The situation of
Tuberculosis
on the United States - Mexico Border

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**Pan American
Health
Organization**

Regional Office of the
World Health Organization

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THE SITUATION OF TUBERCULOSIS ON THE UNITED STATES-MEXICO BORDER

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PROLOGUE

Since the reappearance of tuberculosis as a priority public health problem in the Americas in the early 1980's, the efforts and money spent on trying to control both the individual and collective damages caused by this disease have been endless, albeit perhaps insufficient and poorly coordinated. As a response to this situation, the strategy "Stop TB Partnership" with PAHO/WHO cooperation under the vision of "A World Free of Tuberculosis", presented the Global Plan 2006-2015 stop tuberculosis. This plan, reflected within countries' programs, is based on the management and expansion of strictly supervised therapy (DOTS), along with recognizing the existence and the fight to counter the effects of resistance to anti-tuberculosis medications, as well as the co-existence of TB with HIV/AIDS, the strengthening of health systems and civil society and community organizations, the participation of people living with this disease, their families and all of the community to get involved in actions of control and prevention, and research development for better and more effective drugs, diagnosis techniques and a vaccine.

On the United States-Mexico border, stakeholders recognize that this disease is a health priority for both countries and that the management of individual cases and the complex operational situation and logistics represented by the mobility and displacement of many of these cases across the border, presents challenges and require additional efforts to control the problem adequately. In addition to the control of tuberculosis, the prevention of new cases, especially the development of multi-drug resistant cases is a priority for both countries, particularly for the ten border states (Declaration of the Conference of Border Governors, Hollywood, California, 2008).

In light of the above, and convinced that access to current and reliable information is a critical element in this struggle to combat tuberculosis, the PAHO/WHO Office for the United States-Mexico border has prepared the present report on the situation of tuberculosis. We hope this collaborative effort will serve to have a more in-depth understanding of those problems in the border, considering the complex social dynamics that influence the lifestyles of border population. We offer this report to facilitate information sharing and to support decision making processes that will lead to implementing more coordinated actions, policies and programs in collaboration between both countries with a comprehensive and systematic approach.

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GLOSSARY

AIDS (Spanish equivalent: SIDA) - Acquired Immune Deficiency Syndrome.

BAAR / Bacilloscopy - Laboratory technique used to detect mycobacteria through a Ziehl-Neelsen stain which permits observation in different clinical samples (sputum, gastric lavage, etc.) of the presence of bacilli resistant to decoloration with acidic alcohol (Bacilo Ácido Alcohol Resistente, or BAAR).

BCG - TB vaccine (Bacille Calmette Guerin).

Bk + - Symbol for positive bacilloscopy.

Case of tuberculosis - A person in whom a diagnosis of pulmonary or extrapulmonary tuberculosis is established.

CDC - United States Centers for Disease Control and Prevention.

CENSIDA - Centro Nacional para la Prevención y Control del VIH/SIDA de México – National Center for the Prevention and Control of HIV/AIDS.

CONAPO – Consejo National de Población de México – National Population Council.

DOTS - Directly Observed Therapy (Short-Term) Strategy (Spanish equivalent: TAES) - Recommended by PAHO/WHO (OPS/OMS) to ensure curing tuberculosis in all countries. It is based on five key principles (See Table Number 9 of this document), which are common strategies for the control of diseases and it relies on the early diagnosis and the curing of contagious cases.

Drug resistance (pharmaceutical resistance) - Microbiological evidence in an isolated sample of the Mycobacterium tuberculosis complex that demonstrates the lack of sensitivity (in relation to a therapeutic response) to one or various antituberculosis pharmaceuticals.

Incidence - Frequency of new cases of tuberculosis during a specified period (usually 12 months).

EMB - Ethambutol (antituberculosis pharmaceutical).

HIV (Spanish equivalent: VIH) - Human Immunodeficiency Virus.

INH - Isoniazid (antituberculosis pharmaceutical).

La Paz Accord – Agreement established between the governments of Mexico and the United States through a Joint Consultative Committee and signed by Presidents Miguel de la Madrid and Ronald Reagan, August 14, 1983. In Article 4, it was established that "the border zone is the area situated up to 62.5 miles (100, 000 kilometers) along both sides of the land and sea boundaries between the two countries."

Mortality - Estimation of the population that dies in any given moment.

PAHO (Spanish equivalent: OPS) - Pan American Health Organization.

PZA - Pyrazinamide (antituberculosis pharmaceutical).

Prevalence - The number of cases existent in a population at any given moment.

RIF - Rifampicin (antituberculosis pharmaceutical).

Rate - A measure of the frequency with which a phenomenon occurs. From the point of view of demographics, statistics, or even of epidemiology, the rate is an expression of the frequency with which an event occurs in a defined population in a specific period of time. This measure (rate) permits making comparisons between distinct populations when the same phenomenon is studied.

Social Determinants of Health. – WHO Commission responsible for the final report: Closing the gap in a generation; healthy equity through action on the social determinants of health, 2008

TB-MDR - Multi-drug resistant tuberculosis, a type of tuberculosis in which a microorganism of the *M. tuberculosis* complex is not susceptible to the action of Isoniazid (INH) and rifampicin (RIF) administered simultaneously.

TB-XDR - Extensively resistant tuberculosis, a term used to denominate tuberculosis with extended resistance to isoniazid (INH), rifampicin (RIF), and even one of the medicines known as fluoroquinolones (Ofloxacin, Levofloxacin, Ciprofloxacin, Moxifloxacin, Rifabutin, Gatifloxacin) and also one of the three injectable pharmaceuticals known as aminoglycosides (Capreomycin, Kanamycin, Amikacin).

Tuberculosis - Infectious disease, generally chronic, caused by the complex Mycobacterium tuberculosis (Tuberculosis M. bovis, M. microti, M. africanum y M. canetti), that is transmitted from one sick person to a healthy person by close contact, inhalation of infectious material, or ingestion of milk contaminated by the said complex; it can equally be acquired by contact with sick bovine animals.

Tuberculosis associated with HIV (TB-HIV coinfection) - The presence of both types of infection in one person.

WHO (Spanish equivalent: OMS) - World Health Organization.

The present document is a technical report that describes the situation of tuberculosis in the United States-Mexico border and consists of the following components:

I. Objectives

GENERAL OBJECTIVE

To make available for decision-makers, institutions, and persons that have vested interest in helping improve the monitoring, management, prevention, and control of tuberculosis and other problems of public health of binational relevance a technical report on the situation along the U.S.-Mexico border. It will take into account the existing social determinants, the epidemiology, and the control mechanisms of the disease that has been implemented on both sides of the border.

SPECIFIC OBJECTIVES

To propose recommendations for making decisions to have both short and mid-term impact related to the implementation of the most effective and efficient interventions in order to achieve the national goals of controlling and ultimately eliminating the disease.

II. Review of the social determinants on the United States-Mexico Border

In order to carry out the study of the social determinants on the United States-Mexico border, first the general context of the border is described, the states that are in the area, and the constitution of the border region as applied after the La Paz Accord. Afterwards, the existing social determinants are reviewed in the border states (for both sides), and they are contextualized within each country to make a comparison and discussion possible. Finally, the particular aspects of the social determinants in the border region are reviewed more concretely, and findings are discussed. These discussions are summarized as follows:

EXECUTIVE SUMMARY

SOCIAL DETERMINANTS IN THE SOUTHERN BORDER STATES OF THE U.S. IN RELATION TO TUBERCULOSIS

Information suggests that the border region of the United States is, from a social perspective, more likely to have a higher concentration of tuberculosis than the rest of the country, since its population is growing more rapidly, and part of this growth is the result of a population who are originally from Hispanic nations (Mexico for the vast majority), whose rates of incidence and prevalence of tuberculosis are greater than in the U.S.

