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CureTB and Continuity of Care for Globally Mobile Tuberculosis Patients, 2012–2015

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Summary

Background: In 2016, 3% of newly diagnosed patients with tuberculosis (TB) left the United States, of whom 24% moved to Mexico. Continuity of care for TB is important to ensure patients complete treatment and reduce TB transmission. CureTB provides continuity of care for patients with TB who move out of the United States by referring them for care at their destinations.

Methods: Analysis of CureTB data collected between January 2012 and December 2015 to describe demographics and outcomes of referred patients and examine factors contributing to successful treatment outcomes.

Results: CureTB received 1,347 referrals mostly from health departments and law enforcement agencies in the United States (92%); 858 referrals were for patients with verified or possible TB (64%). Most patients moved to Mexico or other Latin American countries (96%) and most completed treatment before departing (78%). Risk of loss was associated with being in custody (33%), not being interviewed by CureTB (30%), and not having diabetes (18%).

Conclusions: CureTB successfully promoted transnational continuity of care for patients by exchanging information with international public health authorities and linking them directly with patients. This patient-centered strategy helps improve TB treatment success and reduce the global burden and transmission of TB.

Keywords

evaluation; case management; transnational linkages; risk factors

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Disclaimer

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

Introduction

Tuberculosis (TB) remains a disease of public health concern worldwide. The World Health Organization estimates that 10.4 million new TB diagnoses occurred in 2016.[1] In the United States, 308 (3.3%) of the 9,253 patients newly diagnosed with TB in 2016 moved to 55 countries before completing therapy, most (95.8%) were non-US–born.[2] Among these patients, 24.0% moved to Mexico, a pattern observed annually since collection of this information started in 2009.[2–5] An estimated 90% of visitors diagnosed with TB while in the United States in 2016 did not receive services for continuity of care before departing.[6] This finding underscores a gap in public health services and the need to expand transnational continuity of care services for patients with TB.

CureTB is a referral and continuity of care program, established in 1997 within the TB Control Branch of the San Diego County Health and Human Services Agency, for patients with TB relocating outside the United States before completing treatment. CureTB receives referrals from health department TB programs and law enforcement agencies across the United States. The program links patients to health care for treatment and diagnostic services at their destination. During telephone interviews, CureTB informs patients how to access TB services in their destination countries and educates them about TB disease and the importance of treatment adherence. CureTB facilitates the exchange of diagnostic, treatment, and outcome information between receiving countries and referring jurisdictions. Additionally, CureTB accepts referrals for high-risk contacts of persons with infectious TB and helps retrieve information about past treatment upon special request.

CureTB initially served patients traveling between the United States and Mexico, and later broadened to accept referrals for patients traveling to Central American countries. Program operations transferred to the Division of Global Migration and Quarantine of the US Centers for Disease Control and Prevention (CDC) in 2016, expanding services to help patients traveling to all countries worldwide. CureTB retains a partnership with the San Diego County TB Control Branch and works with national TB programs and ministries of health to link patients to care and collect patient outcome information.

The analysis focuses on referrals sent to CureTB between 2012 and 2015, before the program transferred to CDC. The objectives are to describe the types of incoming referrals, to assess factors contributing to successful outcomes, and to estimate the risk of loss to follow-up in order to inform strategies for enhancing transnational management of patients with TB.

Methods

We analyzed CureTB patient referral data collected by the San Diego County TB Control Branch between January 1, 2012 and December 31, 2015. Variables include month and year of birth, name and type of referring agency, a referral’s TB classification (verified, possible, past history request, source case finding), comorbidities, diagnostics, and outcome. We examined data for referrals from health departments and law enforcement agencies to describe referral type, origin and destination jurisdictions of referrals for patients with

verified or possible TB disease, and outcomes of referrals for patients with verified TB disease. Upon review by the Office of Strategy and Innovation of the San Diego County Health and Human Services Agency and by CDC's National Center for Emerging and Zoonotic Infectious Diseases, the analysis protocol was approved and determined to be non-research.

