

# Panorama of Tuberculosis in Mexico Focusing on the Northern Border

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## INTRODUCTION

Tuberculosis is one of humanity's oldest diseases and the one that has caused the most death and suffering. It also continues to be a huge threat given the rise in resistance to medications, its link with the human immunodeficiency virus (HIV-AIDS), and, particularly in Mexico and other countries, a closer and closer link to diabetes mellitus (DM), given the role of certain social determinants of health, such as poverty, marginalization, alcoholism, and migration.

This is a generally chronic systemic or localized infectious disease caused by *Mycobacterium tuberculosis* (MTb), transmittable by air (from person to person), traveling through the droplets that accompany usually untreated patients' coughs or

sneezes. It manifests itself mainly in the form of a cough with phlegm, at times with blood, weight loss, afternoon fevers, heavy night sweats, fatigue, and loss of appetite.<sup>1</sup> In Mexico, cases are found in all 31 states and Mexico City's Federal District, but along the border it presents with certain specificities, as we shall see further along.

## TB IN MEXICO AND THE WORLD

World Health Organization (WHO) estimates indicate that one-third of the planet's population (more than 2.3 billion people) is infected with tuberculosis (TB). Every year, almost nine million new cases are detected, and it causes 1.4 million deaths a year worldwide.<sup>2</sup>

In Mexico, official data for 2012 from the National System of Epidemiological Surveillance (Sinave) registered 21 354

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cases of all forms of TB; of these, 19 697 were new cases and the rest had already been treated; 80.7 percent were pulmonary TB; 1.5 percent, tubercular meningitis; 5.9 percent, lymph node TB; and 11.9 percent, other forms (see Image 1).<sup>3</sup>

Tuberculosis can also accompany other diseases, making diagnosis and follow-up more complex and costly. In Mexico, the most important co-morbidity is with diabetes mellitus, at a 21 percent rate of association. The link-up of TB and HIV-AIDS is 5.8 percent, and of TB and malnutrition, 11.6 percent.

It was in 1997 that Mexico registered its highest number of pulmonary TB cases (see Graph 1), with a rate of 20.7 cases per 100 000 inhabitants. Since then, the rate gradually dropped until 2012, when it had decreased by 34.8 percent to 13.5 cases per 100 000 people.<sup>4</sup>

Parallel to this, in 1990, deaths were caused by pulmonary TB, at a rate of 6.5 per 100 000; this has dropped continually, and by 2012, it had shrunk 69.2 percent to a rate of 1.8.<sup>5</sup> The improvement can be attributed to the strategies of directly observed treatment, short-course (DOTS) as part of the Stop TB Global Plan, which Mexico has followed as closely

IMAGE 1  
TUBERCULOSIS IN MEXICO, 2012

21 354 cases of all forms of tuberculosis  
(new and previously treated)

19 697 new cases of all forms of TB  
80.7% pulmonary  
1.5% meningitis  
5.9% lymph nodes  
11.9% other forms



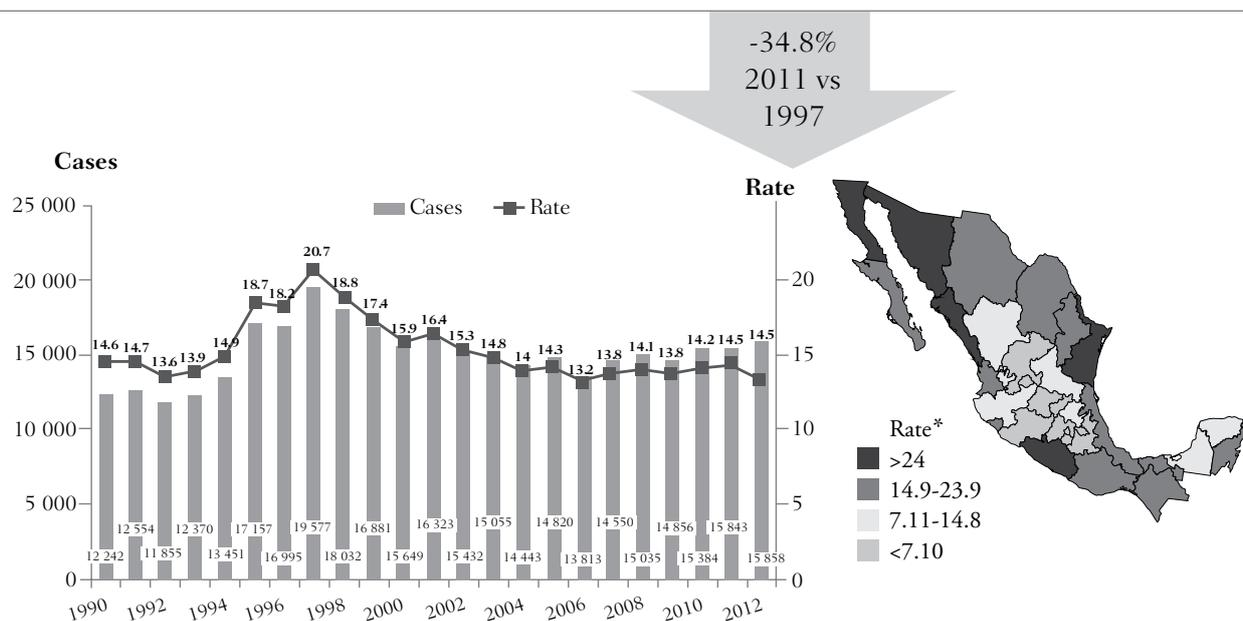
- 19% associated with diabetes
- 5.8% linked to HIV-AIDS