As a result of this situation, the control of those who are sick also presents greater difficulties in the border states of the U.S. This particular population usually reflects higher levels of poverty, confronts other issues such as alcoholism, drug abuse, and so forth, and has less access to health services, living in situations of inequity that present more difficulties for their treatment and personal follow-up as well as that of their possible contacts.

SOCIAL DETERMINANTS ALONG THE NORTHERN BORDER STATES OF MEXICO IN RELATION TO TUBERCULOSIS

Data shows a population with an overall better living standard, that is growing at a slightly higher rate than the national average; where housing characteristics are better compared to the rest of the country, and in which all the states have levels of illiteracy much less than the national average. These characteristics, although more encouraging in some ways for their preventative impact against tuberculosis, are also mixed with other variables that negatively affect the incidence and control of the disease, among others, migration and its mediate and immediate effects related to the floating population in border cities.

It is known that the social and economic factors that prompt people to abandon their places of origin to migrate are intimately related to the causes associated with the occurrence of tuberculosis, among which are these: poverty, bad living conditions, overcrowding and poor nutrition, lack of sources of work, inadequate access to medical services, education and security. The migrants, in general, continue being poor even after they arrive in the richest states on both sides of the border, particularly during the first several years, a fact which needs to be taken into special consideration.

SOCIAL DETERMINANTS IN THE UNITED STATES-MEXICO BORDER REGION IN RELATION TO TUBERCULOSIS

In spite of the fact that the social indicators point to a better quality of life in the cities of northern Mexico with respect to the rest of the country, this is not the case for those who arrive as migrants, nor for a significant proportion of permanent inhabitants . These individuals continue to confront poor social determinants that influence the development of tuberculosis and other diseases independent of an apparently beneficial geographic change.

Furthermore, the migratory phenomenon from one country to another can generate situations that make tuberculosis more likely to occur and that makes its control difficult, including the permanent mobility of the migrants under risk of disease and with illegal migrant status.; a lot of times they remain hidden which prevents them from access to health services; others may be using drugs or abusing alcohol and/or be in jail while already infected. Adequate follow-up is difficult for a disease that requires adhering to a strict and prolonged routine in an unfavorable social, economic, and cultural environment.

III. Review of the epidemiology of tuberculosis

EPIDEMIOLOGY OF TUBERCULOSIS AT THE GLOBAL LEVEL

Tuberculosis remains to be a severe worldwide public health problem, with more than 9 million cases annually and 1.33 million deaths (in 2007), which has prompted PAHO/WHO to alert all countries about the negative impact this disease exerts in their economic and social development. With respect to this situation, PAHO/WHO continues to recommend the adoption of the DOTS and DOTS-Plus strategies as the basis for combating the disease. This situation exhibits great contrasts along the border, given the differences in prevalence of the disease between Mexico and the United States, where the former shows an approximately 25 TB cases per 100 thousand inhabitants, while the second recorded 3 cases of TB among the same population size.

All of the described parameters show that tuberculosis is a disease with a general yearly tendency to diminish. This encouraging tendency should not make decision makers in areas that present special difficulties for effectively combating the disease lower their guard. It should be recognized that the Mexico-United States border is one of those regions in which advances and the fight against TB could become stagnant and even deteriorate if innovative and immediate measures befitting the reality of the social determinants are not adopted.

EPIDEMIOLOGY OF TUBERCULOSIS IN THE AMERICAS

The Americas region has not escaped the global situation and the continent recorded approximately more than half a million prevalent cases, 370,000 new cases each year and more than 53,000 deaths.

EPIDEMIOLOGY OF TUBERCULOSIS IN BORDER STATES IN THE UNITED STATES AND MEXICO

It is worth noting that 30% of the total number of cases of TB registered in the United States and in Mexico are concentrated within their border states, indicating that the program of prevention and management of this disease needs to be better coordinated for a more effective response by implementing binational strategies that go beyond those that each country uses on its own.

The numbers indicate that the situation on both sides has changed very little from 2003 to 2006, and some sources suggest that the situation did not change much either in the figures for 2007 to 2008. The fact that the states of California on the U.S. side and of Baja California Norte on the Mexican side have the highest incidence rates coincides with high concentrations of migrants located in both states. It is obvious that neither of the two countries can achieve success if they try to control the disease separately, especially if one considers that about 400 million human crossings by land are registered along this border annually. For that reason, joint efforts must be reinforced in this area in light of the fact that the whole border is a functional, interdependent unit.

EPIDEMIOLOGY OF TUBERCULOSIS IN THE UNITED STATES-MEXICO BORDER REGION

The incidence of tuberculosis follows the migratory pattern of Mexico, with its highest rates in Baja California Norte and Tamaulipas. In the United States, border counties have an average TB rate higher than the national average, and when these counties are physically next to the border, the incidence rate of TB in patients of Mexican origin is five times higher than the same rate in patients born in the United States.

The incidence of tuberculosis in the border region of the United States is directly associated with the provenance: a great number of these cases occur among those who migrate to the United States from the interior of Mexico.

Despite of limited amount of data, we can indicate in this report that the percentages of TB drug resistance (based on the different drugs available), in the states on the U.S. southern border are greater in persons born in Mexico, although understanding the causes for this requires more research. However, it is known that the social determinants previously reviewed, such as poverty, a native language different from English, little access to health services and work sources, unknown migrant status have affected the capacity of many of these patients to initiate or correctly continue treatment against tuberculosis.

With respect to the situation that now exists in the Mexico-United States border region, it is without a doubt that a better control of cases could be accomplished once a system of binational and integrated surveillance is achieved, one that is timely and reliable, transparent, sufficient, consistent, and coordinated. The presence of such a system would permit an earlier detection of cases, coupled with efficient follow-up, which would help prevent drug resistance in many of these cases, allow treatment to be completed and cure reached, and diminish failures and costs.

IV. Review of strategies for the control of patients with tuberculosis on the United States-Mexico Border

In this chapter, three aspects related to tuberculosis are examined: 1) a review of the problematic situation existing on the border in relation to tuberculosis and a discussion of the different groups and initiatives with an interest in the problem; 2) a general comparative framework related to the management and control of the disease in Mexico and in the United States; and last, 3) a description of the principal recommendations and strategic actions that have been carried out to surmount this problem in the border region.

RECOMMENDATIONS AND STRATEGIES THAT HAVE EMERGED FOR THE CONTROL OF TUBERCULOSIS ON THE U.S.-MEXICO BORDER

With respect to the historical recommendations that have emerged in order to resolve the difficult problem of tuberculosis in the border region, the following should be considered:

In Mexico, within the Specific Program of Action for Tuberculosis 2007-2012 of the Ministry of Health, declared the following national strategies:

a) Strengthening the technical competencies related to the detection, diagnosis, and treatment by medical personnel, paramedics, and laboratory technicians in units and laboratories of the health sector and in private practice, for the intensification and expansion of outreach efforts to the general population and vulnerable groups.

b) Consolidation of the public-private alliance through the dissemination of the *Estándares para la Atención de la Tuberculosis* ["Standards for Addressing Tuberculosis"] in Mexico.

c) Strengthening the epidemiologic surveillance system at a sector level, through the support of the *Plataforma única de información en Salud* : modulo tuberculosis, ["Consolidated Health Database":tuberculosis module, including the mortality analysis due to tuberculosis.

d) Integration of a network of experts on drug-resistant tuberculosis and updating the guidelines for dealing with TB-MDR and TB-XDR patients, with interinstitutional participation and with the involvement of international organizations.

e) Strengthening the interprogram collaboration with CENSIDA [National Center for the Control of HIV/AIDS (Mexico)] in order to address the coinfection of TB and HIV/AIDS.

f) Promotion of community participation and that of organized civil society through strategies of legal advocacy and social mobilization for the empowerment of the infected, their families and communities with the goal of increasing shared social responsibility in the prevention and control of tuberculosis.

g) Strengthening research in tuberculosis to improve the operation and decision making in the program.

