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Evaluation of the Latent Tuberculosis Care Cascade Among Public Health Clinics in the United States

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Abstract

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Supplementary Data

Supplementary materials are available at *Clinical Infectious Diseases* online. Consisting of data provided by the authors to benefit the reader, the posted materials are not copyedited and are the sole responsibility of the authors, so questions or comments should be addressed to the corresponding author.

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Background.—Tuberculosis (TB) elimination within the United States will require scaling up TB preventive services. Many public health departments offer care for latent tuberculosis infection (LTBI), although gaps in the LTBI care cascade are not well quantified. An understanding of these gaps will be required to design targeted public health interventions.

Methods.—We conducted a cohort study through the Tuberculosis Epidemiologic Studies Consortium (TBESC) within 15 local health department (LHD) TB clinics across the United States. Data were abstracted on individuals receiving LTBI care during 2016–2017 through chart review. Our primary objective was to quantify the LTBI care cascade, beginning with LTBI testing and extending through treatment completion.

Results.—Among 23 885 participants tested by LHDs, 46% (11 009) were male with a median age of 31 (interquartile range [IQR] 20–46). A median of 35% of participants were US-born at each site (IQR 11–78). Overall, 16 689 (70%) received a tuberculin skin test (TST), 6993 (29%) received a Quantiferon (QFT), and 1934 (8%) received a T-SPOT.TB; 5% (1190) had more than one test. Among those tested, 2877 (12%) had at least one positive test result (3% among US-born, and 23% among non-US–born, $P < .01$). Of 2515 (11%) of the total participants diagnosed with LTBI, 1073 (42%) initiated therapy, of whom 817 (76%) completed treatment (32% of those with LTBI diagnosis).

Conclusions.—Significant gaps were identified along the LTBI care cascade, with less than half of individuals diagnosed with LTBI initiating therapy. Further research is needed to better characterize the factors impeding LTBI diagnosis, treatment initiation, and treatment completion.

Keywords

latent tuberculosis; care cascade

The Centers for Disease Control and Prevention (CDC) has set ambitious tuberculosis (TB) elimination goals (<1 case per million population) for the United States [1]. Although TB incidence has declined, incidence remains at ~2–3 per 100 000 individuals [2–4]. Once infected with *Mycobacterium tuberculosis*, roughly 10% will develop TB disease [5]. Although TB disease can develop shortly after initial exposure, most US cases arise following asymptomatic latent TB infection (LTBI) [6, 7]. Identifying and treating individuals with LTBI can prevent TB disease progression [5, 8]. Targeted testing and treatment of high-risk individuals for LTBI or disease progression is thus critical to TB elimination efforts [9–12].

Epidemiologic data are limited, but the National Health and Nutrition Examination Survey (NHANES) estimates US LTBI prevalence as 4.7% (~13.2 million individuals) [13]. Non-US–born (non-USB) residents may have LTBI prevalence 13 times that of US-born (USB) residents (20.5% vs 1.5%); some analyses have estimated prevalence at 34% among non-USB [14, 15]. Notably, more than 70% of domestic TB cases occur among individuals born, or having spent time in, high TB-incidence areas [4, 16].

Improved understanding of LTBI care gaps will facilitate targeted interventions. Successful LTBI treatment requires sequential steps in the LTBI care cascade, including: (1) identifying high-risk individuals, (2) administering and interpreting LTBI testing, (3) excluding TB

disease (symptom screening, chest radiography, and microbiological testing, as needed), (4) initiating treatment, and (5) documenting treatment completion. Missed opportunities and loss to follow-up can occur at each step. Incomplete treatment is a known problem, and shorter-course regimens have emerged to improve treatment completion [12, 17, 18]. However, less attention has been paid to attrition occurring at earlier steps in the cascade [19, 20].

We sought to comprehensively evaluate LTBI services in 15 local health department (LHD) TB clinics across 11 states. Our objective was to quantify the LTBI care cascade among individuals without prior TB or LTBI diagnosis and identify factors associated with failure to complete each cascade step in order to inform future TB prevention efforts.