Data analysis

To illustrate the progression of a referral through the analysis process, we created an algorithm for referral types (Figure 1). We used ArcGIS software to create maps visualizing the movement of referred patients from the originating jurisdiction in the United States to the destination country. Additionally, we used SAS version 9.3 to assess associations between an unfavorable treatment outcome of patients with verified TB disease and risk factors, including being in custody, being interviewed by CureTB, and having diabetes.

Data quality checks and criteria for diagnosis

CureTB referral data were stored in distinct yearly data files, which had inconsistent methods in notation or identification of referrals and outcomes variables. We addressed all inconsistencies and potential duplication of referrals before merging them into one continuous de-identified analytical data set. Referrals were grouped into the following categories: patients with verified TB, patients with possible TB, notifications of people exposed to TB (contacts), requests for a patient's past TB medical history, and requests for identifying index patients in another country. Only patients with verified or possible TB were included in any further analysis.

Defining patients with TB and outcomes

Patients with verified TB disease are those meeting laboratory or clinical criteria, as defined by CDC's Division of Tuberculosis Elimination guidelines (5, 6). Patients with verified TB disease included those having bacteriologic confirmation of disease and those presenting with signs and symptoms consistent with clinical disease, having a positive tuberculin skin test or positive interferon-gamma release assay for *M. tuberculosis*, and showing clinical improvement with TB treatment. These patients were categorized as either warranting or not warranting a referral. CureTB does not routinely refer patients if the remaining course of treatment is less than 30 days. Patients with verified TB disease warranting a referral were grouped into the following categories for outcomes analysis: a) completed treatment/ achieved cure, b) lost to follow-up, c) refused or abandoned treatment, d) treatment stopped by provider, or e) died. Completing treatment and achieving a cure were combined into a single outcome category to account for differences in the way countries classify these outcomes.

Patients with possible TB disease are those whose laboratory test results were pending, but had preliminary clinical evidence and positive tuberculin skin test or positive interferon-gamma release assay for *M. tuberculosis*, and include those not meeting criteria for having verified TB disease. These patients were grouped into the following categories: a) permanent possible TB classification or b) not having TB. Patients initially presenting with possible TB disease who were later confirmed bacteriologically as having TB disease before leaving the

United States were reclassified as having verified TB disease and included in the categorization for the outcomes analysis described above. Patients for whom there was a strong clinical suspicion of TB disease but were never confirmed bacteriologically or clinically as having TB disease before leaving the United States, or for whom additional diagnostic testing was never became available from the destination country and TB had not been definitively ruled out, were classified as having permanent possible TB disease. Since CureTB does not refer patients who do not meet bacteriologic or clinical criteria for diagnosis, patients with permanent possible TB classification were excluded from further analysis of outcomes.

Risk analysis

We estimated the risk of loss to follow-up of patients with verified TB using circumstantial risk factors and comorbidities, including being interviewed by CureTB, being in law enforcement custody, and having diabetes. Any patient for whom circumstantial risk factors and comorbidities data were missing was excluded from analysis. We grouped patients reported as having refused or abandoned treatment with those reported as being lost to follow-up to create a single loss to follow-up category for analysis. Mantel-Haenszel chi-square test was used for tables with expected cell counts greater than five, and Fisher's Exact test was used for tables with expected cell counts fewer than five. We assessed significance at $p<0.05$.

Results

CureTB received 1,347 referrals between 2012 and 2015. Referrals ranged in age from under 6 months to 95 years (median: 39 years). Most referrals were patients with verified (n=541, 40%) or possible (n=317, 24%) TB disease. Half of the referrals initially classified as patients with verified or possible TB disease (n= 440, 51%) eventually required referrals to other jurisdictions for continued treatment. The remaining referrals were for contacts of patients with infectious TB disease (n=295, 22%), requests for patients' past TB medical histories (n=162, 12%) or for identifying an index patient in another country (n=32, 2%) (Figure 1). These remaining referral types were excluded from further analysis.

Referrals for patients with verified or possible TB disease

Most (n=435, 80%) of the 541 patients with verified TB disease were referred to another jurisdiction for continued treatment. The remaining patients did not require a referral because they did not move before completing treatment or they departed the United States with less than 30 days of therapy remaining (n=103, 19%) or a TB diagnosis was ruled out after further diagnostic testing (n=3, 1%) (Figure 1).