On the other hand, in June of 1999, representatives of the CDC, in conjunction with the officials involved in tuberculosis control in the four American states adjacent to the border with Mexico, conducted a gathering to deliberate about the prevention and management of tuberculosis in the border zone as a preliminary step toward a gathering of officials that deal with this problem in both countries. The proposals that emanated from this gathering can be seen in this report.

Also, between January 2003 and August 2004, members of the Technical Committee of Ten Against Tuberculosis came together to discuss the different issues related to establishing a strategic plan for the upcoming years. The technical recommendations of this plan are also described in this report.

DISCUSSION OF STRATEGIES FOR THE CONTROL OF TUBERCULOSIS ON THE UNITED STATES-MEXICO BORDER

In the United States-Mexico border region, many binational efforts have been and are being carried out to control the problem of tuberculosis. Of these, the one that is best documented and described in the literature, is the "Ten Against Tuberculosis" strategy. This involved a great initiative with the collaboration of both countries, and the objectives that were delineated emphasized the for an integral binational collaboration, which is in agreement with the chapters discussed in our social determinants as much as in the one on epidemiology. The problem in conjunction with the strategies indicated by different occurrences in both countries delivers a very broad perspective in relation to deficiencies that require priority attention and also in relation to the courses of action that ought to be carried out to achieve success.

Some of the problems identified have been has been the lack of continuity, and realization of plans, lack of follow-up to what has been initiated, and lack of interinstitutional integration. In conducting a bibliographic review by means of the Internet, which is the current way of delivering and searching rapid and accurate document availability, it is easy to find plans of action. What is not easy is to find documentation of follow-ups to processes and plans that were initiated, characterization and evaluation of results, documentation, integration, and revelation of experience gained and lessons learned, or taking into account the border as a functional unit, that is, a binational universe.

The same can be said about other objectives of the project "Ten Against Tuberculosis", whose completion was not achieved by the dates they had established.

Similar commentaries can be made in relation to other binational projects. These were functioning or continue to function to a greater or lesser extent, and there is no doubt that their contributions are vital for continuing on the road towards an adequate control of tuberculosis. However, the interstate and binational integration of efforts continue to be missing, as it does the easy and efficient availability of information; accessible and integrated for whoever may be interested. Furthermore, there is a lack of intensive promotion of these projects and programs so that all potential service providers are aware of their existence as well as the public at large on both sides of the border. In summary, description of the complex problem of tuberculosis would seem to be sufficient for bettering the current response to this problem; nevertheless, efforts are still lacking to make the details and some of the specifics more apparent. The principal lines of action that ought to be in place are clear, but follow-up, evaluation, documentation and, completion of other agreed upon steps are still lacking.

V. Conclusions and Recommendations

CONCLUSIONS

Conclusion 1

One of the primary social determinants of tuberculosis on both sides of the border between Mexico and the United States is migration from the interior of Mexico to the U.S.

Conclusion 2

The situation of tuberculosis on the border between Mexico and the United States is aggravated because this region does not function as a binational epidemiological unit that is integrated and coordinated for that purpose.

Conclusion 3

No system is available for the complete registry and interchange of data in an integrated format that provides timely, up-to-date, and useful information for access on both sides of the border.

Conclusion 4

Efforts carried out for combating tuberculosis in the border region between Mexico and the United States are fragmented.

Conclusion 5

Several worthwhile proposals exist that have not been adequately carried out.

Conclusion 6

The control of tuberculosis in the United States is intimately tied to the support that the U.S. can provide to Mexico.

RECOMMENDATIONS

Recommendation 1

To advance toward the solution of the tuberculosis problem on the border between Mexico and the United States, it is required to improve the social determinants and the inequity, giving top priority to states, municipalities and counties with the highest degree of migration.

Recommendation 2

It is fundamental for the border region between Mexico and the United States to be considered as one single unit with the purposes of epidemiological surveillance, detection and case management, and control of tuberculosis.

Recommendation 3

A binational system of collecting data on tuberculosis needs to be designed that has information related to the whole border as an epidemiological unit, with variables of binational interest, and that is accessible to all parties with a vested interest in the problem.

Recommendation 4

A lead institution in charge of overseeing all the efforts carried out in the battle against tuberculosis along the United States-Mexico border is needed, which should be capable of creating the necessary alliances and maintaining common objectives among all participating institutions.

Recommendation 5

A process of following up the strategic plans that have already been carried out should be designed and consolidated in order to preserve and document successful experiences, and to re-instate and strengthen those most effective and undertaking those that have been interrupted.

The strategy of "Ten Against Tuberculosis" might be a good example to be considered.

Recommendation 6

The monitoring and study of tuberculosis on the border ought to continue in order to have the most complete and up-to-date information available in relation to the immediate situation.

BACKGROUND

The present work had its origins on the recommendation expressed during the XXVI Conference of Border Governors, which was held in August 2008, where:

"It was recommended that the United States-Mexico Border Health Commission, in coordination with the Pan American Health Organization / Mexico-United States Regional Border Office, develop a report that describes the binational problem related to the increase in the number of cases of tuberculosis (TB) along the entire border, including TB resistant to pharmaceuticals."

26th Conference of Border Governors, 8/2008

Studying the problem related to tuberculosis on the United States-Mexico border involves the consideration of two complex and intertwined aspects: on the one hand, tuberculosis is a pathological entity, which due as much to its etiopathogenic as its epidemiological characteristics, is extremely difficult to follow and control in a comprehensive manner; and on the other hand, the border ought to be recognized as a geographic zone in which two different nations are mixed together with two cultures, two legal systems, and different health profiles, but nevertheless having an intense relationship that encompasses political, educational, cultural, commercial, and work environments, etc. This document is one more step in the effort to expand the understanding that this complex problem of public health derives from the nature of the illness and its specific environment. This document aspires to advance the realization that the border region functions in a coordinated manner as an epidemiological unit for purpose of achieving a coordinated and adequate management of tuberculosis.

The effort of preparing this report was shared since its first draft proposal, with the Executive Secretary of the Mexico Section and the General Manager of the U.S. Section of the United States - Mexico Border Health Commission. Also, between September 2009 and March 2010, state health authorities of the ten border states were consulted.

We hope this report will be useful and help deepen the understanding of tuberculosis behavior in the border region and with this, improve communication and coordination among those engaged in the control and prevention of this disease.

JUSTIFICATION

Why is an up-to-date report on tuberculosis on the United States-Mexico border necessary?

a) The incidence of tuberculosis between 1990 and 2007, in spite of the work that has been accomplished on both sides of the border, remains significant and impacts the health of resident population on both sides. The available data could be indicating that it is necessary to carry out an exhaustive analysis of the situation and the way in which activities are carried out in order to make decisions oriented toward improving the intervention efforts currently in effect (prevention, identification of cases, management, and control).

b) Current information related to the behavior of tuberculosis on the border, particularly in the specific area identified as the border zone (62.5 miles on either side of the border line), is inconsistent, incomplete, sometimes contradictory, and in many cases not official or representative of the whole region, limiting its usefulness and reliability for analysis and decision making. The official existing registries group information by continent, country, and within countries by state, municipality, or county. These registries do not establish descriptions or references for an overall binational zone, which would require its own separate analysis for purposes of obtaining viable information for making decisions and taking action, understanding that information is available at the local level, could be better utilized. In other words, it is necessary to have a technical report that specifically deals with a description and a clear analysis of the specific overall context and of the disease and the mechanisms of prevention and control that exist for the border states, particularly the border zone between the United States and Mexico.

c) A report with data, an analysis, and recommendations providing an integrated binational vision would contribute evidence and understanding to the decision makers in both countries that would facilitate the formulation of policies and plans favorable to a coordinated work effort for the benefit of the patients, their families, and the entire border population of both countries.