METHODS

Patient Population and Data Collection

We conducted an observational cohort study through the Tuberculosis Epidemiologic Studies Consortium (TBESC), a partnership between the Centers for Disease Control and Prevention (CDC), local TB programs, and academic institutions (Supplementary Figure 1). Six months of routinely collected clinical data were abstracted between 2016 and 2017 on all patients tested or treated for LTBI; based on local site capacity, data collection was prospective, retrospective, or a combination (specific time intervals differed between sites). Demographic and clinical data were abstracted from medical records. To characterize the full care cascade beginning with testing, inclusive of estimating LTBI prevalence, our primary analysis focused on those receiving LHD-directed testing and excluded those referred/presenting with a known history of positive testing (ie, inclusion of individuals with known test positivity would be expected to inflate LTBI prevalence estimates). Those with LTBI or TB disease history, or without documented testing, or in whom all available testing was > 30 days prior to initial visit, were excluded. In secondary analysis, we characterized the care cascade after test positivity inclusive of the population with prior positive testing who were referred to LHD for treatment.

Definitions of LTBI Care Cascade Steps

LTBI Testing and Cohort—Individuals with recent LTBI testing and without prior history of LTBI/TB disease or positive tests, regardless of testing indication, were included. We reported the proportion of individuals with an indication for testing, defined as non-USB persons, or epidemiologically higher risk (eg, residents of a correctional facility, persons experiencing homelessness), or with medical risk for progression to TB disease (eg, immunosuppression), consistent with current US guidelines [21, 22]. LTBI tests included tuberculin skin tests (TST) and interferon-γ release assays (IGRA), QuantiFERON TB Gold-In-Tube or Plus; (QFT; Qiagen; Germantown, Maryland, USA) or T-SPOT.TB (T-SPOT; Oxford Immunotec Ltd; Abingdon, United Kingdom).

LTBI Test Positive—Qualitative LTBI test results were abstracted from available clinical documentation in patient charts; quantitative results were not consistently available. We report proportions of patients with a positive LTBI test (TST or IGRA).

Chest Imaging—Proportion of patients with a positive LTBI test with documentation of chest radiography to exclude TB disease, as recommended by guidelines [21, 22].

LTBI Diagnosis—Proportion of patients with a positive LTBI test subsequently diagnosed with LTBI, defined by meeting (either criteria):

1. Clinic documentation of diagnosis by American Thoracic Society (ATS) class 2 (latent TB infection, no disease) or class 4 (tuberculosis, not clinically active) [8]. ATS classification was abstracted from electronic medical record (EMR)-based diagnosis fields or provider documentation, depending on site.
2. Without clear clinical documentation, those initiating LTBI therapy were presumed to have LTBI.

Due to gaps in chest radiography documentation, LTBI diagnosis was based on documented diagnoses or treatment initiation (ie, not conditional on imaging). Patients with TB disease or alternative final diagnosis (eg, non-TB infection) were excluded.

LTBI Treatment Initiation—Proportion with LTBI diagnosis initiating treatment. Given clinic record's variability, patients were considered to have initiated therapy if clinic documentation noted: (1) treatment prescribed, (2) treatment dispensed, or (3) first treatment dose ingested.

LTBI Treatment Completed—Proportion of patients completing LTBI treatment. This designation was based on provider notes and/or documentation of the last month of therapy dispensed.

Statistical Analysis

Statistical analysis was conducted in Stata 16 (StataCorp LLC, College Station, Texas, USA). Clinical and demographic characteristics were reported, and differences between USB and non-USB were calculated using Student *t* tests for continuous variables and χ^2 tests for categorical variables (Table 1). A care cascade was populated using data from eligible study participants. Generalized linear mixed effects regression analyses with binomial distribution and logit links were used to identify associations between clinical and demographic factors and failure to start or complete treatment, with study site incorporated as a random effect; adjusted odds ratios (aORs), and 95% confidence intervals (CIs) were reported. Included variables were those of clinical/epidemiologic relevance (age, sex, race, ethnicity, testing reason, homelessness, recent exposure/contact investigation, type of TB infection test or presence of discordant test results, whether individual was non-USB).

Ethical Review

This study was reviewed at CDC and excluded from IRB review as research not involving identifiable human subjects. Some individual study sites relied on the CDC determination [23]. It was additionally reviewed and approved by the Institutional Review Boards (IRBs) of Johns Hopkins University School of Medicine, University of Maryland, Maryland Department of Health, North Texas Regional IRB, and Atrium Health.

RESULTS

Study Population

In total, 25 792 patients were referred or evaluated for LTBI across sites (Figure 1). Also, 1,907 were excluded (159 had no recent LTBI testing documented or had LTBI testing performed > 30 days prior to first visit; 1,748 had a history of positive LTBI test), leaving 23 885 patients in primary analyses. Median participants per site was 1181 (IQR 362–2022, Supplementary Table 1).