Nearly half (n=147, 46%) of the 317 patients with possible TB disease were determined not to have TB disease, 32% (n=103) were permanently classified as having possible TB disease, and 21% (n=67) were later verified as having TB disease. Most (n=62, 93%) of the 67 patients later verified as having TB disease did not require a referral and the remaining patients (n=5, 7%) were referred to another jurisdiction for continued treatment (Figure 1).

Referral circumstances of patients with verified or possible TB disease

The majority (n=789, 92%) of patients with verified or possible TB disease came from health departments (n=547, 64%), followed by law enforcement agencies (n=239, 28%), or other domestic sources (n=3, <0.5%). Law enforcement agencies include US Immigration and Customs Enforcement, Federal Bureau of Prisons, US Marshals Service, and state, county, and city correctional facilities. Other domestic sources include the Centers for Disease Control and Prevention, US Customs and Border Protection, and healthcare facilities. The remaining referrals (n=69, 8%) came from Mexico and two Central American countries for patients with verified or possible TB disease who lived in or who might have traveled to the United States. These referrals were from ministries of health (n=33, 48%), and healthcare facilities or private physicians (n=36, 52%) (Figure 2).

Referrals of patients with verified or possible TB disease originated from 31 states. Most were from California (n=362, 46%), Arizona (n=132, 17%), Texas (n=69, 9%), and Louisiana (n=65, 8%). CureTB referred most of these patients to public health agencies in Mexico (87%), Honduras (4%), Guatemala (4%), and El Salvador (2%). The remaining patients were referred to eight countries in South America and one in West Africa. The majority of patients referred to CureTB by health departments and law enforcement agencies were referred to Mexico (88% and 73% respectively) or to other Latin American countries (8% and 21% respectively) (Figures 3 and 4).

Outcomes of patients with verified TB disease

The outcomes of patients warranting a referral (n=440) varied by year but did not change substantially over time (Figure 5). Among these patients, 78% (n=343) completed treatment or had a bacteriologically confirmed cure, 9% (n=40) were lost to follow-up, 6% (n=27) refused or abandoned treatment, 6% (n=26) died, and 1% (n=4) had their treatment stopped by their provider.

Risk analysis

Patients with verified TB who were interviewed before leaving the United States (n=305) had a 12.5% risk of loss to follow up, compared to a 29.9% risk among patients who were not interviewed (n=97) ($p<0.001$). Additionally, patients who were in law enforcement custody (n=137) had a 32.9% risk of being loss to follow up, compared to an 8.2% risk among patients who were not in custody (n=269) ($p<0.0001$). Lastly, patients who had diabetes (n=62) had a 6.2% risk of being loss to follow up, compared to an 18.2% risk among patients who did not have diabetes (n=335) ($p=0.022$) (Figure 6).

Discussion

Health departments and law enforcement agencies made most of the referrals of patients with verified or possible TB. About half of patients referred to CureTB moved to another country; a majority of them continued receiving care in Mexico.

Most (78%) patients with verified TB successfully completed treatment to cure. This rate was comparable to the 2014 treatment success rate reported in Mexico (80%) but slightly

lower than those reported in El Salvador (91%) and Guatemala (85%).[8,9] In 2015, 90% of persons newly diagnosed with TB in the United States who remained in country completed treatment within 12 months; 96% completed treatment regardless of duration of completion time.[10]

Patients interviewed by CureTB before leaving the United States had better chances of completing treatment. In these interviews, patients received information about their TB diagnosis before moving to their destination countries and learned about continuing care at their destination. Directly observed therapy, regular home visits, social support, and patient-centered interventions are important for increasing treatment adherence. [11–13] Reasons for loss to follow-up may include migration, poverty, homelessness, and poor access to healthcare.[7,11,13,14]

Referred patients who had unsuccessful treatment outcomes were more likely to have been in law enforcement custody. In 2017, 3.1% of patients with TB in the United States were in law enforcement custody at the time of diagnosis.[10] Before 2016, CureTB frequently received referrals from law enforcement agencies after individuals had been released from custody and left the United States, limiting opportunities for pre-departure interviews and increasing the possibility of unsuccessful treatment outcomes. Improved linkages with health departments and law enforcement agencies have enhanced opportunities for CureTB to receive timely referrals, thus facilitating patient interview and education before departure.