Rate  
 ■ >24  
 ■ 14.9-23.9  
 ■ 7.11-14.8  
 ■ <7.10



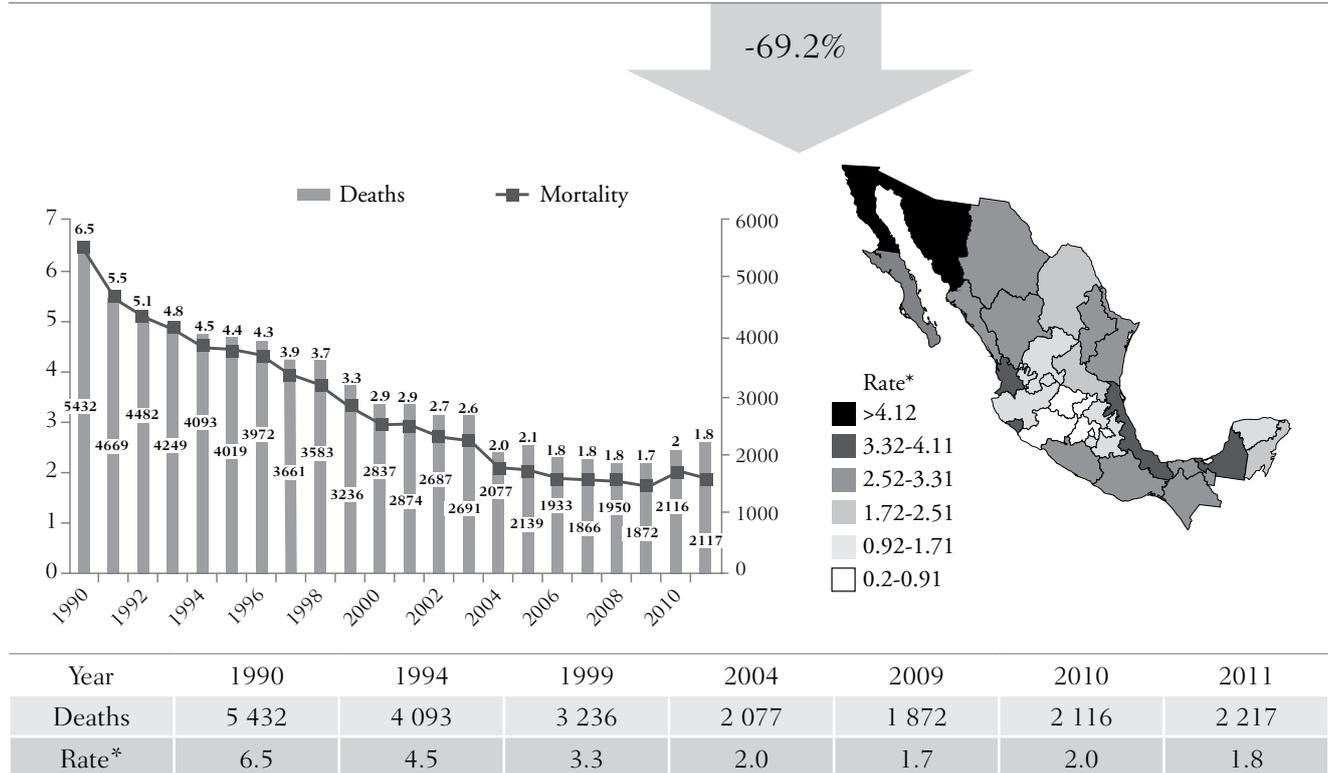
Source: Plataforma Única de Información/Suive/DGE/SS, June 6, 2013, DGIS/Cubos 2011.  
 Note: Rate per 100 000 inhabitants.

