

## Border Lookout: Enhancing Tuberculosis Control on the United States–Mexico Border

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**Abstract.** We evaluated the use of federal public health intervention tools known as the Do Not Board and Border Lookout (BL) for detecting and referring infectious or potentially infectious land border travelers with tuberculosis (TB) back to treatment. We used data about the issuance of BL from April 2007 to September 2013 to examine demographics and TB laboratory results for persons on the list ( $N = 66$ ) and time on the list before being located and achieving noninfectious status. The majority of case-patients were Hispanic and male, with a median age of 39 years. Most were citizens of the United States or Mexico, and 30.3% were undocumented migrants. One-fifth had multidrug-resistant TB. Nearly two-thirds of case-patients were located and treated as a result of being placed on the list. However, 25.8% of case-patients, primarily undocumented migrants, remain lost to follow-up and remain on the list. For this highly mobile patient population, the use of this novel federal travel intervention tool facilitated the detection and treatment of infectious TB cases that were lost to follow-up.

### INTRODUCTION

Foreign-born populations in the United States have a higher rate of tuberculosis (TB) than U.S.-born populations.<sup>1</sup> Among countries of origin for foreign-born persons with TB, since 1993 Mexico has contributed almost twice as many new cases as the second highest contributing country.<sup>2</sup> Two-thirds of all foreign-born TB cases occur in the border states of California, Texas, Arizona, and New Mexico.<sup>3</sup> The fluidity of travel for border residents creates a favorable opportunity for treatment lapses and TB transmission on both sides of the international boundary. For example, in 2012, over 159 million persons entered the United States at the land border with Mexico via personal vehicle, bus, or on foot.<sup>4</sup>

Federal public health travel intervention tools—the Do Not Board (DNB) and Border Lookout (BL) list—were created in 2007 to prevent commercial air travel by infectious persons who pose a public health threat.<sup>5</sup> These tools are managed by the Department of Homeland Security (DHS) based on requests from the Centers for Disease Control and Prevention (CDC) Travel Restriction and Intervention expert work group. The BL supplements the DNB§ by enabling federal authorities to detect individuals on the list when they enter the United States at any federal port of entry (POE), and this BL component is especially applicable at land POEs. When a person with a BL enters the United States at a POE, Customs and Border Protection (CBP) officers notify CDC so that a public health evaluation can be conducted before the person is released.<sup>6</sup> In turn, CDC quarantine public health officers notify local and state public health authorities that a person on the list has been detected and work with them to implement effective public health interventions. These interventions include isolation, coordinated treatment referral, and implementation of prearranged federal and state legal measures.

Persons can be placed on the lists for any federal quarantinable illness or any disease posing a threat to fellow trav-

elers,<sup>7</sup> but most persons placed on these lists have infectious or potentially infectious TB, for which coordinated follow-up and control measures are needed.<sup>3</sup> We have worked with local and state TB controllers since 2007 to use the BL to find and resume care for lost-to-follow up infectious or potentially infectious TB patients who regularly cross the United States–Mexico border.

CDC uses the following criteria to determine eligibility for requesting placement on the lists from DHS: 1) infectiousness or potential infectiousness with a communicable disease that would pose a public health threat if the individual traveled internationally; 2) the person is unaware of his/her diagnosis, fails to adhere to public health recommendations, including treatment, or public health authorities are unable to locate the person; and 3) the person poses a risk to travel internationally or on a commercial flight (Figure 1). CDC, state and/or local health departments, and other public health officials discuss each case thoroughly and reach group consensus before requesting list placement. Removal from the lists requires a single criterion: noninfectiousness. Achieving noninfectious status for TB generally requires at least 1 week of adequate treatment and documentation of three consecutive negative sputum acid-fast bacteria (AFB) smear results. For multidrug-resistant (MDR) strains of TB, a longer duration of treatment and negative sputum cultures are needed to demonstrate noninfectiousness.

We summarize here 6 years of data of United States–Mexico border experience with the BL, demonstrating that the tool facilitates the detection and referral of TB patients that travel internationally via land borders.