Observational studies have found an association between TB treatment failure and having diabetes as a comorbidity.[15–17] However, findings from our analysis indicate that patients who had unsuccessful treatment outcomes were more likely not to have diabetes. Referred patients with TB who also have diabetes may have a greater incentive to seek care, which could have improved their access or motivation to receive treatment for their TB.

Limitations

Data used in this analysis were programmatic, not collected for ongoing systematic surveillance activities in TB control. Combining the results of completing treatment and achieving cure into a single category may have resulted in a potential misclassification affecting true rates of successful outcomes. When calculating treatment completion rates we used the total number of referred patients with verified TB disease and did not stratify by referring agency type, age, gender, or race/ethnicity. Further analyses could obtain standardized rates by specific variables in order to strengthen the comparison of completion rates and recommendations for program and policy improvement. Additionally, the CureTB treatment completion rate presented in this report is not representative of the general population; therefore, readers should interpret comparisons of this rate to those from Mexico and Central America with caution.

Conclusions

CureTB helps ensure continuity of care for globally mobile persons with TB by notifying and exchanging patient information with ministries of health and healthcare facilities in other countries. In the absence of reliable and medically relevant information from the

originating jurisdiction, health authorities in destination countries may be unaware of an arriving patient, may not continue treatment, or may inadvertently switch to inadequate regimens.

Direct interaction with patients provides motivation, opportunities for individualized patient education about TB disease and its treatment to prevent transmission and drug resistance, and assistance in continuing care at destination countries; these are essential elements for successful treatment completion.

Referring patients in detention or correctional facilities to CureTB before their release will likely improve outcomes among this high-risk population.

Strengthening and promoting transnational continuity of care services are likely to help reduce the global burden and transmission of TB. CureTB enhances continuity of care in mobile populations with TB and contributes to global efforts in TB control.

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CureTB has expanded its programmatic focus from movement between the United States and Mexico or Central America to routinely making continuity of TB care referrals worldwide (over 40 countries to date). More information on the CureTB Program, including how to make a referral, is available at https://www.cdc.gov/usmexicohealth/curetb.html

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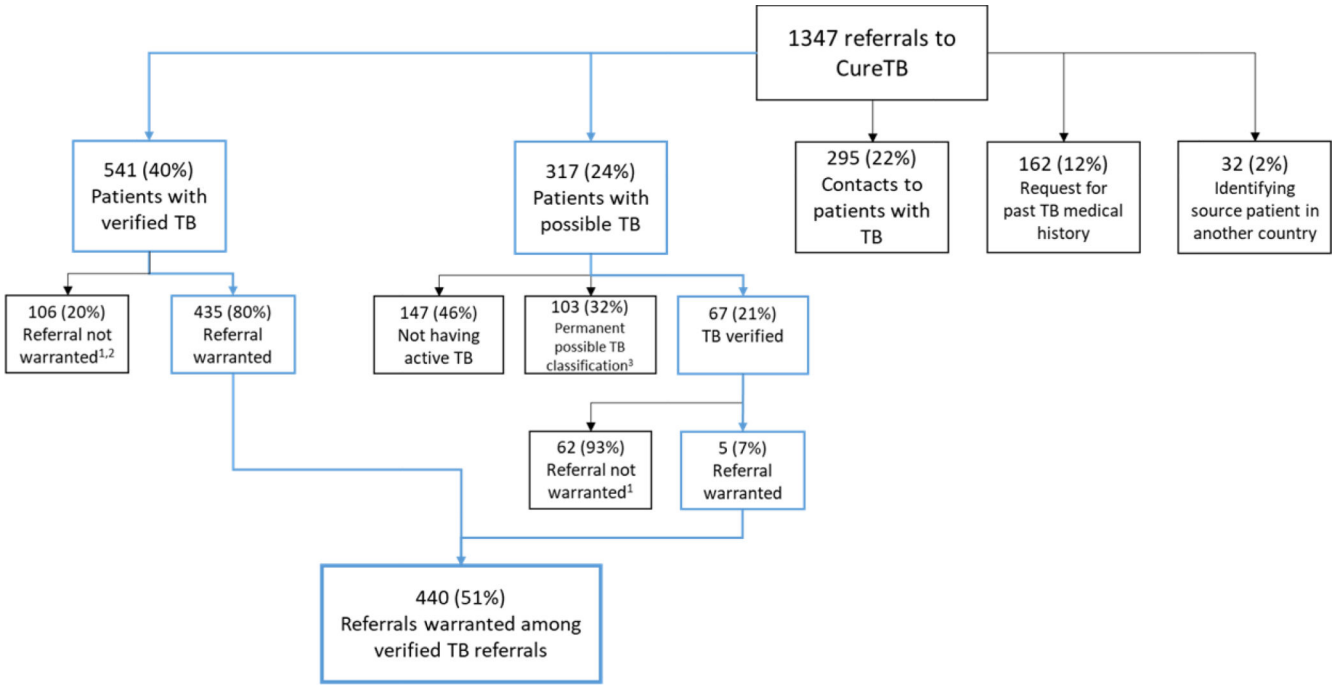