OBJECTIVES

GENERAL OBJECTIVE

To make available for decision makers, institutions, and individuals interested in supporting the improvement of actions for surveillance, management, prevention and control, as well as, for other public health problems of binational relevance, a technical report of this disease along the U.S.-Mexico border, considering the existing social determinants, as well as its epidemiology and mechanisms of control carried out on both sides of the border.

SPECIFIC OBJECTIVES

a) To carry out a search of current data related to the different variables that affect the occurrence and behavior of tuberculosis along the border states and their populations.

b) To analyze the situation of tuberculosis in the border states from each country related to the rest of the country from a national perspective.

c) To analyze the situation of tuberculosis in the populations on each side of the border with respect to their epidemiological interrelationships, and mutual influence, given the geographic proximity and the current dynamic social and economic relationship from an integrated and binational perspective.

d) To discuss and present the most relevant conclusions related to the topic, based on the evidence exposed and analyzed in this report.

e) Issue recommendations for making decisions of immediate and indirect impact related to the execution of interventions in order to achieve the national goals of controlling and ultimately eliminating the disease.

PROPOSED METHODOLOGY

The preparation of this document required the development of three work phases:

PHASE OF LITERATURE REVIEW:

Initial phase where an extensive exercise of a systematic literature review of published literature and access to public information related to the tuberculosis situation in the world, in the Americas, in Mexico, in the U.S. and in the border between the two countries, trying to identify as many sources of information as possible, including gray literature and available technical reports.

PHASE OF DATA COLLECTION:

Following the previous phase, it was contemplated the design of a format for data collection usually not available to describe and analyze the situation of the most important aspects of this disease at local level (border municipalities and counties), taking into account maintaining and protecting the confidentiality of patients. Annex 1 of this report sets out the format that was designed, however it was never used due to lack of time to meet the deadline for the preparation of this report.

The proposal included coordination with health authorities in both countries (at their federal, state and local levels) to develop a work plan that would include minimal training of personnel, distribution of formats and data collection.

PHASE OF DATA ANALYSIS FOR CONCLUSIONS AND RECOMMENDATIONS:

Taking into account the information gathered both at the stage of literature review and in data collection at local level, this report would contain a description and discussion of such data, trying to show objectively the current situation of tuberculosis in the border region, and linking it to the many social, economic and cultural variables dominating this region that coexists two countries. Recognizing that it was not feasible to develop the data collection phase at the local level, the description and analysis presented here were done through an approach to the border region by two types of analysis:

1) The border region seen in relation to the specific context of each country, and

2) The border region as a functional unit, trying to approximate situations that occur on both sides of the border and that could be compared for purposes of better understanding of the situation in relation to the dynamics of this disease. This phase ended with the drafting of conclusions and recommendations that can be seen in chapter four.

CHAPTER 1

Determinants Related to Tuberculosis on the United States-Mexico Border
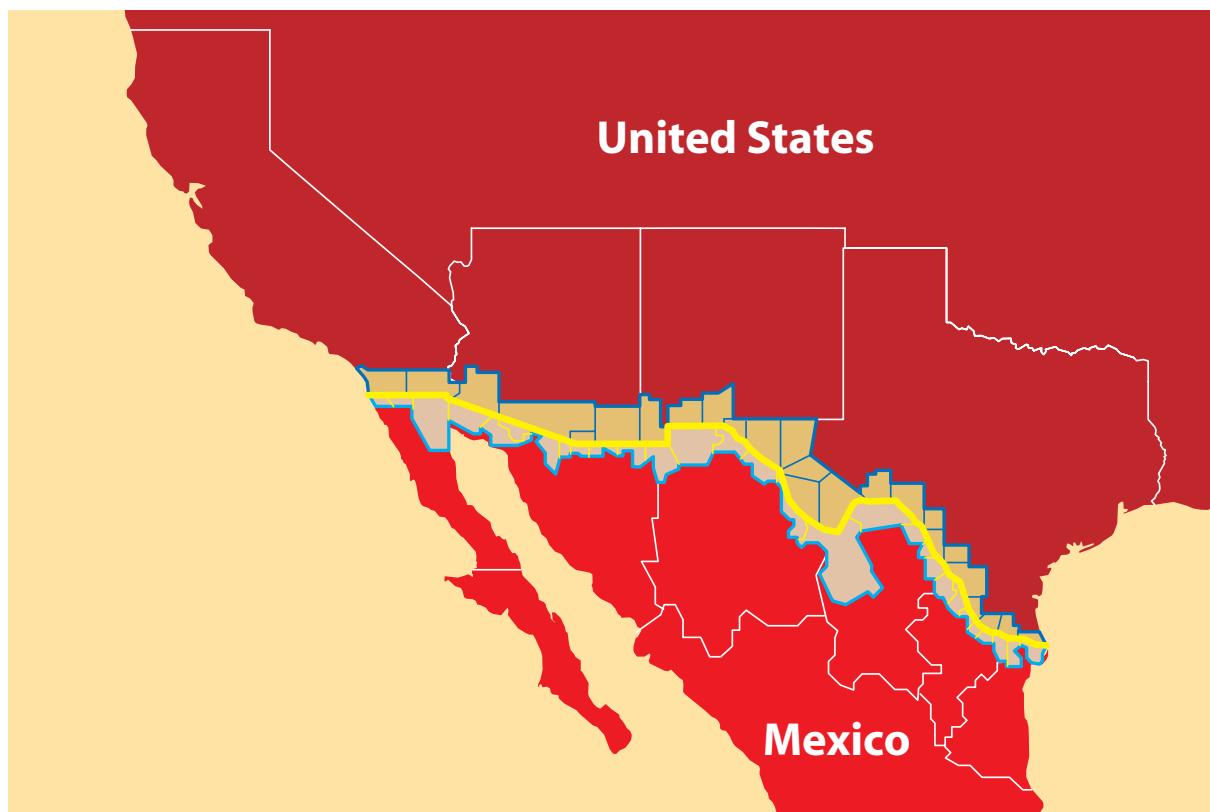
Map No. 1 • The United States-Mexico Border

The study of the social determinants on the United States-Mexico border has been organized in the following manner: first, the general context of the border is described, including the states within, and the official constitution of the border zone after the La Paz Accord. Next, the existing social determinants of health at the border states are reviewed for each side of the border and they are situated within the context of each country for purposes of comparison and discussion. Finally, the particular aspects of the social determinants in the border region are reviewed in detail and the findings discussed in regards to its health impact.

GENERAL CONTEXT OF THE UNITED STATES-MEXICO BORDER

The borderline between the United States and Mexico has an extension of 3,141 kilometers (1,952 miles), from the Gulf of Mexico to the Pacific Ocean. In 1983, as a result of "La Paz Accord", the United States-Mexico border region was defined legally as 62.5 miles (100 kilometers) on either side of the international border.

The U.S.-Mexico border is formed by 10 states. There are 4 states on the United States side (Texas, New Mexico, Arizona, and California). These states have 48 counties situated within the 62.5 miles extension that defines the border zone. On the Mexican side, there are 6 states (Baja California Norte, Sonora, Chihuahua, Coahuila, Nuevo Leon, and Tamaulipas) that contain 80 municipalities within the border zone and 14 pairs of neighboring cities (See Table No. 1). Thirty-eight of the 80 Mexican municipalities are physically adjacent to the United States while 24 American counties are physically adjacent to Mexico.