### MATERIALS AND METHODS

We reviewed all case patients who traveled across the United States–Mexico land border and were added to the BL for infectious TB from April 20, 2007 to September 20, 2013 ( $N = 66$ ). Occasionally, some persons previously removed are placed back on the list when lost to follow-up again after CDC had referred them to the health department. Unless otherwise noted, analyses only include data from the most recent list placement to avoid duplication. Ethical approval was not required for this analysis.

We examined demographics including ethnicity, sex, country of citizenship, and age at the time of BL placement. We

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§ The DNB prevents the issuance of a boarding pass to a person on the list for any commercial flight arriving in, departing from, or within the United States.

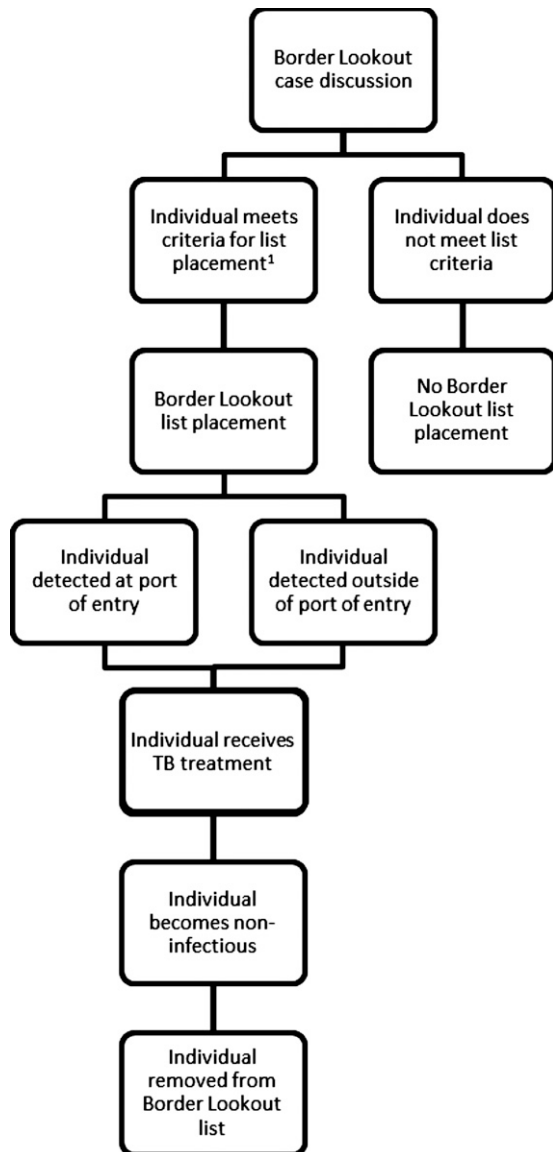


FIGURE 1. Border Lookout list process. <sup>1</sup>Criteria for list placement: (1) infectiousness or potential infectiousness with a communicable disease that would pose a public health threat if the individual traveled internationally; (2) the person is unaware of his/her diagnosis, fails to adhere to public health recommendations, including treatment, or public health authorities are unable to locate the person; and (3) the person poses a risk to travel internationally or on a commercial flight.

also examined immigration status; categories include U.S. citizen, legal permanent resident (LPR) or someone who has applied for legal permanent residence, undocumented migrant, and other. The latter category includes persons on a temporary nonimmigrant visa, such as tourists and students.

State health departments and local health jurisdictions are the primary sources of notifications to CDC when a TB patient under their care is lost to follow-up and becomes a potential candidate for list placement. We describe which states requested assistance from CDC for such cases.

When infectious TB is suspected, three sputum samples are typically collected at least 8 hours apart and analyzed for AFB by smear. Cultures and drug susceptibility testing (DST) are routinely performed on samples in the United States. We

examined the laboratory test results of cases and dichotomized resistance as either MDR or non-MDR. Non-MDR TB includes mono-resistance to isoniazid.

Removal of cases from the BL requires detection and subsequent referral for treatment until noninfectious. An individual remains on the list if he or she 1) continues to be infectious despite treatment or 2) cannot be located. We determined the list removal status for persons placed on the list and performed Fisher's exact test to determine differences in case removal status by immigration status.