Figure 1. Referrals to CureTB, a US-based transnational referral service for patients with tuberculosis (TB), 2012–2015

[1]Individual decided to remain in the United States or current country of residence or the individual left when less than 30 days of treatment were needed for completion of therapy.

[2]For 3 patients an original TB diagnosis was ruled out agter further diagnostic testing.

[3]Patients not confirmed bacteriologically or verified clinically as having active TB before leaving the United States, or for whom additional diagnostic testing was not available from the destination country and TB had not been definitively ruled out.

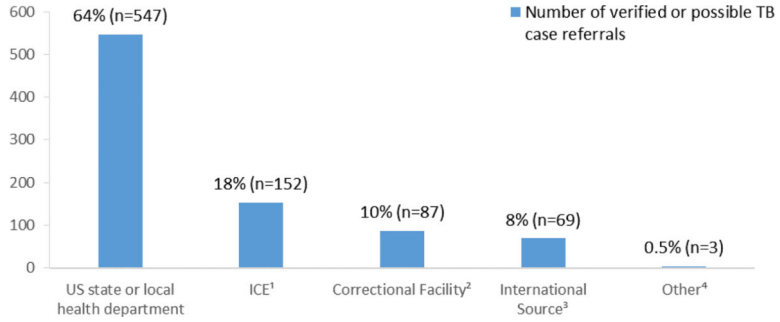

Figure 2. Verified or possible tuberculosis (TB) referrals to CureTB by referring agency, 2012–2015 (n=858)

[1]Immigration and Customs Enforcement detention facilities

[2]Bureau of Prisons, US Marshals, city/state/county corrections center

[3]International ministries of health and healthcare facilities or private physicians

[4]Other domestic sources (Centers for Disease Control and Prevention, Customs and Border Protection, medical centers)