Table No. 1 • Neighboring states and cities in the border region

MEXICO		UNITED STATES	
STATE	ADJOINING CITY	ADJOINING CITY	STATE
Baja California	Tijuana	San Diego	California
	Mexicali	Calexico	
Sonora	San Luis	Yuma	Arizona
	Nogales	Nogales	
	Naco	Naco	
	Agua Prieta	Douglas	
Chihuahua	Puerto Palomas	Columbus	New Mexico
Chihuahua	Ciudad Juarez	El Paso	Texas
	Ojinaga	Presidio	
Coahuila	Ciudad Acuňa	Del Rio	Texas
	Piedras Negras	Eagle Pass	
Tamaulipas	Nuevo Laredo	Laredo	Texas
	Reynosa	McAllen	
	Matamoros	Brownsville	

Source: Border of the United States and Mexico. Health in the Americas, 2007, Vol. II – Countries.

DESCRIPTION AND ANALYSIS OF SOCIAL DETERMINANTS IN THE SOUTHERN U.S. BORDER STATES AND THEIR RELATION WITH THE REST OF THE COUNTRY

The determinants of health in the social, economic and cultural context at the border, and which influence the occurrence of tuberculosis, are important because the association of diseases with situations of poverty and overcrowding are well known. Among the indicators that are relevant to the United States and of interest to the present study are first shown in Table No. 2.

Table No. 2 • Comparison of demographic aspects between border states and the national average, U.S. 2000-2006

INDICATOR	U.S.	CALIFORNIA	ARIZONA	NEW MEXICO	TEXAS
Population increase 2000-2006 (%)	**6.4**	7.6	20.2	7.5	12.7
Minors, 5 years old (%)	**6.8**	7.3	7.8	7.3	8.2
Minors, 18 years old (%)	**24.6**	26.1	26.4	26	27.6
Persons 65 years old and older (%)	**12.4**	10.8	12.8	12.4	9.9
Persons of Hispanic origin 2006 (%)	**14.8**	35.9	29.2	44	35.7
Foreign born, 2000 (%)	**11.1**	26.2	12.8	8.2	13.9
Persons who speak another language at home (%)	**17.9**	39.5	25.9	36.5	31.2

Source: U.S. Census Bureau 2000-2006.

The following aspects of the table above stand out the most:

a) The four border states in the United States have a percentage of population growth higher than the national average. Arizona has the highest rate at 20.2% compared to 6.4% nationally.

b) The four border states have a percentage of persons of Hispanic origin significantly higher than the national average, especially the state of New Mexico, which is 44% Hispanic, in comparison with 14.8% nationally.

c) The four border states have a much higher percentage of persons who speak a language other than English at home.

The economic indicators of the U.S. border states (which could have a bearing on tuberculosis) are shown and compared to the national average on Table No. 3 and Figure No. 1:

Table No. 3 • Comparison of economic indicators among border states and the national average, U.S. 2000-2006

INDICATOR	U.S.	CALIFORNIA	ARIZONA	NEW MEXICO	TEXAS
Percentage of persons in conditions of poverty, 2004	**12.7%**	13.2%	14.6%	16.7%	16.2%
Per capita income 1999 (USD)	**21,587**	22,711	20,275	17,261	19,617

Source: U.S. Census Bureau 2000-2006.

Figure No. 1 • Index of poverty and income in the border states compared with the national average, U.S. 2000 - 2006
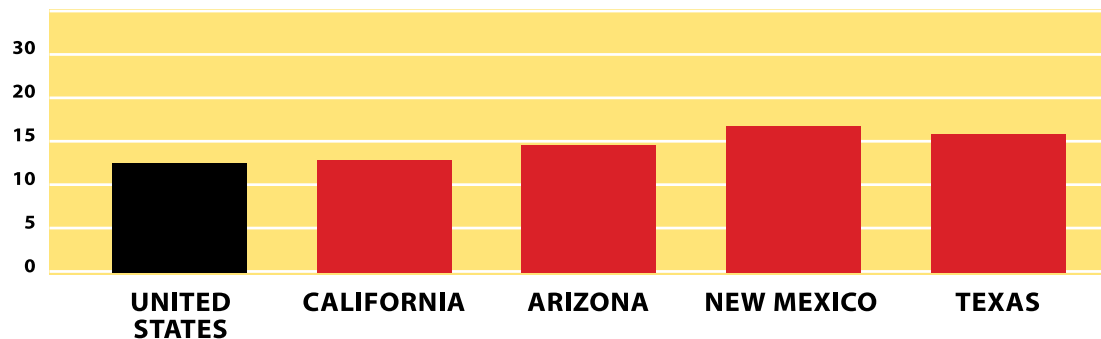
Source: U.S. Census Bureau 2000-2006.

The economic indicators show that all of the border states have a rate of impoverishment among its population greater than the national average. The highest level of poverty is found in New Mexico, just as its per capita income is also the lowest. The per capita income is less than the national average in all the border states except for California.

With regard to the percentage of persons 25 years and older who have graduated from secondary school (high school), all the U.S. border states, with the exception of Arizona, are below the national average (Figure No. 2)

Figure No. 2 • Comparison of the education indicator (Percentage of people 25 years and older who graduated from high school) between the border states and the national average, U.S. 2000 – 2006
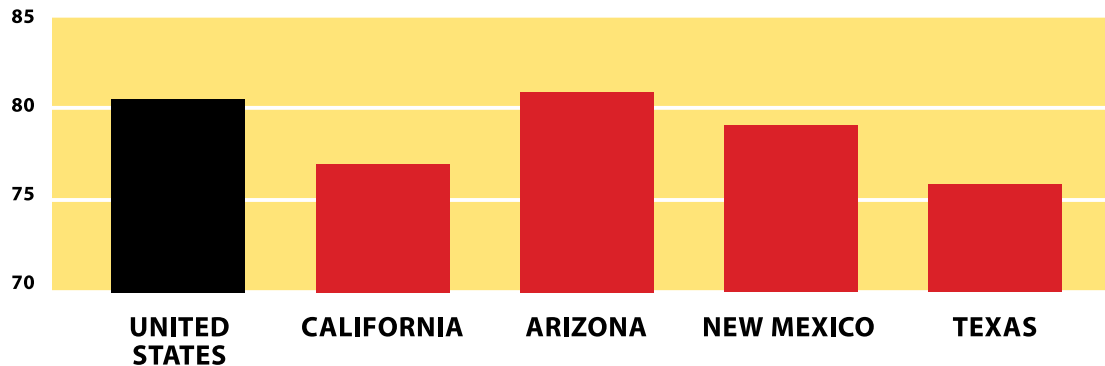
Source: U.S. Census Bureau 2000-2006.

DISCUSSION:
SOCIAL DETERMINANTS IN THE STATES OF THE SOUTHERN BORDER OF THE UNITED STATES IN RELATION TO TUBERCULOSIS

In synthesis, the social determinants of the border states speak to us of a young population, with a low but considerable percentage of persons who were not born in the country and who speak another language in addition to or instead of English, and with a culture tied to Hispanic countries (principally Mexico).

The economic indicators demonstrate for their part that in general border states are poorer than the national average. However, the Per capita income of the state of California is higher than the national average, which contrasts with its poverty level, which is also higher than the national average, a situation which probably suggests a poor distribution of wealth. The educational level is less in border states, except for the state of Arizona. From a social perspective, these data suggest that tuberculosis cases show a greater propensity to be concentrated in the border region of the U.S. when compared with the rest of the country, particularly since the zone is growing faster, and part of this growth comes from the population that is originally from Hispanic nations (primarily Mexico), where the rates of incidence and prevalence of tuberculosis are greater than in the U.S. This population, exposed to a greater level of poverty and having the significant disadvantage of a mother tongue other than English, and as a result, experiences difficulties in seeking health care and work, shows a higher risk than the rest of the country for contracting the disease. The control of TB cases also presents greater difficulties in the border states of the U.S., for the reasons given earlier: higher levels of poverty, less access to health, and greater difficulties for follow-up and treatment of cases and their contacts.