We calculated time from placement on the BL until detection. For cases removed from the list, we categorized the person as either 1) removed after detection at a POE or 2) detection stemming from binational case investigations triggered by BL placement, but without detection at a POE. We also calculated the time each person spent on the list, which reflects treatment time before achieving noninfectiousness. We used the nonparametric Wilcoxon rank sum test to quantify the difference in total time spent on the list, by method of detection (POE and non-POE), and by MDR TB status. Seven individuals were each placed on the list twice. Since each time a person was placed on the list and subsequently detected is a unique event representing the capabilities of the BL tool, here we used the total number of list placement events.

All analyses were performed in SAS version 9.3 (SAS Institute, Cary, NC). We assessed significance at  $P < 0.05$ .

## RESULTS

The majority of United States–Mexico land border TB case-patients placed on the BL ( $N = 66$ ) were Hispanic (89.4%) and male (71.2%), with a median age of 39 (range 17–88) (Table 1). Country of citizenship was primarily Mexico (45.5%) and the United States (43.9%). Undocumented migrants comprised a significant portion of the

TABLE 1

Demographic characteristics of tuberculosis case patients ( $N = 66$ ) detected at the United States–Mexico land border, April 20, 2007 to September 20, 2013

Characteristic	Median (range)
Age (years)	39 (17–88)
Characteristic	Frequency (%)
Hispanic	59 (89.4)
Male	47 (71.2)
Citizenship country	
Mexico	30 (45.5)
United States	29 (43.9)
Other*	3 (4.6)
Unknown	4 (6.1)
Immigration status	
U.S. citizen	29 (43.9)
Undocumented migrant	20 (30.3)
Immigrant visa/legal permanent resident	7 (10.6)
Other†	5 (7.6)
Unknown	5 (7.6)
Requesting state	
California	38 (57.6)
Texas	19 (28.8)
Arizona	3 (4.6)
New Mexico	2 (3.0)
Other/unknown‡	4 (6.1)

\*Includes: Guatemala and China.

†Includes persons, such as tourists and students, on a temporary, nonimmigrant visa.

‡Includes: Public Health Agency of Canada, Kentucky, and Florida.

TABLE 2  
Public health Border Lookout list case outcome status, by immigration status, April 20, 2007 to September 20, 2013

		Case status, frequency (%)			
		Found and actively followed	Remain lost to follow-up	Found, treated, and removed from BL (achieved noninfectious status)	Total (%)
Immigration status	LPR/immigrant visa	1 (14.3%)	0	6 (85.7%)	7 (10.6%)
	U.S. citizen	5 (17.2%)	0	24 (82.8%)	29 (43.9%)
	Undocumented	1 (5.0%)	14 (70.0%)	5 (25.0%)	20 (30.3%)
	Other*	0	2 (40.0%)	3 (60.0%)	5 (7.6%)
	Unknown	0	1 (20.0%)	4 (80.0%)	5 (7.6%)
	Total	7 (10.6%)	17 (25.8%)	42 (63.6%)	66

BL = Border Lookout list; LPR = legal permanent resident.  
\*Includes persons, such as tourists and students, on a temporary, nonimmigrant visa.

cases (30.3%). California requested the majority of additions (57.6%), followed by Texas (28.8%), Arizona (4.6%), and New Mexico (3.0%).

Forty-six persons had complete initial AFB smear and culture results available. Of these, 100% were culture positive and 21 (45.7%) were AFB smear positive.

The majority of cases added to the BL were found and achieved noninfectiousness and were thus removed from the list (63.6%) (Table 2). However, a quarter of cases remain lost to follow-up on the BL (25.8%). Although the majority of cases in U.S. citizens (82.8%) and LPRs (85.7%) were resolved and removed from the BL, most cases (70.0%) in undocumented migrants remained lost to follow-up ( $P < 0.0001$ ). All U.S. citizens and LPRs placed on the BL were either found and treated to noninfectiousness or continued treatment.