GRAPH 1  
INCIDENCE OF PULMONARY TUBERCULOSIS, MEXICO (1990-2012)



Source: Plataforma Única de Información/Suive/DGE/SS, June 6, 2013. \*Rate per 100 000 inhabitants.

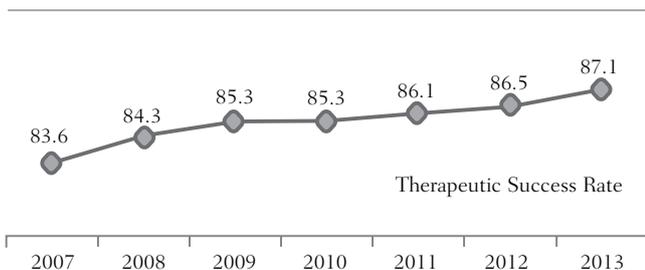
GRAPH 2  
DEATHS FROM PULMONARY TUBERCULOSIS, MEXICO (1990-2011)



\*Rate per 100,000 inhabitants, CONAPO, proyección 2010-2050.  
Source: DGIS Cubos dinámicos de mortalidad año 2011.

Tuberculosis can also accompany other diseases, making diagnosis and follow-up more complex and costly. In Mexico, the most important co-morbidity is with diabetes mellitus.

GRAPH 3  
THERAPEUTIC SUCCESS



Source: Suive/DGE/SS 2012.

as possible (see Graph 2). The aim of the national program is to diagnose and cure cases, and we can say that therapeutic success has grown steadily, from 83.6 percent in 2007 to 87 percent by 2012 (see Graph 3).

Based on this and the TB-related aspects of the Millennium Development Goals (MDGs),<sup>6</sup> Mexico has achieved the standards targeted for 2015, both regarding mortality rates and cures. However, in recent years, the concern about a gradual increase in the incidence rate continues due to the number of cases associated with diabetes mellitus, which is a threat for TB control.<sup>7</sup> We should remember that this disease is more frequent among males than females at a rate of 1.6:1, and affects mostly members of the active workforce (from 18 to 45 years of age).

TB ON MEXICO'S NORTHERN BORDER

This border area has certain specificities and conditions vis-à-vis tuberculosis. It is the most developed part of the country and, therefore, the destination for the migrant population.

Baja California, Sonora, Chihuahua, Coahuila, Nuevo León, and Tamaulipas registered 34 percent of the country's total pulmonary tuberculosis cases and almost 40 percent of the drug-resistant cases.<sup>8</sup> This makes it the region with the highest incidence and mortality rates nationwide.

Other social determinants for tuberculosis in this region are the high rate of transient population, of agricultural day-workers, of illicit drug users, as well as the high prevalence of diabetes and HIV-AIDS, the large number of people confined in jails and prisons, and others who for different reasons live in circumstances that make it impossible to strictly supervise treatment due to phenomena associated with insecurity and organized crime. These determinants have the highest incidence in the state of Baja California, which also has the highest morbidity and mortality rates for tuberculosis: more than three times the national number. It is followed by Ciudad Juárez in Chihuahua and Reynosa and Matamoros in the state of Tamaulipas.