In total, 11 009 (46%) patients were male with median age 31 (IQR 20–46) (Table 1). Nearly half of participants were USB (10 962 [46%]) with median 35% USB at each site (IQR 11–78). Of non-USB patients reporting birth country, the most common were Philippines (1945 [18%]), Cuba (972 [9%]), Syria (719 [7%]), Democratic Republic of the Congo (748 [7%]), and Mexico (492 [4%]). Birth country was unknown for 1873 (8%).

For this analysis, all non-USB patients were considered to have an indication for LTBI testing, although additional testing reasons included: refugee evaluation (n = 5,098, 46%), employment clearance (n = 1,830, 17%), and student clearance (n = 987, 9%). Additionally, 1692 (15%) were tested as part of other immigration-related services and 639 (6%) were tested through contact investigations. Evaluation reasons varied by site. For example, some sites noted few individuals evaluated for refugee evaluation (ie, <1%). In other clinics, refugee evaluation represented > 90% of all LTBI testing.

Among USB patients, 3734 (34%) had indications for testing, with common reasons being homeless shelter screening (1310 [35%]), drug rehabilitation screening (1031 [28%]), contact investigations (569 [15%]), and medical risk (eg. human immunodeficiency virus [HIV], immunosuppressed) (208 [6%]). Among 7228 USB patients tested without indication, common reasons were employment screening (n = 4508 [62%]) and student clearance (n = 1976 [27%]).

Overall, 16 103 (67%) had an indication for LTBI testing; across sites, the median proportion evaluated for LTBI with documented indication was 95% but ranged from 25% to 100% (IQR 51%–99%). The overall care-cascade is shown in Figure 2 and Supplementary Figure 2.

LTBI Test Results

Among 23 885 individuals evaluated for LTBI by LHDs, 16 689 (70%) received TST, 6993 (29%) QFT, and 1934 (8%) TSPOT; 1190 (5%) received > 1 LTBI test. Test selection varied by site (Supplementary Table 1), with proportions receiving TST within a clinic ranging from 5% to 100%.

Overall, 2877 (12%) had at least 1 positive test result. Proportions testing positive were higher among non-USB (23%, 2,498/11 050) versus USB (3%, 336/10 962, $P < .01$; Supplementary Table 1). Among USB, 6% (212/3734) with indications for testing had positive tests versus 2% (124/7228, $P < .01$) without indications for testing (eg, employment

screening without other risk factors). Also, 15% (85/569) of USB individuals tested due to contact to someone with infectious TB had a positive test.

LTBI Evaluation and Diagnosis

Of 2877 individuals with a positive LTBI test, 2575 (90%) had documented chest imaging to evaluate for TB disease, and 2482 (86%) had documented diagnoses of LTBI (Figure 2). An additional 33 individuals without documented positive LTBI test results also received a diagnosis of LTBI (Figure 1). Ultimately, a total of 2515 were diagnosed with LTBI following clinical evaluation. Overall, 20% of non-USB individuals (2192/11 050) were diagnosed with LTBI versus 3% of USB (291/10 962, $P < .01$; Supplementary Table 1).

LTBI Treatment

Of 2515 diagnosed with LTBI, 1073 (43%) initiated therapy (43% non-USB and 39% USB; $P = .145$). Therapy consisted of rifamycin (rifampin or rifabutin) monotherapy (once daily × 4 months; 4R) for 615 (57%) patients, isoniazid/rifapentine (once weekly × 3 months; 3HP) for 226 (21%) patients, isoniazid/rifampin (once daily × 3 months; 3HR) for 62 (6%) patients, and isoniazid monotherapy (once daily × 6–9 months; 6H/9H) for 163 (15%; Supplementary Table 2). More USB patients were prescribed isoniazid monotherapy (27%) versus non-USB (14%, $P < .01$).