Of cases found and eventually removed from the BL ( $N = 48$ ), including seven persons who were each added and removed twice, the mean time on the list was 179 days (standard deviation: 211 days; median: 117 days; range: 12–861 days). Complete data on when persons were located were available for 45 cases. Those detected at a POE spent an average of 41 days (standard deviation: 71 days; range: 1–253 days) on the list before detection, while those located outside a POE as a result of a BL binational case investigation spent an average of 93 days (standard deviation: 156 days; range: 1–627 days) on the list before being located and referred to treatment (Table 3;  $P = 0.0452$ ). Those detected at a POE spent an average of 91 days (standard deviation: 85 days; range: 12–283 days) before being removed from the list, compared with an average of 310 days (standard deviation: 258 days; range: 41–861 days) for those referred to treatment after being detected at a location outside a POE ( $P = 0.0002$ ).

TABLE 3

Average amount of time on the public health Border Lookout list among persons eventually removed from the list ( $N = 45$ ) by location of detection, POE, or other non-POE location, April 20, 2007 to September 20, 2013

	Mean	Standard deviation	Range (days)
Detected at POE ( $N = 30$ )			
Time to detection	41.1 days	71.4 days	1–253
Time on list	90.7 days	85.1 days	12–283
Non-POE detection ( $N = 15$ )			
Time to detection*	92.9 days	155.9 days	1–627
Time on list†	309.8 days	257.6 days	41–861

POE = port of entry.  
\*Those detected at a POE had a shorter time to detection than those detected outside a POE ( $P = 0.0452$ ).  
†Those detected at a POE spent less time on the list than detected outside a POE ( $P = 0.0002$ ).

DST results were available for 40 persons, of whom 9 (22.5%) had MDR TB. Of the 31 persons with non-MDR TB, 16 (51.6%) were detected at a POE, compared with 2 (22.2%) of the 9 persons with MDR TB. The mean time to detection and referral for non-MDR cases was 40 days, compared with 215 days for MDR cases. Persons with non-MDR TB spent an average of 99 days on the BL (standard deviation: 95 days; range: 12–260 days), compared with an average of 397 days (standard deviation: 364 days; range: 103–861 days) for MDR cases ( $P = 0.0220$ ).

DISCUSSION

Nearly two-thirds of United States–Mexico land border TB case-patients placed on the BL were found and subsequently removed after achieving noninfectiousness. Patients who were successfully found and restarted on treatment spent an average of 178 days on the list before becoming noninfectious. Persons located at a POE were on average found and treated to noninfectiousness more quickly than persons found outside of a POE as a result of BL stimulated communication and collaboration with binational public health authorities. Referral health departments on both sides of the border are responsible for ensuring TB treatment completion. Although the BL system does not track completion of TB treatment, most persons removed due to noninfectiousness do complete treatment according to the treating health departments. Future studies documenting treatment completion rates among this population will be important.

The majority of United States–Mexico land border case patients placed on the BL are U.S. citizens, followed by undocumented migrants. The observation that a greater proportion of persons on the list are U.S. citizens and undocumented migrants is not surprising because LPR applicants must undergo TB screening and, if needed, treatment of active disease in their country of origin before being issued an LPR visa. LPR are also a less hard to reach population in general than undocumented migrants, and thus less likely to become lost during TB treatment.

U.S. Immigration and Customs Enforcement (ICE) maintains authority to detain and deport undocumented persons.<sup>8</sup> These undocumented persons are held in detention centers and jails nationwide through various contracts and intergovernmental service agreements.<sup>9</sup> Upon admission to ICE custody, detainees are screened for TB by chest x-ray and skin testing.<sup>10</sup> Confirmed active TB cases are reported to local and/or state health departments.<sup>10</sup> Persons in custody who have not yet completed treatment or are pending AFB laboratory confirmation for TB are sometimes deported without

binational case management planning despite ongoing federal and state public health efforts and progress in addressing this situation. Case finding and continuity of care in the country of repatriation for these patients are challenging. Such persons comprise the majority of undocumented cases that remain on the BL.

Undocumented migrants disproportionately remain lost to follow-up, while U.S. citizens and LPRs comprise most of the resolved cases that have been removed from the BL. Undocumented migrants are understandably less likely to cross the border into the United States at POE from which CBP BL notifications to public health usually take place. Increasing communication between CDC and Border Patrol, the arm of CBP that focuses on border regions outside of POEs, for BL cases is desirable and can strengthen lost TB case finding efforts, but will require extensive coordination with DHS and training.