In 2012, the northern states reported pulmonary TB cases as follows: Baja California, 1 507, or 9.5 percent of the national total, with a rate of 45.3 cases per 100 000 inhabitants; Sonora, 749 cases, 4.7 percent of the national total and a rate of 26.1; Chihuahua, 630 cases, or 3.9 percent of the national total and a rate of 17.5; Coahuila, 461 cases, 2.9 percent of the national total and a rate of 16.2; Tamaulipas, 1 025 cases, 6.46 percent of the national total and a rate of 30; and Nuevo León, 1 072 cases, 6.75 percent of the national total and a rate of 22 per 100 000 inhabitants. The total for the six states

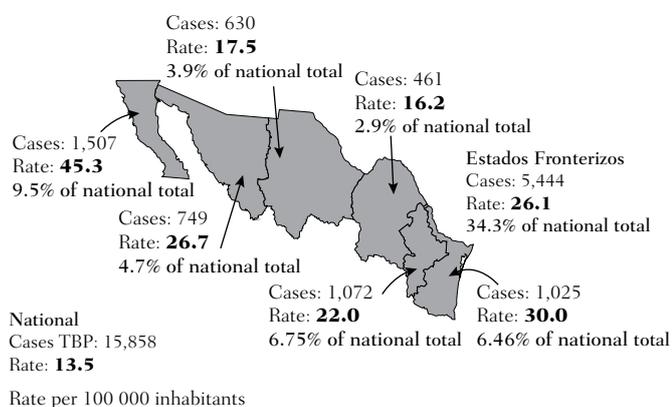
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is 5 444 pulmonary TB patients, representing 34.3 percent of the nation's total and a rate of 26.1 cases per 100 000 inhabitants, compared to the 2012 national total of 13.5 (see Image 2).

With regard to death rates, the trend is in marked decline both nationwide and regionally. Despite the region's problems, efforts have been aimed at improving TB prevention and control; in addition to national support, binational projects have added to the mix, particularly international agencies like USAID, the Pan-American Health Organization, the PCI, CATRE, Los dos Laredos, Juntos, and Puentes de Esperanza (Bridges of Hope), among others. This has meant that treatment success in the area is 81.5 percent, almost as high as the 87.1 percent nationwide. We can infer from this that the border's success is not greater due to the fact that rates of treatment abandonment and deaths are still high. The state with the least success and the highest number of patients who have stopped treatment is Baja California, with 72.7 percent and 17.3 percent respectively, while Sonora and Chihuahua both registered higher death rates in 2012.

Drug-resistant tuberculosis is a priority for the National Tuberculosis Program (PNT), particularly along the northern border, since 38.5 percent of the cases can be found there, especially in Tamaulipas, Nuevo León, Baja California, Coahuila, and Sonora.<sup>9</sup>

IMAGE 2  
INCIDENCE OF PULMONARY TB IN  
MEXICAN BORDER STATES (2012)

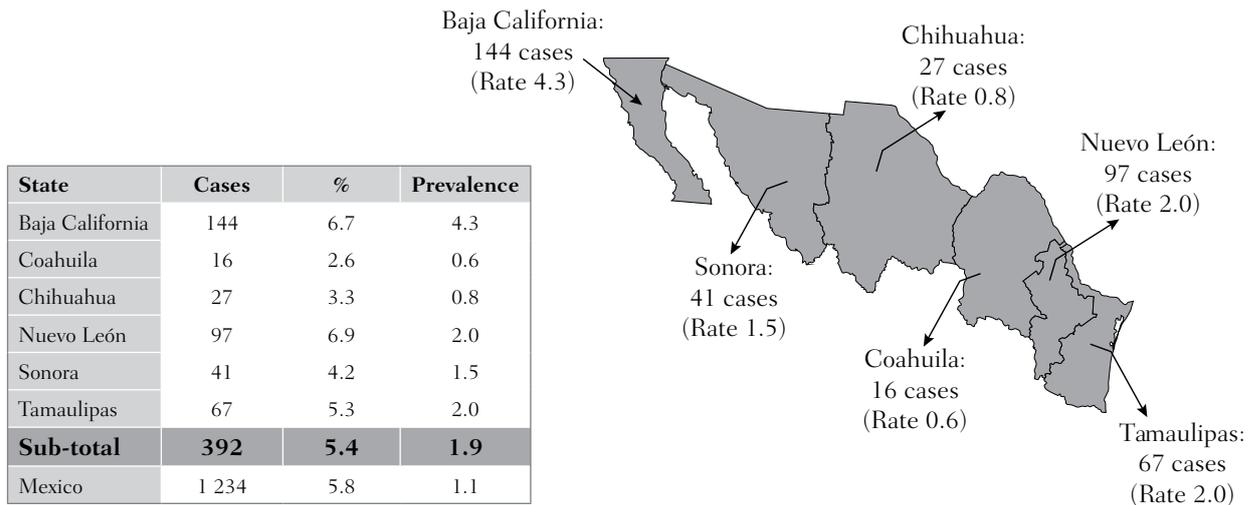


Source: Developed by the author with data from Reforma Única de Información/Módulo Tuberculosis SINAVE.