Proportions of patients diagnosed with LTBI who started therapy varied by site, ranging from 10% to 91% (median 54% [IQR 37%–70%], $P < .01$). Of 1442 individuals with LTBI not starting therapy, 555 (38%) declined treatment or were lost to follow-up, whereas 76 (5%) did not start due to “clinical considerations,” and 150 (10%) had no reason recorded; other “local practices/administrative reasons” were cited as the reason for not starting therapy for 46% (661). Notably, 604/661 (91%) of individuals not starting therapy due to “local practice/administrative reasons” were from a single site. At this site, 4770/9053 (53%) of patients were USB individuals tested for student or employment screening; patients were given written documentation of their LTBI test results and asked to contact the clinic for further treatment but received no formal discussion of treatment options or associated risks/benefits due to limited capacity. In secondary analysis, eliminating this site, the most common reason for not initiating therapy was “patient declined” or “lost to follow-up” (548/811, 68%); 76 (9%) individuals were not started due to “clinical reasons,” whereas 130 (16%) did not have reasons documented.

Among patients diagnosed with LTBI, factors associated with *not* starting LTBI treatment in multivariable mixed-effects regression analysis were: age > 65 years (aOR 2.15 [95% CI 1.47, 3.15]), homelessness (aOR 4.55 [95% CI 2.12, 9.74]), evaluation for student/employment clearance (aOR 2.10, [95% CI 1.47, 2.99]), and having discordant test results (ie, different results when more than one test was performed, aOR 2.15 [95% CI 1.32, 3.51]). Persons of Asian race (aOR 0.49 [95% CI .34, .70]), those evaluated as part of contact investigation (aOR 0.18 [95% CI .13, .26]), and those tested by IGRA (aOR 0.36 [95% CI .26, .50]) had greater odds of starting therapy (Table 2, Supplementary Figure 3).

Of 1073 patients initiating therapy, 817 (76%) completed treatment (78% and 61% for non-USB and USB, respectively, $P < .01$), which was 32% of those initially diagnosed

with LTBI (34% of non-USB and 24% of USB, $P = .001$). Among those prescribed isoniazid monotherapy, 67% completed therapy (109/163), compared to 78% who took shorter rifamycin-based therapies (706/907, $P = .002$). In multivariable mixed-effects regression analysis among those starting therapy, those treated with 3HP had greater odds of completing treatment (aOR 3.39, 95% CI 1.85, 6.19), versus those treated with isoniazid alone (Table 3, Supplementary Figure 4). Hispanic ethnicity (aOR 0.49, 95% CI .28, .86) and homelessness (aOR 0.11, 95% CI .03, .40) were associated with not completing therapy (Table 3), compared to those without Hispanic ethnicity or without history of homelessness, respectively.

The proportion starting and completing therapy were similar when including those individuals referred to the health department with a known prior positive test (Supplementary Table 3).

DISCUSSION

Understanding gaps in LTBI care is critical to inform TB prevention efforts. We present data from over 24 000 individuals evaluated for LTBI at 15 health department clinics across 11 states, representing one of the largest epidemiologic datasets of LTBI care reported to date. Overall, we found only 32% of individuals diagnosed with LTBI completed treatment, with the biggest drop-off at treatment initiation. Across sites, less than half of individuals with LTBI started treatment.

Our study yielded insights at each care-cascade step. We found a large proportion of individuals were tested without indication, with low test positivity within this subgroup (2%). CDC/ATS/Infectious Diseases Society of America guidelines recommend targeted testing for LTBI, owing in part to the poor positive predictive value of available LTBI tests within low-risk populations [21]. Nevertheless, we found nearly half of LTBI testing occurred among USB persons, often without epidemiological risks for infection or disease progression, with differences across sites. These data emphasize the need to review and update local policies to ensure that low-risk groups are not being tested, to align with current guidelines recommending targeted testing.

Predictably, we found higher LTBI prevalence among non-USB persons (20%) compared to USB (3%), similar to findings from NHANES [13]. Among USB individuals without indications for testing, only 2% tested positive, compared to 6% with indications for testing [13, 14]. The high prevalence of LTBI among non-USB adds support to current recommendations by USPSTF and national guidance that advocate prioritization of LTBI testing for individuals with epidemiologic risk factors for infection or disease progression [21, 24].

We also found TST remained commonly utilized for LTBI testing during the study period, although the proportion of patients receiving TST varied between study sites. Recently updated guidelines (during the study period) recommend IGRAs over TST in most scenarios, including in patients with a history of BCG vaccination or unlikely to return to have TST reading [21]. Research is needed to evaluate whether there have been changes

in LHD and provider practice for LTBI testing since the release of recent clinical practice guidelines.