California and Texas request the majority of BL placements. These two states have large populations of foreign-born residents and the two highest incidences of TB among all U.S. states.<sup>1</sup> California and Texas are also the recipients of the largest number of LPRs with admissible suspected TB conditions.<sup>11</sup> Arizona and New Mexico request fewer BL placements than California and Texas, but more list placements than non-United States–Mexico border states. Proximity to the border and volume of immigration clearly contribute directly to the number of BL requests by states. Efforts to increase awareness of the BL tool are warranted in other nonborder states that have large Hispanic mobile immigrant populations with significant TB burden.

Since most United States–Mexico land border case patients are Hispanic, many with limited English proficiency, the CDC United States–Mexico Border Quarantine Stations and other parts of CDC have Spanish language communication skills and resources available for the BL system. These resources include translation of legal notices compelling treatment and partnership with binational TB referral programs such as Cure TB in San Diego County, CA<sup>12</sup> and Migrant Clinicians Network's TB-Net in Austin, TX.<sup>13</sup> We also notify the Mexican Ministry of Health and Mexican National TB Program about binational cases.

DST results were available for 40 persons in our analysis. Many of the cases that lacked results were diagnosed in Mexico. In Mexico, TB diagnoses are made based on World Health Organization diagnostic criteria for TB, which require positive AFB smear results and medical assessment of symptoms; culture is generally not performed because of limited resources.<sup>14</sup>

Twenty-two percent of United States–Mexico land border TB cases with available DST results were MDR. In the United States, overall, 1.2% of TB cases in 2012 were MDR.<sup>15</sup> Intermittent or inadequate treatment, a common element in the case history of travelers placed on the BL, is a factor in the development of drug resistance. Access to health care is an important issue for foreign-born TB patients in the United States, especially for undocumented migrants, and could be a factor in the delays or interruptions to treatment.<sup>16</sup> Other social risk factors for intermittent treatment include homelessness and drug or alcohol addiction.<sup>17</sup> MDR rates are higher in Mexico than the United States.<sup>18</sup> Achieving TB remission for persons with MDR strains is difficult, as the treatment is far more complex and time consuming, leading to a greater adher-

ence challenge for the patient. This phenomenon helps explain why persons who had MDR TB remained on the BL longer than non-MDR cases. Although the BL process for identifying lost to follow up MDR TB patients was not as timely, the eventual location of and returning such patients into treatment is important to prevent the further spread of MDR strains.

Nearly half of all persons placed on the BL had positive AFB smears, indicating highly infectious cases. Persons with a history of positive TB culture and insufficient treatment must also be considered potentially infectious even if sputum AFB smear results are negative. Each case receives careful consideration at each step in the BL addition and removal process, taking into account the person's specific medical history. Public health officials discuss each case and recommend placement on the BL after reaching consensus that federal protocol criteria are met. Although not included in this analysis, discussion often leads to case resolution—that is, finding the case that was lost to follow-up—without BL placement. From April 2007 to September 2013, 13 United States–Mexico land border TB case patients were considered for but not placed on BL because they were found and returned to treatment. Thus, interagency communication and collaboration stimulated and enabled by the BL process helped to reduce the burden of untreated or improperly treated TB in the United States, even without the need to put the tool into use.

## CONCLUSION

The BL is a federal travel intervention tool that facilitates the detection of infectious TB cases and improves the continuation of treatment. To enhance the effectiveness of this tool at the United States–Mexico border, strategies should be considered for 1) applying the tool earlier for binational TB case patients who are at risk of progressing to infectious due to nonadherence<sup>19</sup> and who are likely to travel across the international border, 2) training Border Patrol officers to contact CDC if they locate undocumented migrants who are on the BL, and 3) maximizing the utilization of binational TB referral projects and resources in collaboration with ICE. The use of the BL should continue, perhaps with expanded efforts directed toward states as yet not familiar with the process. Future studies that analyze the costs of the BL and evaluate its public health impact will be important.

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