Description and analysis of social determinants in the northern Mexican border states and their relation to the rest of the country

For the description of the social determinants, in the case of the northern border states of Mexico, the indicators of demographic growth, housing and illiteracy were used. These indicators are shown in Table No. 4, while Figure No. 3 shows the relative rates of growth.

Figure No. 3 • Comparison of the rates of population rates increase (%) in the Mexican border states, 2005

	MEXICO	BAJA CALIFORNIA	SONORA	CHIHUAHUA	COAHUILA	NUEVO LEON	TAMAULIPAS
	1	2.6	1.5	1.7	1.2	1.5	1.8
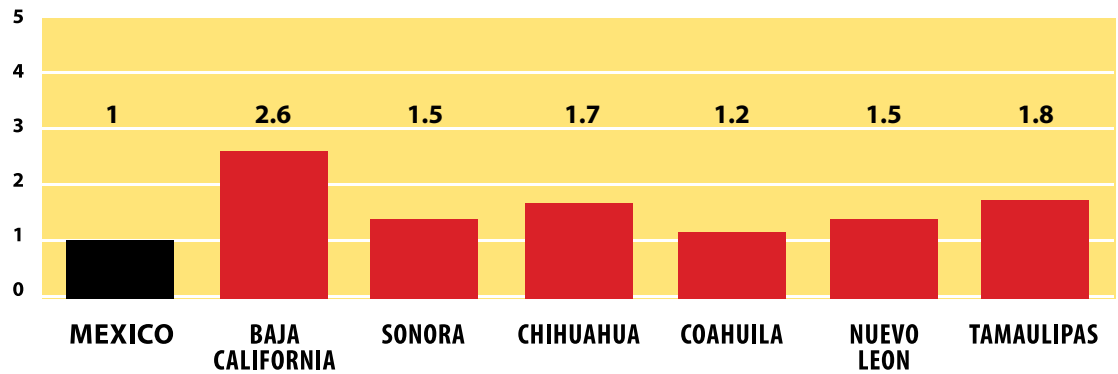
Source: 2nd Census of Population and Housing 2005, Mexico.

In relation to the rates of demographic growth, it can be observed that the totality of the Mexican border states show a higher rate than the national average. Baja California shows the greatest growth, with a 2.6 % compared to the rate of 1.0 for the nation as a whole. Also, the demographic indicators in regards to different age groups do not reveal variations with respect to the national average.

The indicators corresponding to housing and illiteracy described in Figures No. 4 and No. 5 compares the border states with the national average.

Figure No. 4 • Comparison of housing indicators: border states – Mexico, 2005

Proportion of population with piped water in their homes
Proportion of population with electricity in house
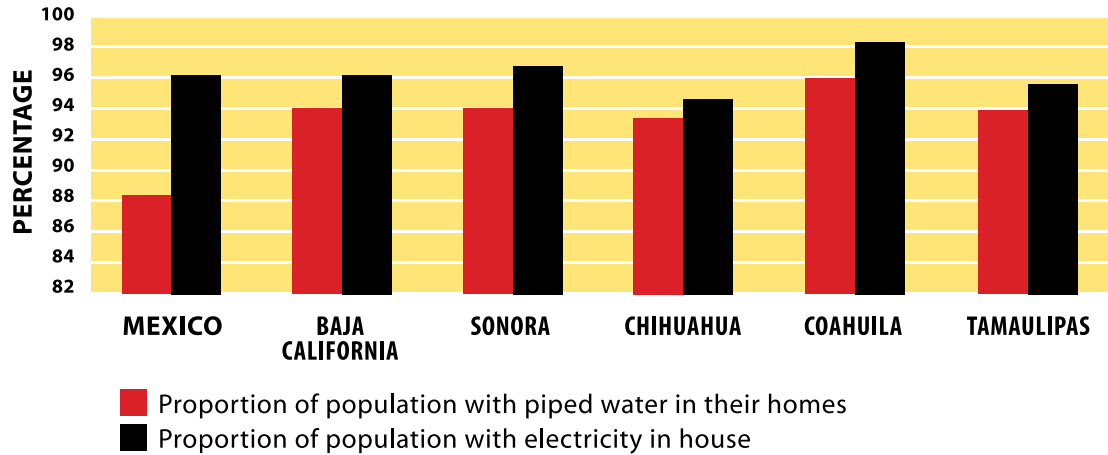
Source: 2nd Census of Population and Housing 2005, Mexico.

Figure No. 5 • Comparison of illiteracy rates: border states – Mexico, 2005
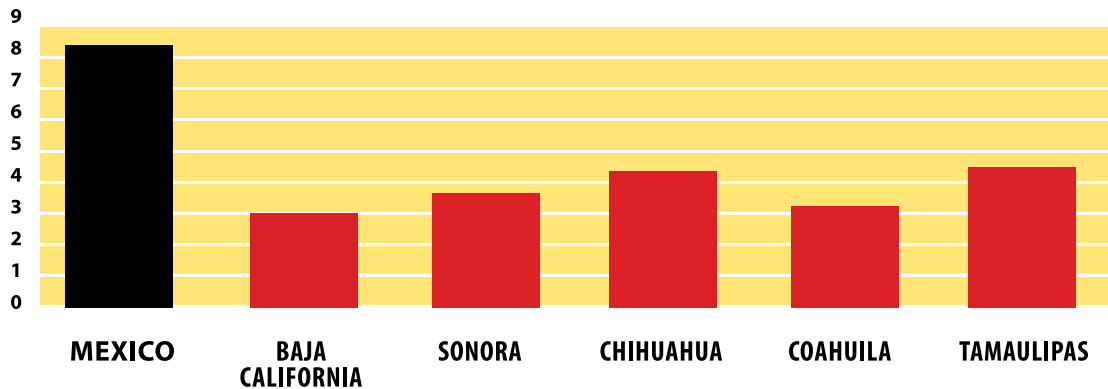
Source: 2nd Census of Population and Housing 2005, Mexico.

As it can be observed, in the case of the housing indicator with tap water and electricity, all the northern Mexican border states demonstrate higher percentages of people living in this type of housing, relative to the national average; it is also observed that the level of illiteracy is higher at the national level than any of the border states, where education levels seem to be better.

DISCUSSION:

SOCIAL DETERMINANTS IN THE NORTHERN BORDER STATES OF MEXICO IN RELATION TO TUBERCULOSIS

The social determinants, in the case of the northern border of Mexico, shows a population that is growing at a slightly greater rate than the national average (Baja California Norte stands out the most as seen in Figure No. 3); a population with better housing characteristics (Figure No. 4); and where all the border states have illiteracy percentages much lower than the national average (Figure No. 5). These situations, although encouraging, seem to be insufficient for counteracting the following effects:

a) Living conditions in the northern border states of Mexico, although relatively better with respect to the national average, are insufficient to inhibit migration toward the United States.

b) The migrant population does not correspond solely to the northern border states of Mexico, but to the whole country.

A comparative summary of the social determinants among the northern border state of Mexico and the southern border states of the U.S. is shown in Table No.4.