Second, we found large gaps in LTBI treatment initiation; two-thirds of individuals diagnosed with LTBI never started treatment, with significant heterogeneity by site (median 54% starting therapy). At most sites, the most common reason cited for not initiating treatment was “patient declined therapy” or “lost to follow-up” (68%), with “clinical considerations” (9%) also cited for some individuals. Prior literature on this gap in LTBI treatment initiation is limited. Nonetheless, our findings are consistent with self-reported NHANES data that suggested only half of individuals diagnosed with LTBI are prescribed treatment [25]. In our analysis, factors associated with an increased risk for not initiating treatment included older age, homelessness, and testing for the purposes of student or employee clearance; new strategies may be needed to improve acceptability and uptake of treatment in some subgroups. By contrast, we found that those diagnosed with LTBI in the context of testing during contact investigations were more likely to initiate therapy (73%, Supplementary Table 2), similar to national reports. This may reflect prioritization of close contacts within local health departments. CDC’s National TB Program Objectives set a goal of treatment initiation for 92% of people diagnosed with LTBI found during contact investigations; in 2018, the national average reported from state and city TB programs was 77% [3, 26].

Finally, we found that 76% of patients starting treatment had documented treatment completion. Individuals prescribed short-course rifamycin-based regimens (ie, 3HP) were more likely to complete treatment compared to those prescribed 6–9 months of isoniazid monotherapy, consistent with prior findings [18, 27]. These results underscore the importance of recently updated LTBI treatment guidelines (2020) prioritizing short-course regimens [12].

Our study has several limitations. Included clinics may not be representative of all US health departments. Barriers might differ in other care settings including primary care, where competing priorities might limit available time for TB preventive services. In some instances, health departments serve as a site for referral for LTBI treatment. We had access only to data on patients who engaged with the health department for care. Inclusion of referred individuals who failed to link to care would be expected to further decrease the proportion of diagnosed patients starting treatment [28]. Although we reported a low proportion of individuals with LTBI starting therapy, we had limited data on the potential unmeasured patient, provider, or health system level barriers driving this finding. Finally, we could not measure adherence to treatment and relied on chart documentation of treatment completion.

Our study has important strengths. Targeted testing and treatment of LTBI must play a central role in TB elimination efforts within the United States [25]. Understanding the LTBI care cascade is critical to identifying current gaps and designing targeted interventions. We present data from one of the largest cohorts describing the LTBI care cascade. Given limited health department resources, our data suggest LHDs should prioritize targeted testing of individuals with risk factors, such as non-USB from high-incidence settings,