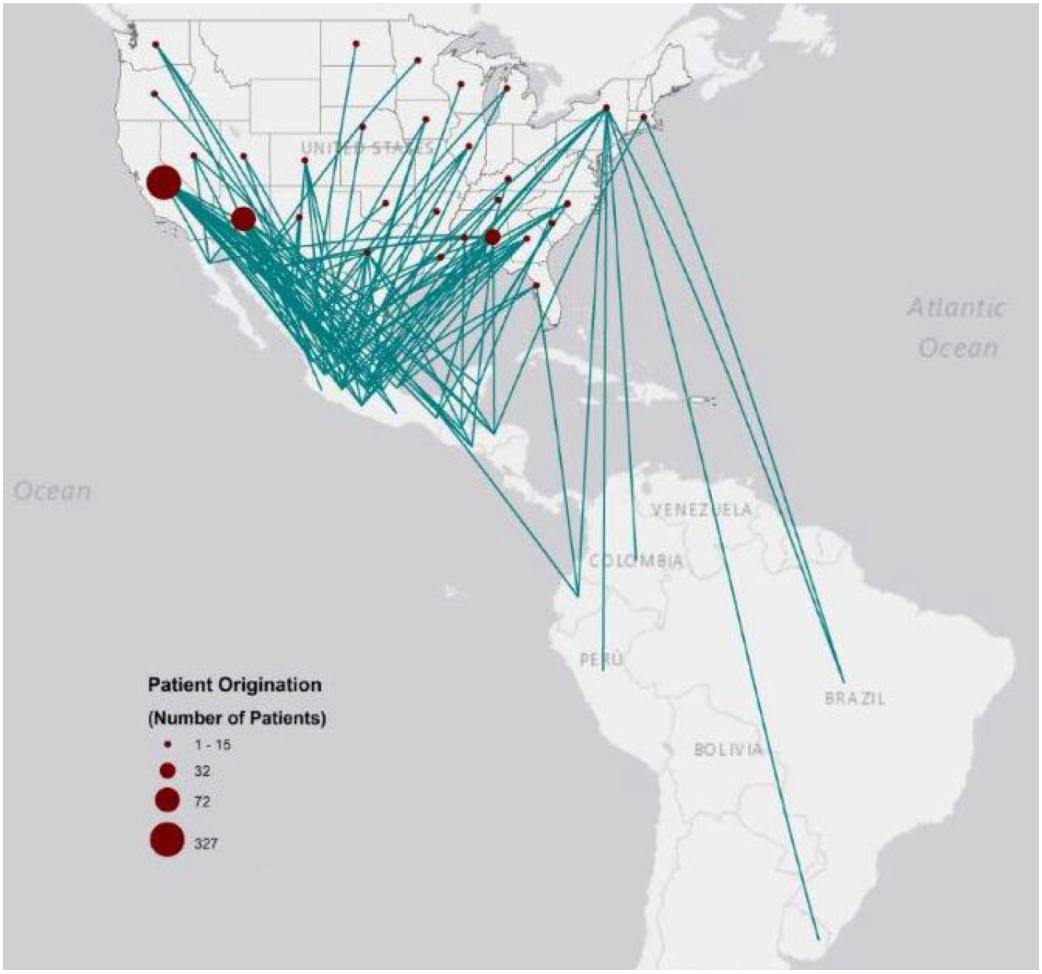

Figure 3. Referring US states and receiving jurisdictions (country or Mexican state) of verified or possible tuberculosis (TB) referrals to CureTB from US health departments, 2012–2015*

*One patient referred by a US health department moved to a country in West Africa, not shown.