#### TB AND HIV-AIDS IN MEXICO AND ON THE NORTHERN BORDER

The TB/HIV-AIDS binomial is a lethal combination: one influences the other. This co-morbidity trend in Mexico is on the rise: in 2003, 598 cases were registered, while by 2012, 1 234 cases had been detected. The northern border logged 32 percent of the total TB/HIV-AIDS co-morbidity cases in 2012, with Baja California registering the highest number (144), followed by Nuevo León (97), and Tamaulipas (67) (see Image 3).

IMAGE 3  
ALL FORMS OF TB AND HIV ON THE NORTHERN BORDER, MEXICO (2012)



**Mexico, National Total:** 1 234 cases; all forms of TB/HIV (rate = 1.1)  
**Northern Border:** 392 cases of all forms of TB/HIV (rate, 1.9), or 32% of national total.

One priority for controlling tuberculosis is a deliberate search for HIV among TB patients. In 2012, then, 12 239 HIV tests were done on all TB patients over 15 (18 645). This was 65.7 percent, when the National Tuberculosis Program goal for that year was 70 percent. Of those covered, 939 persons tested positive for HIV, or 7.7 percent of newly reported TB cases.

The 2012 cohort of TB/HIV-AIDS cases treated on the northern border was 251; of those, 115 (46 percent) were successful and 30 (12 percent) abandoned treatment. The important thing about this cohort is that of the 76 people who died, only 11.2 percent did so because of TB (see Table 1). The states with the lowest percentages of cures and successful TB/HIV-AIDS treatment are Coahuila and Baja California, with 30 and 33 percent respectively.

TB/DIABETES MELLITUS CO-MORBIDITY  
IN MEXICO AND ON THE NORTHERN BORDER

Tuberculosis and diabetes (DM) are both serious treatment and control challenges. The idea that there is a strong link between the two is very longstanding. However, few studies evaluate this risk quantitatively in the general population. Based on this, TB/DM co-morbidity has recently been recognized by the

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Pan-American Health Organization (PAHO) and the International Union against Tuberculosis and Respiratory Diseases (The Union) as a serious world threat.

In Mexico the link between TB and diabetes clearly increased from 2003 to 2012, with 1 469 cases in 2003 and 4 031 in 2012, a 174 percent hike. The northern border was home to 1 245 of the 4 031 cases of all forms of TB, a 31 percent rise for the country. The states with the largest number of cases are Nuevo León and Tamaulipas (see Image 4).

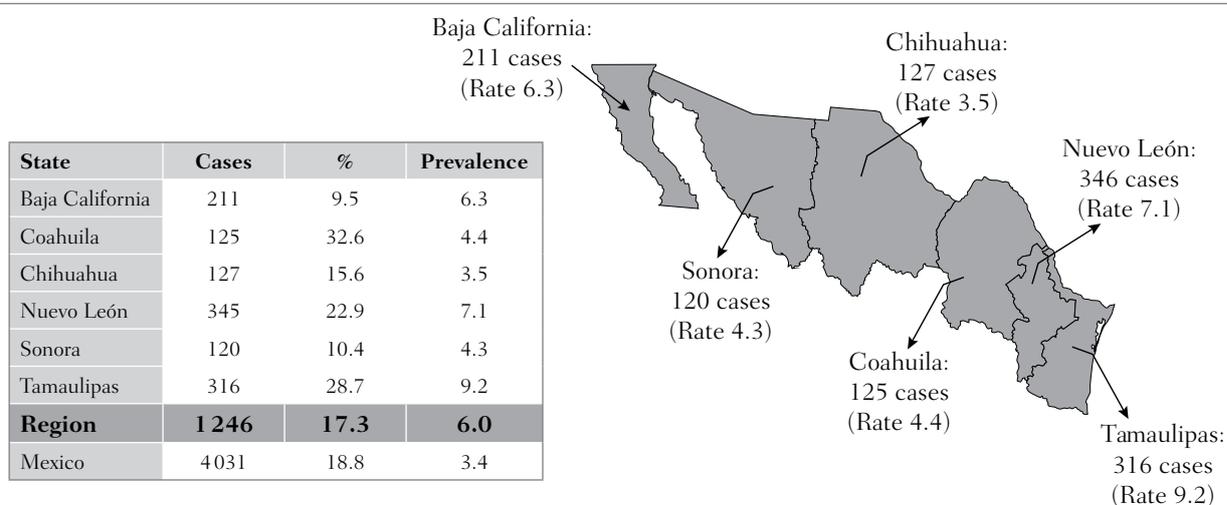
In 2012, 8 089 persons with TB accepted taking a test for diabetes; of those, 1 568 (19 percent) tested positive. This finding was made thanks to the strategy of intentionally searching for diabetes among TB patients. The cohort for treatment of the TB/DM binomial contrasts markedly from the results for the TB/HIV-AIDS binomial, with a much bigger advantage for TB/DM patients: of the 830 people who were treated, 81 percent (that is, 673) were successful. However, of that total of 673, 19.1 percent (129 people) did not test bacteriologically