and avoid screening populations with low LTBI prevalence. Although much focus has been directed towards shortening LTBI treatment, attention is needed at earlier points along the cascade. The largest gap in care occurs at treatment initiation, which should inform future interventions. Further research is needed to better understand patient knowledge/acceptance of LTBI diagnosis and treatment and factors impacting retention in care. In conclusion, further strides toward TB elimination require focused efforts to evaluate individuals with LTBI, and address health-system, provider, and patient barriers to treatment initiation and completion.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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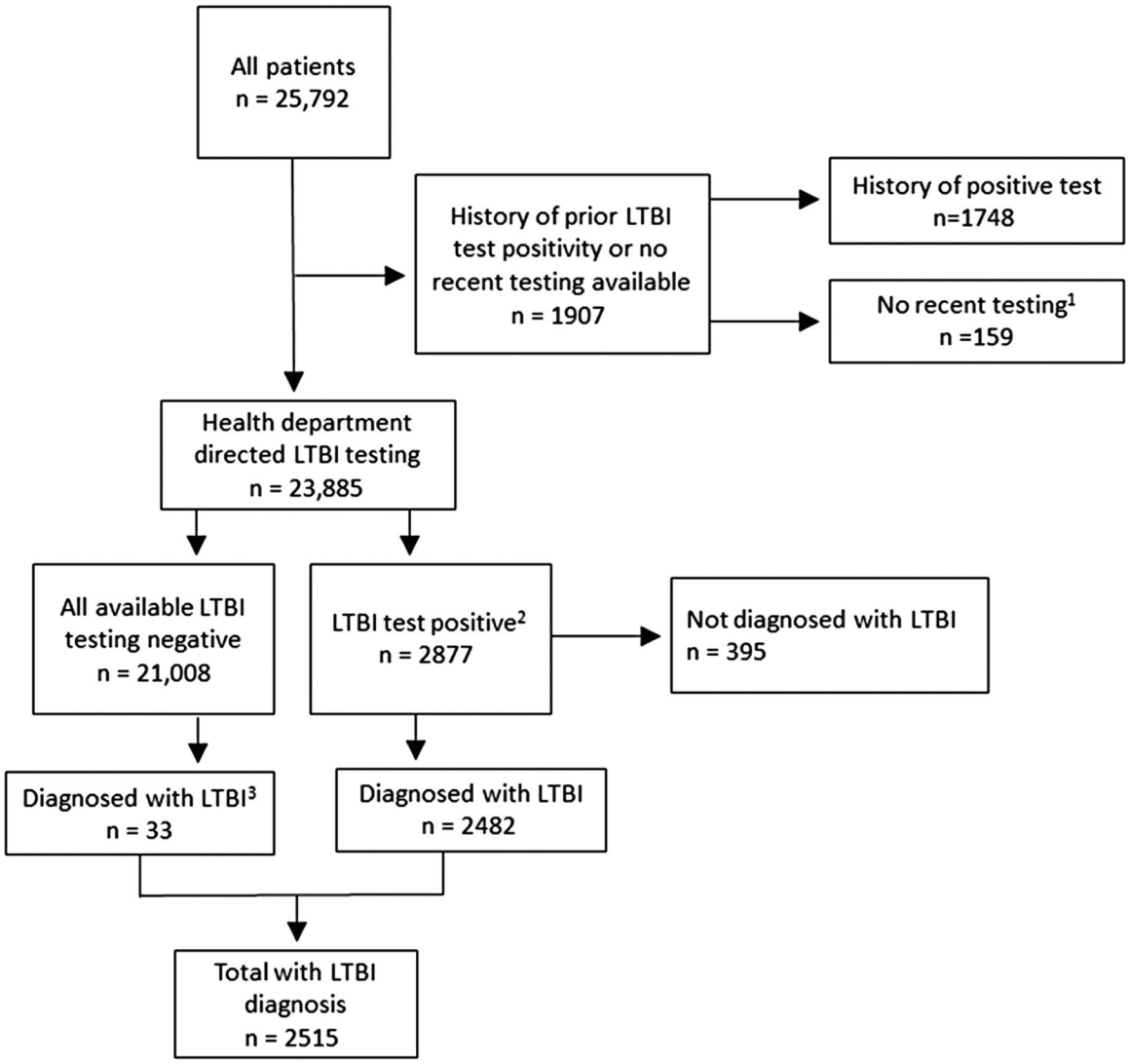

Figure 1.

Selection of patients with local health department directed LTBI diagnosis. Abbreviation: LTBI, latent tuberculosis infection. [1]Patients were excluded if all available test results were 30 days prior to initial health department visit. [2]If more than 1 test completed, at least 1 positive. [3]Diagnosis based on available documentation of final recorded clinical diagnosis in patient records, despite no available documentation of positive test results.