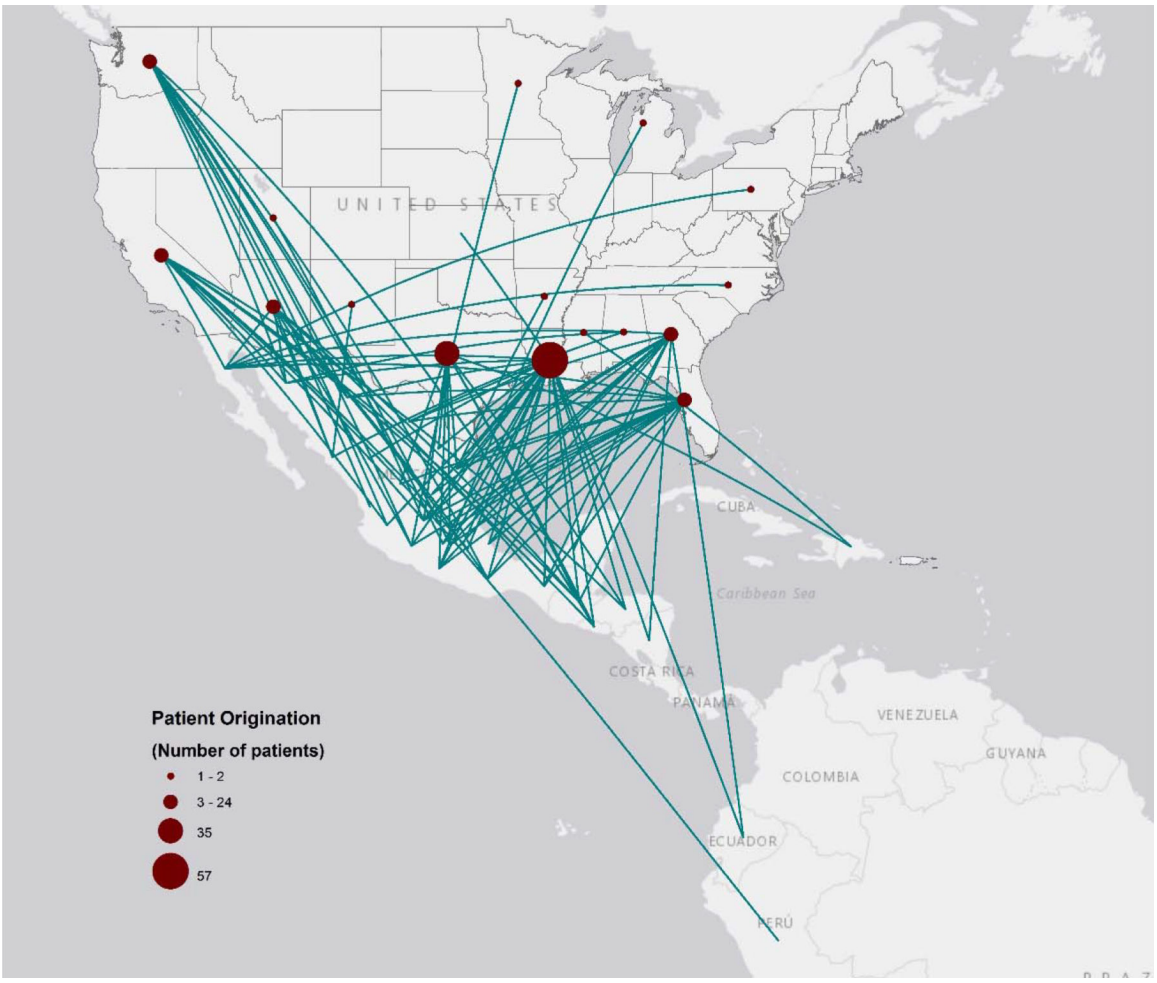

Figure 4.

Referring state and receiving jurisdiction (country or Mexican state) of verified or possible tuberculosis (TB) referrals to CureTB from Immigration and Customs Enforcement or other correctional facilities in the US, 2012–2015