TABLE 1  
SUMMARY OF TB-HIV COHORT  
(January-September 2012)

22.9% finish treatment without verifying cure through smear or culture; 19% die from causes other than TB					
Total # of cases that began treatment	Successes	Failures	Deaths	Stopped treatment	No follow-up
Border: 251	115 (46%)	4 (1.6%)	76 (30.4%)	30 (12%)	26 (10.4%)
National: 778	409 (52.6%)	7 (0.9%)	176 (22.6%)	49 (6.3%)	137 (17.6%)

Source: Developed by the author using information published in the Plataforma Única de Información/Suive/DGE/SS, Programa Nacional de Tuberculosis de la Secretaría de Salud.

IMAGE 4  
ALL FORMS OF TB AND DIABETES MELLITUS (DM) ON THE NORTHERN BORDER, MEXICO (2012)



Mexico, National Total: 4 031 cases; all forms of TB/DM (rate = 3.4)

Northern Border: 1 271 cases of all forms of TB/DM (rate, 6.1), or 31% of national total

Source: Plataforma Única de Información/Suive/DGE/SS, at close of 2012.

negative at the end of their treatment. Now, of the overall number (830), the treatment of 21 patients (2.5 percent) failed and they had to be admitted to a different treatment for drug resistance, which is evaluated separately in this study. Of those, 58 (7 percent) died; 48 (5.8 percent) halted treatment; and in 29 cases (3.5 percent), no follow-up was logged (see Table 2). The states with the poorest treatment results for this binomial were again Baja California and Coahuila.<sup>10</sup>

Among Mexico's national TB control strategies is the referral of the so-called binational cases that enter from the

United States. That is, through two agencies, CureTB and TBnet, Mexico is informed when a TB patient is referred voluntarily or involuntarily to Mexico. Information exchange, then,

TB/Diabetes Mellitus co-morbidity has recently been recognized by the Pan-American Health Organization as a serious world threat.

has improved substantially in recent years, which implies a better chance of following up and assuring treatment continuity until a cure is obtained.<sup>11</sup> In 2012, 88 cases were referred, 64 percent of which were therapeutically successful, contrasted with 2005, when the success rate was only 30 percent, and in many of those cases it was not possible to locate the patients for follow-up. It should be mentioned that the state with the most binational referrals is Baja California, with almost 25 percent of the country’s total.

CHALLENGES FOR ADVANCING IN THE CONTROL OF TB

The challenges are greater today than in previous decades. That is why the performance of state programs is very important, particularly the links inside the sector; only that way will it be possible to consolidate the strategies to beat this ancient disease.

Therefore, we can conclude that the following are the main tasks that will have to be carried out along the northern border during the 2013-2018 administration:

1. Increase political determination in the priority border states. This implies technically and operationally updating public and private-sector health care personnel

The challenges are greater today than in previous decades. That is why the performance of state programs is very important, particularly the links inside the sector.