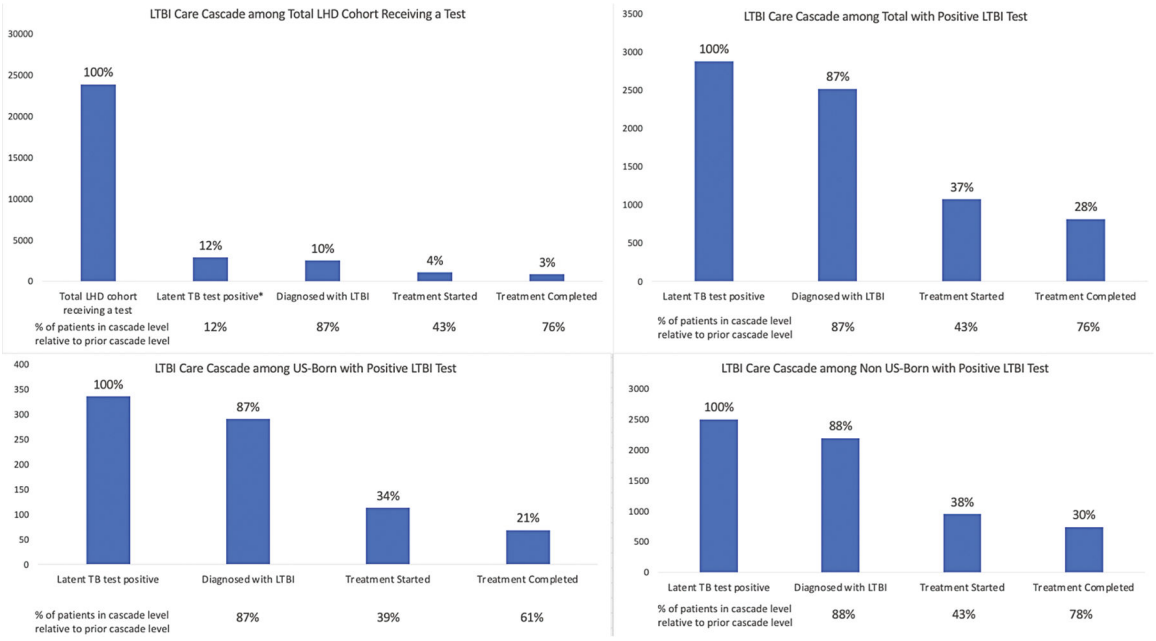

Figure 2.

LTBI care cascade across 15 local health department TB clinics. Abbreviations: LHD, local health department; LTBI, latent tuberculosis infection; TB, tuberculosis; USB, US-born. *In the upper left panel, *all* individuals receiving a test at the health department clinic without prior known positive tests were included. This includes individuals with and without an indication for testing. The proportion testing positive (second bar, upper left panel) was higher among non-USB (23%, 2498/11 050) compared to USB (3%, 336/10 962, $P < .01$). In the upper right panel, we present the cascade beginning with all patients with at least one positive latent TB test result in the primary cohort. In the lower left and right panel, we present the latent TB care cascade among USB and non-USB in the primary analysis cohort who had a positive latent TB test result. In all panels, percentages listed above bars are relative to the first bar; percentages below the bars are relative to the prior step in the care cascade. **In panel *B*, the proportion diagnosed with LTBI includes 33 individuals with a final diagnosis of LTBI but without documentation available for LTBI test result.

Table 1.

Clinical and Demographic Characteristics and Reason for Latent Tuberculosis Evaluation by Birth Country

Clinical and Demographic Characteristics	Non-US–born n = 11 050	US-born n = 10 962	Total n = 23 885[a]	*P*
Age, median (IQR)	28.3 (16.5–-43.0)	30.8 (22.4–46.3)	30.7 (20.4–46.1)	<.01
Gender, N (%)				.81
Male	5,029 (46)	5,010 (46)	11 009 (46)	
Female	5,999 (54)	5,901 (54)	12 803 (54)	
Other/Unknown	22 (0)	51 (0)	73 (0)	
Homelessness, N (%)				<.01
No	10 864 (98)	9,218 (84)	21 105 (88)	
Yes	186 (2)	1,744 (16)	2,780 (12)	
Student, N (%)				<.01
No	10 024 (91)	8,937 (82)	20 735 (87)	
Yes	1,026 (9)	2,025 (18)	3,150 (13)	
Race, N (%)				<.01
American Indian/Alaska Native	28 (0)	129 (1.2)	164 (0)	
Asian	3,875 (35)	1,941 (18)	5,854 (25)	
Black	2,509 (23)	2,093 (19)	5,194 (22)	
White	3,201 (23)	3,377 (31)	7,374 (31)	
Native Hawaiian/Pacific Islander	985 (9)	2,763 (25)	3,755 (16)	
Other/Unknown	452 (4)	659 (6)	1,544 (7)	
Hispanic or Latino ethnicity, N (%)				<.01
No	8,895 (81)	9,090 (83)	18 453 (77)	
Yes	1,821 (17)	1,402 (13)	3,540 (15)	
Unknown	334 (3)	470 (4)	1,892 (8)	
Evaluation reason				<.01
Refugee care	5,098 (46)	1 (0)	5,144 (22)	
Employment screening	1,830 (17)	4,508 (41)	6,688 (28)	
Student clearance	987 (9)	1,976 (18)	3,062 (13)	
Immigration-related (not refugee)[b]	1,692 (15)	4 (0)	1,701 (7)	
Medical risk	27 (0)	208 (2)	244 (1)	

Clinical and Demographic Characteristics	Non-US–born n = 11 050	US-born n = 10 962	Total n = 23 885[a]	*P*
Contact investigation	639 (6)	569 (5)	1,616 (7)	
Other	364 (3)	747 (7)	1,108 (5)	
Drug rehabilitation	68 (1)	1,031 (9)	1,216 (5)	
Symptoms or abnormal chest radiograph	73 (1)	30 (0)	104 (0)	
Homeless shelter	140 (1)	1,310 (12)	2,288 (10)	
Institutional care or group home	11 (0)	3 (0)	18 (0)	
Other targeted testing	119 (1)	555 (5)	674 (3)	
Correctional facility	2 (0)	20 (0)	22 (0)	

Abbreviation: IQR, interquartile range.