The northern border of Mexico is in better socioeconomic condition than the rest of the country, while the southern U.S. border also has disadvantages in relation to the rest of the country. The common factor on both sides of the border is the rate of greater demographic growth, a factor contributed to by the migratory phenomena from Mexico. The association of the demographic and economic determinants and tuberculosis in the border states could be related to the better conditions in northern Mexico that attract a migrant population from the south, but these conditions remain insufficient to retain this population within Mexican territory. On the other hand, in the southern U.S. border states, there are greater levels of poverty than in the rest of the country, but those states continue being sufficiently prosperous that the migrant population that relocates in northern Mexico ultimately seeks to reside in the neighboring country. It is known that the causes that lead the population to abandon their places of origin to migrate to other sites are closely related to the causes associated with the appearance of tuberculosis: particularly poverty, poor living conditions, the lack of opportunities for work and the subsequent economic deterioration, overcrowding, and poor nutrition. Migrants remain poor even when they arrive to the richer states on either side of the border; once they are established anywhere in this zone, their conditions do not immediately improve, which in turn makes them even more vulnerable. As a result, they ultimately become a floating population.

Table No. 4 · Summary of social determinants in the United States-Mexico border states in comparison to the national average of their respective countries

BORDER STATES: MEXICO	BORDER STATES: UNITED STATES
Rate of population increase slightly greater than the national average	**Population growth** greater than the national average
Housing characteristics better than the national average	**Level of poverty** greater in relation to the national average
Percentages of illiteracy less than the national average	**Education level** less than the national average

Source: 2nd Census of Population and Housing, Mexico; U.S. Census Bureau 2000-2006.

Description and analysis of social determinants in the United States-Mexico border region

Jointly, the border zone shared by Mexico and the U.S. was home to approximately 13,385,682 inhabitants in the year 2000 (53% on the Mexican side), who are primarily located in cities on both sides of the dividing line between the two countries, and of these, 32.4 % of them were in the San Diego (2,936,609) Tijuana (1,410,700) area; and 53% lived in the U.S. side. About 95% of the border population lives in 14 pairs of neighboring cities distributed along the border. This zone has its own demographic dynamic, primarily as a result of its attraction to the population that decides to emigrate from other regions of Mexico seeking work in the border cities of Mexico or wanting to cross the border to the neighboring country. As documented by the information distributed by the II Conteo de Población y Vivienda [2nd Population and Housing Census, México] of 2005, the population of the border zone in northern Mexico was 7,089,185, which represents 39% of the total population of the 6 border states and 7% of the total population of the country. In contrast, in 1995 these quantities were 35.8% and 6% respectively. This relative increase in population is important because the rate of growth in this zone has been greater than for the rest of the country and for the overall population of the border states as a whole. In fact, the rate of population growth of the 80 municipalities that comprise the northern border zone of Mexico had an annual average increase of 1.96% between 2000 and 2005; almost double the national average (1%). At the same time, the Mexican northern border zone also demonstrates a rate of growth slightly higher that for the border states as a whole, which was 1.59%. If the pattern of growth documented for 2000 through 2005 were to continue, the population of the border zone would double in 35 years while that of the border states as a whole would require 43 years, and that of the entire country in 67 years. (Needs proper citation: González, Raúl, Vela, Rafael. Territorio y población en la frontera México-Estados Unidos. Colegio de la Frontera Norte).

For their part, U.S. border states, grouped in 2000 to 6 296,497 people in the border region, of which 2,813.833 resided in San Diego County, California, and the rest in cities or towns of less than one million inhabitants. Of the more than 6 million border inhabitants on the U.S. side, just under half were Hispanic or Latinos.

However, the Hispanic or Latino population along the length of the whole southern border of the U.S. varies considerably and is primarily concentrated in the border counties of Texas and to a lesser extent the counties of New Mexico, Arizona, and California. Also in 2000, in San Diego County only 26.7% of the resident population was of Hispanic or Latino origin, while in various counties of Texas that rate raised to 80%, even to 90% in the counties close to Nuevo Laredo, Reynosa, Matamoros, and Tamaulipas (González, Raúl, Vela, Rafael. Territorio y población en la frontera México-Estados Unidos. Colegio de la Frontera Norte).

The municipalities of the northern border zone of Mexico cover a total of 317,947 km², which corresponds to 16% of the national territory; accordingly, the average population density of this area is 22 inhabitants per km², in contrast with the national average of 53 persons per km². In contrast with this information, the municipality of Tijuana, Baja California, has the greatest population density on the border, with more than 1,605 persons per km². The same happens in the rest of the big border municipalities, such as Ciudad Juarez, Nuevo Laredo, Mexicali, and Matamoros, where the density reaches 300 inhabitants per km², rising above the national average.

The territorial extension of the southern U.S. border counties is 246,464.74 km², and the population density is 25.9 inhabitants per km². Thus in general terms, the population here is a little more dispersed than the national average. The counties with the greatest concentrations of population are San Diego County, California and El Paso, Texas with levels that reach 260 inhabitants per km². The counties of Cameron and Hidalgo in Texas also exceed the national average, with 140 inhabitants per km² for each one. The rest of the border counties have lesser densities with 36 inhabitants per km² (González, Raúl, Vela, Rafael. Territorio y población en la frontera México-Estados Unidos. Colegio de la Frontera Norte). The make-up of the population on both sides of the border zone according to age and sex is indicative of a population that is primarily young and that furthermore is fed by significant numbers of migrants of productive and reproductive age, which is the reason that the population pyramid is widened at the base among the 15 to 30 year-old age group.

Table No. 5 • Principal demographic aspects of the U.S.-Mexico Border

DEMOGRAPHIC ASPECT	NORTHERN BORDER REGION – MEXICO	SOUTHERN BORDER REGION – UNITED STATES
Total population	7, 089,185 (2005 Census, Mexico)	6,926,147 (2000 Census, U.S.)
Important characteristics of the population	Increase is more accelerated than the rest of the country, as a result, among other things, of the existing migratory flow	The population with Hispanic origins can be as much as 90% in some counties
Population structure by age and sex	Population principally young, in both productive and reproductive age	Population principally young, in both productive and reproductive age
Migration	The proportion of the population of Mexico which migrated to the region of the northern border was 11.7 % (2000 Census) during the 5 years previous to this census	The 4 border states had around 7 million Mexican immigrants in 2005

Source: González, Raúl, Vela, Rafael. Territorio y población en la frontera México-Estados Unidos. Colegio de la Frontera Norte; (Border of the United States and Mexico. Health in the Americas, 2007. Vol. II – Countries).

TThe northern border region of Mexico attracts migrants who decide to change their place of residence in order to find work, following the head of household or any other member of the nuclear family. Many of the resident migrants of this region originally arrived with the idea of crossing to the U.S., either in a documented or undocumented way, but not everyone was able to do so and decided not to return to their place of origin, recognizing moreover that there are greater possibilities for employment in the northern border region than in the rest of the country. Baja California and all its municipalities have traditionally had the largest migratory influx, for which reason a significant percentage of population in this state was born in a municipality outside of the area. Likewise, in the rest of the northern border region, the municipality of Ciudad Juarez and the population centers along the border between Tamaulipas and Texas, particularly Nuevo Laredo and Reynosa, and to a lesser extent, Matamoros have large migrant populations.

The most recent study of migration in Mexico (1995 – 1999) gives us an updated panoramic of its magnitude. In the 5 years prior to the 2000 census, around 11% of the population declared that they had changed their place of residence to the northern border region of Mexico. Likewise, the proportion of the population that emigrated in the year 2000 was 11.7% (González, Raúl, Vela, Rafael. Territorio y población en la frontera México-Estados Unidos. Colegio de la Frontera Norte).