- in the detection, diagnosis, and treatment of difficult cases such as those that are drug resistant;
2. Strengthening inter-program coordination for the comprehensive care of cases of TB/HIV-AIDS and TB/DM co-morbidity;
3. Periodic evaluation of the scope of inter-institutional TB control;
4. Design and implementation of information, education, and training campaigns targeting migrants and agricultural workers about signs of the disease so they know when to request medical care;
5. Effective coordination with U.S. Immigration and Customs Enforcement (ICE) to strengthen strategies for handing over and admitting binational cases;
6. Joint binational evaluation of the on-going projects implemented in the northern border states: Juntos (Together), CureTB, TBnet, CATRE, Los dos Laredos, and Puentes de Esperanza (Bridges of Hope), among others;

TABLE 2  
SUMMARY OF TB-HIV COHORT  
(January-September 2012)

Classification	2007	2008	2009	2010	2011	2012	%
Deaths	5	5	4	5	2	6	4.9
Lost	20	29	21	34	12	12	23.3
Stopped Treatment	2	2	5	4	6	7	4.7
Cases Cured	50	68	71	25	45	19	50.5
End of Treatment					39	36	13.6
<b>Success in Treatment</b>							<b>64.1</b>
Continue in Treatment					2	1	0.5
Counter-referrals					3	3	1.0
Transfers					2	2	0.7
Did not accept treatment					2	2	0.7
<b>Total</b>	<b>77</b>	<b>104</b>	<b>101</b>	<b>68</b>	<b>113</b>	<b>88</b>	<b>551</b>
Registered in Platform						77.3	100

7. Promoting operational research in tuberculosis on the northern border for decision-making.

Thus, the National Program for the Prevention and Control of Tuberculosis, together with the different bodies involved in the United States in the control of TB, strengthen their strategies and lines of action for, as the program's slogan says, a TB-free border and Mexico. **NM**

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NOTES

<sup>1</sup> Secretaría de Salud, "NOM-006-SSA2-2013 para la prevención y control de la tuberculosis," *Diario Oficial de la Federación* (Mexico City: Government of Mexico, November 13, 2013), [http://dof.gob.mx/nota\\_detalle.php?codigo=5321934&fecha=13/11/2013](http://dof.gob.mx/nota_detalle.php?codigo=5321934&fecha=13/11/2013).

<sup>2</sup> WHO, "The Global Tuberculosis Report 2012," Geneva, Switzerland, 2013, [http://www.who.int/tb/publications/global\\_report/gtbr12\\_main.pdf](http://www.who.int/tb/publications/global_report/gtbr12_main.pdf).

<sup>3</sup> Secretaría de Salud, Sinave, 2012, <http://web.ssaver.gob.mx/tuberculosis/files/2014/04/EPIDEMIOLOGIA-DE-LA-TB-en-Veracruz.pdf>.

<sup>4</sup> Ibid.

<sup>5</sup> Ibid.

<sup>6</sup> See [http://www.who.int/topics/millennium\\_development\\_goals/diseases/en/](http://www.who.int/topics/millennium_development_goals/diseases/en/). [Editor's Note.]

<sup>7</sup> SIODM, "Los objetivos de desarrollo del milenio. Informe de avances 2013" (Mexico City: Government of Mexico/INEGI, 2013), <http://www.objetivosdesarrollodelmilenio.org.mx/odm/doctos/InfMex2013.pdf>.

<sup>8</sup> I. Bojórquez-Chapela, C.E. Bäcker, I. Orejel, A. López, A. Díaz-Quiñónez, M.I. Hernández-Serrato, and S. Balandrano, et al., "Drug Resistance in Mexico: Results from the National Survey on Drug-Resistant Tuberculosis," *The International Journal of Tuberculosis and Lung Diseases* vol. 17, no. 4, April 17, 2013, pp. 514–519.

<sup>9</sup> Ibid.

<sup>10</sup> Martín Castellanos, Guadalupe Delgado, Leticia Ferreyra et al., "Resultados de la implementación de un modelo piloto de detección y manejo conjuntos de pacientes con tuberculosis pulmonar y diabetes mellitus en México," at press.

<sup>11</sup> Martín Castellanos Joya, "Epidemiología y determinantes sociales en tuberculosis," paper presented at the 18th "Updating the Diagnosis of Tuberculosis in Children and Adults" course, June 9-13, 2014 (Mexico City), [http://www.cenaprece.gob.mx/curso\\_tb/programa\\_2014.pdf](http://www.cenaprece.gob.mx/curso_tb/programa_2014.pdf).