data to explore the reasons for sub-optimal adherence rates among those identified with *M. tuberculosis* infection through ICF activities; individuals received phone-calls, reminders, and extensive counseling regarding test results, but adherence rates were not improved compared to individuals from other community sources. Further studies to assess factors associated with LTBI evaluation and treatment within Baltimore City are warranted. Additionally, our study relied on tuberculin skin testing to estimate LTBI prevalence. In the absence of a reference-standard for LTBI diagnosis, it is possible that our study overestimated the prevalence of LTBI due to the possibility of false-positive TST results in this foreign-born population with likely high rates of BCG vaccination. Moreover, prevalence estimates varied slightly from year to year. These variations did not meet statistical significance, but analysis was limited by small sample size in this subgroup analysis. Further studies with larger samples may be warranted to explore temporal trends. Finally, the ICF activities reported upon in this study primarily targeted foreign-born individuals that had arrived in the country within five years based on prior guidelines [3]. It has been suggested, however, that a large proportion of TB cases occur in individuals that arrived more than five years ago[12]. Whether targeting individuals who have lived in the US for longer durations would enhance the yield of the current ICF activities remains unknown.

Our study also had several strengths. We are among the first to report the yield of a volunteer-driven TB intensified case-finding strategy within a large urban setting in the US, and found a high prevalence of undiagnosed latent TB infection. A similar program, conducting ICF among students at an adult education center in Minnesota in 2009, had a 18.5% rate of LTBI identification, which was primarily among individuals from Africa, Latin America, and Asia[13]. Given continued pressures on local health department budgets, this data suggests that ICF efforts utilizing community partners, students, and volunteers can be a successful strategy to target difficult to reach immigrant populations. Among the advantages of such a strategy includes the ability to provide culturally appropriate TB education, individualized case management, and improved access to populations that may be marginalized from the current health care system.

In conclusion, the high rate of undetected LTBI among Baltimore City's rapidly growing foreign-born Hispanic population may represent a significant public health concern. Passive case-finding and reliance on traditional sources of health care to provide TB screening in the Hispanic community may overlook a large number of individuals with TB infection. Due to disparities in healthcare access and political barriers related to immigrant status, increased ICF efforts may be warranted to improve rates of LTBI prevention and detection. We found that partnerships between local health-departments and student-run organizations may help augment TB control activities within immigrant communities.

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Table 1

Characteristics of individuals screened for LTBI

Characteristic	Total screened: N (%)	TST positive: N (%)	TST Negative: N (%)	Did not return for reading: N (%)
Total	478	164 (34.3%)	227 (47.5%)	87 (18.2%)
Gender				
Female	174 (36.6%)	55 (31.6%)	93(53.4%)	26 (15.0%)
Male	302 (63.5%)	108 (35.8%)	134 (44.3%)	60 (20.0)
Age				
Mean Age (SD)	34.0 (10.8)	35.0 (10.2)	33.2(11.2)	34.0 (11.0) *
Time in country *				
Mean (SD)	4.75 years (4.4)	5.02 (4.2)	4.53(4.76)	4.60 (4.2)
Country of origin				
Bolivia	3 (0.63%)	2 (66.7%)	0 (0%)	1 (33.3%)
Columbia	3 (0.63%)	1 (33.3%)	1(33.3%)	1 (33.3%)
Costa Rica	1 (0.21%)	0 (0%)	1 (100%)	0 (0%)
Dominican Republic	3 (0.63%)	1 (33.3%)	2(66.7)	0 (0%)
Ecuador	25 (5.2%)	7 (28.0%)	12(48.0%)	6 (24.0%)
El Salvador	77(16.1%)	31 (40.3%)	35(45.5%)	11(14.3%)
Guatemala	37 (7.7%)	12 (32.4%)	16(43.2%)	9 (24.3%)
Honduras	72(15.1%)	35 (48.6%)	22(30.6%)	15 (20.8%)
Mexico	129 (27.0%)	58 (45.0%)	57(44.2%)	14 (10.9%)
Nicaragua	1 (0.21%)	0 (0%)	1(100%)	0 (0%)
Peru	13 (2.7%)	4 (30.8%)	7(53.8%)	2(15.4%)
Puerto Rico	1 (0.21%)	0 (0%)	1(100%)	0 (0%)
Unspecified	111 (23.2%)	11 (9.9%)	72(64.9%)	28 (25.2%)
Venezuela	2 (0.42%)	2 (100%)	0(0%)	0 (0%)

Legend for Table 1:

Abbreviations: SD, Standard Deviation. BCHD, Baltimore City Health Department

* Data were only available for 370/478 screened individuals

Table 2
Difference in LTBI evaluation and treatment between ICF referrals and referrals from other community sources

Group	Referral: N (%)	Evaluated by BCHD: N (%)	Diagnosed LTBI ^{***} : N(%)	Started Treatment: N (%)	Completed Treatment: N (%)
ICF	153 (4%)*	109 (71%)	101 (93%)	84 (83%)	53 (63%)
Other referral sources	3,576 (96%)	2,315 (64.7%)	1988 (86%)	1484 (75%)	966 (65%)
<i>p</i>		0.099	0.045	0.054	0.364

Legend for Table 2:

Abbreviations: (ICF) intensified LTBI case finding, BCHD, Baltimore City Health Department

* excludes 11 individuals that on review did not live in Baltimore City

** BCHD performs additional TB screening that includes a Quantiferon-Gold-in-Tube(QFT) test. Individuals with a discordant QFT and TST results are diagnosed with LTBI based on clinical judgment that includes assessment of risk factors, BCG status, country of origin, and degree of TST induration.