[a]Birth country not reported for 1873 patients but are included in the totals.

[b]Immigration-related refers to latent tuberculosis infection (LTBI) screening conducted for immigration-related reasons other than refugee care. This includes evaluation for newly arrived immigrants.

Table 2.

Clinical and Demographic Factors Associated With Failure of Initiation of Treatment Among Patients With LTBI

Clinical and Demographic Characteristics	aOR (95% CI)[a]	*P*
Age > 65 years		
No	Ref	
Yes	2.15 (1.47, 3.15)	<.01
Gender		
Male	Ref	
Female	1.12 (.92, 1.37)	.256
Race		
White	Ref	
Unknown/other	0.84 (.51, 1.40)	.511
Native American	1.46 (.30, 7.10)	.634
Asian	0.49 (.34, 0.70)	<.01
Black	0.82 (.60, 1.12)	.220
Native Hawaiian/Pacific Islander	0.96 (.48, 1.90)	.897
Hispanic/Latino		
No	Ref	
Yes	0.97 (.66, 1.42)	.874
Unknown	1.41 (.86, 2.33)	.166
Homeless		
No	Ref	
Yes	4.55 (2.12, 9.74)	<.01
Evaluated for employment or administrative reasons[b]		
No	Ref	
Yes	2.10 (1.47, 2.99)	<.01
Evaluated for contact investigation		
No	Ref	
Yes	0.18 (.13, .26)	<.01
Birth country		
Non-USB	Ref	
US Born	0.83 (.58, 1.20)	.329
Discordant LTBI testing results		
No	Ref	
Yes	2.15 (1.32, 3.51)	.002
IGRA done for testing		
No	Ref	
Yes	0.36 (.26, 0.50)	<.01

Abbreviations: aOR, adjusted odds ratio; CI, confidence interval; IGRA, interferon-γ release assays; LTBI, latent tuberculosis infection; Ref, reference; USB, US-born.

[a] Results from a generalized linear mixed-effect multivariable model (logit link and binomial distribution), with random effects incorporated for study site (Supplementary Figure 3).

[b] Includes all people with an evaluation for purposes of employment or student clearance.

Table 3.

Clinical and Demographic Factors Associated With Completing Treatment Among Patients Started on Treatment for LTBI

Clinical and Demographic Characteristics	aOR (95% CI)[a]	*P*
Age > 65		
No	Ref	
Yes	0.66 (.36, 1.23)	.189
Gender		
Male	Ref	
Female	0.99 (.72, 1.34)	.929
Race		
White	Ref	
Unknown/other	1.29 (.63, 2.66)	.485
Native American	1.18 (.10, 13.75)	.892
Asian	1.27 (.73, 2.20)	.402
Black	0.75 (.46, 1.22)	.249
Native Hawaiian/Pacific Islander	6.75 (1.59, 28.64)	.010
Hispanic/Latino		
No	Ref	
Yes	0.49 (0.28, 0.86)	.012
Unknown	0.80 (0.38, 1.68)	.551
Homeless		
No	Ref	
Yes	0.11 (.03, .40)	.001
Evaluated for employment or administrative reasons[b]		
No	Ref	
Yes	0.83 (.44, 1.59)	.583
Evaluated for contact investigation		
No	Ref	
Yes	0.92 (.60, 1.42)	.708
Birth country		
Non-USB	Ref	
US-born	0.74 (0.45, 1.23)	.245
Discordant LTBI testing results		
No	Ref	
Yes	1.86 (0.77, 4.50)	.171
Treatment regimen		
INH (6H/9H)	Ref	
INH + Rifampin (3HR)	1.27 (.57, 2.81)	.560
INH + Rifapentine (3HP)	3.39 (1.85, 6.19)	<.001
Rifampin (4R)	1.38 (.91, 2.09)	.132
Other/unknown	1.62 (.15, 17.74)	.694

Abbreviations: aOR, adjusted odds ratio; CI, confidence interval; INH, isoniazid; LTBI, latent tuberculosis infection; Ref, reference; USB, US-born.

[a]Results from a generalized linear mixed-effect multivariable model (logit link and binomial distribution), with random effects incorporated for study site (Supplementary Figure 4).

[b]Includes all people with an evaluation for purposes of employment or student clearance.