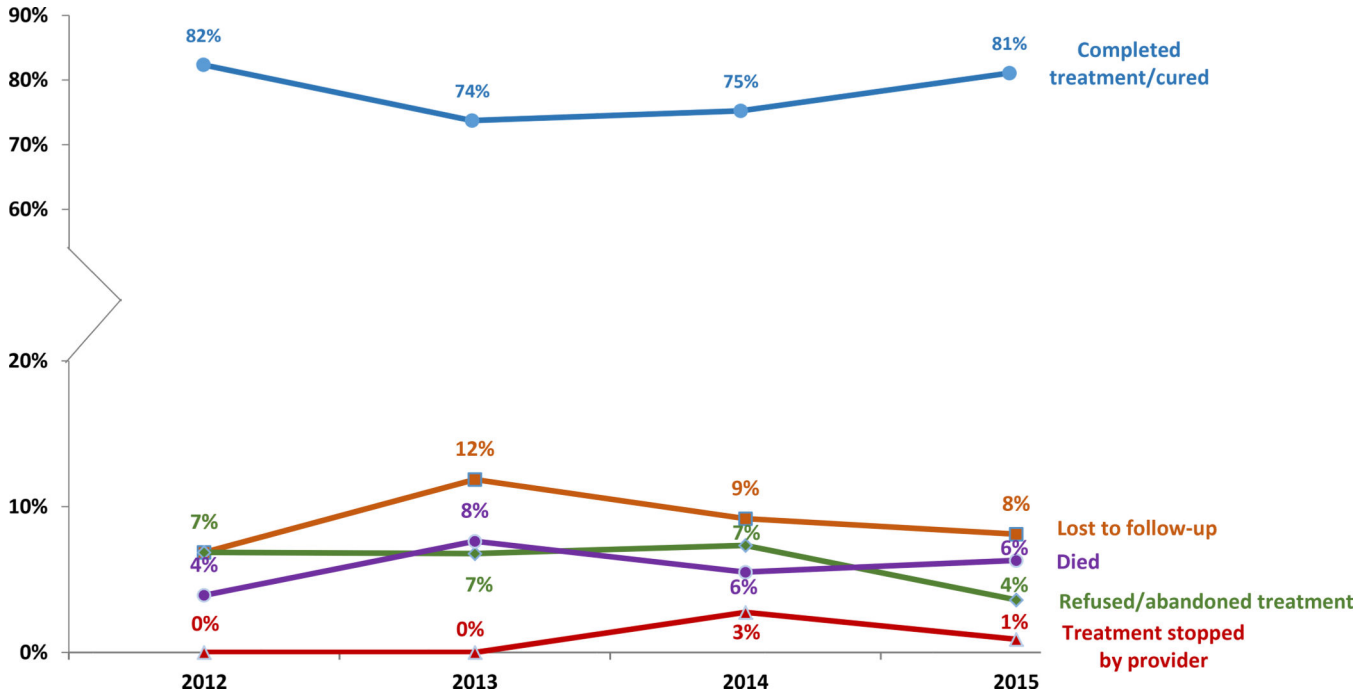

Figure 5.

Outcomes of CureTB referrals for patients with verified tuberculosis (TB) (n=440), by year of referral, 2012–2015

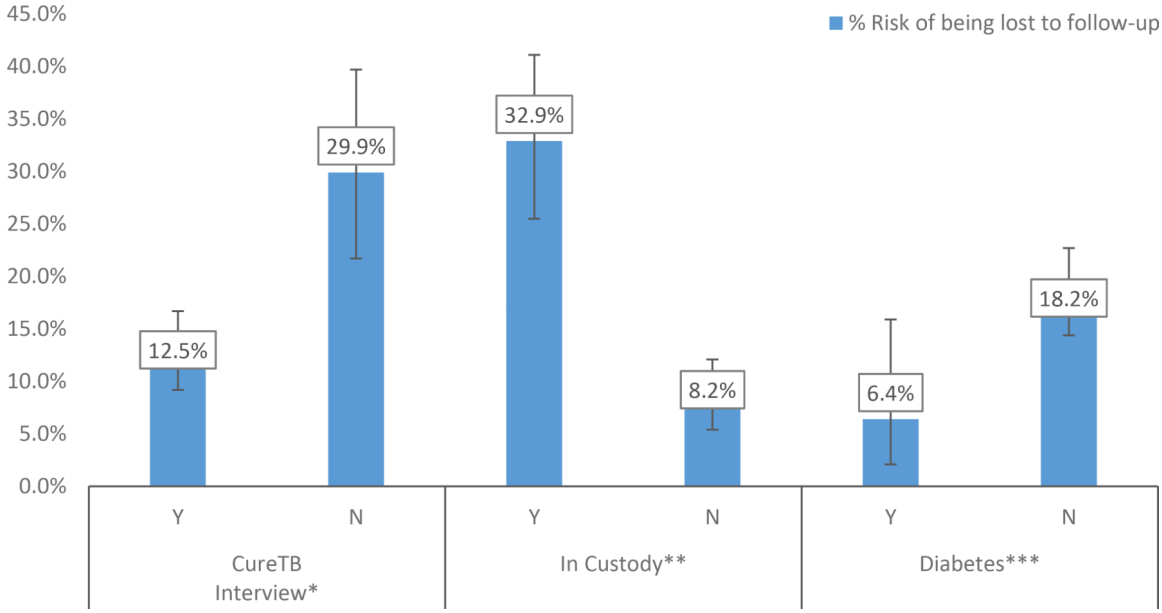

Figure 6. Relative risk of loss to follow-up1 for CureTB referrals with verified tuberculosis (TB), by circumstantial factors and comorbidities, 2012–2015

[1]Loss to follow-up is defined as a reported treatment outcome of lost to follow-up or having refused or abandoned treatment

*Variable data was missing for 38 patients; they were excluded from analysis

**Variable data was missing for 34 patients; they were excluded from analysis

***Variable data was missing for 43 patients; they were excluded from analysis

Note: Brackets represent the 95% confidence intervals of the percentages