Figure No. 6 • Migratory flow from Mexico to the United States compared by periods 1961-1970 and 2001-2004
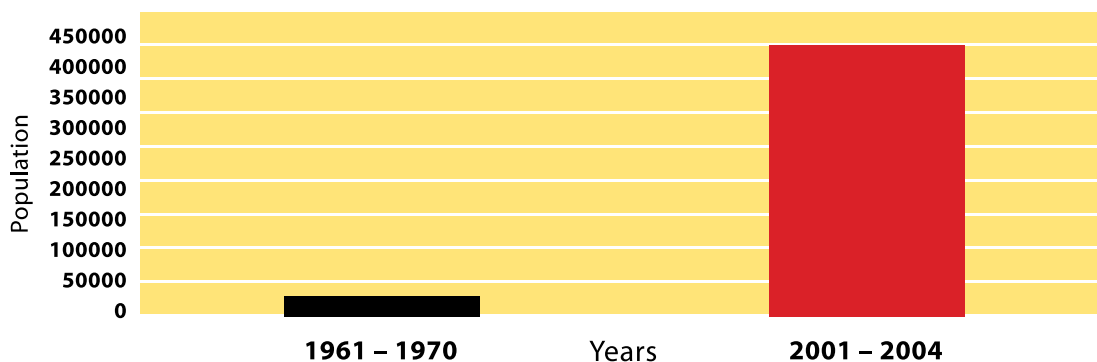
Source: Border of the United States and Mexico. Health in the Americas, 2007. Vol. II – Countries.

In relation to the passage of migrants from the municipalities of Mexico to the U.S., the number showed a notable increase in the period after 1970, rising to almost 400,000 between 2001 and 2004, after demonstrating a lesser annual average of 30,000 persons between 1961 and 1970. This migratory flow, which shows continuous growth, has given rise to a large community in the U.S.; with of inhabitants of Mexican origin, obviously with respective repercussions in family structure, employment, and quality and access to health services. According to information in 2004 from the Iniciativa de Salud México-Estados Unidos [Health Initiative Mexico-United States], the four U.S. border states were among the 13 states with more than 100,000 immigrants, in ascending order: New Mexico, Arizona, Texas, and California, that together accumulated more than 7 million immigrant inhabitants in 2005.

In the period from 2001-2004, three-fourths of immigrants lacked the appropriate documentation for crossing the border legally, while among 1993 – 1997, the number of undocumented immigrants wasn't even 50%. CONAPO in Mexico [National Council of Population] used a classification to evaluation the degree of migratory intensity in all the states of this country (See Table No. 6). The classifications used for describing the intensity of migration for each state are these: none, very low, low, medium, high, or very high. The Mexican states with the degree of "very high" migratory intensity in 2000 were the following: Durango, Guanajuato, Michoacan, Nayarit, and Zacatecas. The states with an index of "high" migration were Aguascalientes, Colima, Guerrero, Hidalgo, Jalisco, Morelos y San Luis Potosi. The states along the northern border of Mexico, on the other hand, received the following classifications: "medium" for Baja California, Chihuahua, Coahuila y Tamaulipas and "low" for Sonora y Nuevo Leon. (See Table No. 7.) This shows us clearly that the states along the northern border of Mexico live in a double situation in relation to the phenomenon of migration: in addition to be producers of migrant population, they share the situation of the states along the southern U.S. border; they are also recipients of migration.

Table No. 6 • Degree of migratory intensity in the states of Mexico 2000

MIGRATORY INTENSITY		
VERY HIGH	HIGH	AVERAGE OR BELOW
Durango Guanajuato Michoacan Nayarit Zacatecas	Aguascalientes Colima Guerrero Hidalgo Jalisco Morelos San Luis Potosi	Baja California Norte Sonora Chihuahua Coahuila Nuevo Leon Tamaulipas

Source: Estimates of CONAPO based on the 12th Census of Population and Housing 2000.

From an economic perspective, the United States-Mexico border region also shows its particular aspects that are important to highlight, among others, the fact that this is the border with the most international crossings in the world. According to the Immigration and Naturalization Service of the United States, in 2002 more than 190 million persons entered the United States from Mexico through 24 official ports of entry. According to information published by Economic Development America, in 2004 about 60% of the 500 million visitors admitted to the United States entered across this border, along with 90 million automobiles and 4.3 million trucks. This human and vehicular movement is a great contributor to the U.S. economy, with $638 million a day, resulting from commercial trade generated along the border. Data from the office of Statistics of the U.S. Department of Transportation indicated that the number of trucks that entered the United States in 2005 increased to 4.9 million and that this number varied between 40,042 (0.8% of all truck crossings) in New Mexico and 3,275,563 (66% of all truck crossings) in Texas (United States-Mexico Border Area. Health in the Americas, 2007. Vol II-Countries).

Table No. 7 • Diverse socio-economic aspects in the border region between the United States-Mexico

ASPECTS	FACTS
Estimated human entries to the United States across the border with Mexico	-190 million of persons through 24 ports of entry in 2002 -300 million persons in 2004 -90 million automobiles in 2004 -4.3 million trucks in 2004 -4.9 million trucks in 2005
Trade through the U.S.-Mexico border	-U.S. $638 million in income in trade to the U.S. to the on a daily basis (2004) -Exports from Mexico to the U.S. – U.S. $146.8 trillion (in 2003) -Imports to Mexico from the U.S. - $105.7 trillion.
Labor and industry	-In 1990 there were 1,700 maquiladora plants (in Mexico) -In 2003 there were 3,800 maquiladoras, of which 2,700 were situated in Mexican border states -In 2004 more than one million Mexicans were working in more tan 3,000 maquiladoras situated along the border

Source: Border of the United States and Mexico. Health in the Americas, 2007, Vol. II – Countries.

Mexico is the third greatest commercial partner of the U.S.; the U.S. is the number one partner of Mexico. In 2003, the exportation from Mexico to the U.S. rose to 146.8 trillion dollars and its imports for the same period were 105.7 trillion dollars. The maquiladoras of Mexico (manufacturing plants that import raw material and parts for manufacturing or assembling by Mexican labor for later exportation of the finished products) have become the major element of commerce of the U.S. with Mexico and are a driving force behind the growth of the border zone. Almost all the maquiladoras are property of the U.S. and they import the majority of their parts from United States providers. (See Table No. 7)

With the signing of the North American Free Trade Agreement (NAFTA) and the consequent aboli- tion of the majority of barriers to commerce and investments between Canada, Mexico, and the U.S., the rate of industrial development along the border grew even more, and in 1990 there were already 1,700 maquiladora plants functioning in Mexico. For 2001, this number had risen to almost 3,800 ma- quiladoras, of which 2,700 were located in the border states. It is estimated that in 2004 alone, more than a million Mexicans were working in more that 3,000 maquiladoras along the border (United States-Mexico Border Area. Health in the Americas, 2007. Vol. II-Countries).

IIn spite of the extraordinary degree of transborder interdependence, the economic development along the border is unequal. For example, the border states of Mexico have lower rates of unemployment and greater salaries in comparison to the other regions of the country. The Mexican border states also have lower rates of poverty and higher rates of literacy in comparison to the other regions of the country. The previous situation contrasts with the situation on the U.S. side, where the contrary can be observed: four of the seven cities and five of the poorest counties of the United States are located in Texas along the border with Mexico. In general, the counties on the U.S. side have undergone an increase in unemployment and a reduction in per capita income in the last 30 years. For example, in the city of El Paso, Texas, the poverty is almost double the national average and the average salary is equivalent to almost one third of the national figure. The level of schooling of the population in most counties along the U.S. border is alos less than in other parts of the country (United States-Mexico Border Area. Health in the Americas, 2007. Vol II-Countries).

The benefits of commerce between Mexico and the United States have had an unfavorable side; for example, it is suspected that the increase of vehicular traffic for transport within the two nations could exacerbate the risk of environmental pollution and injuries from transit. In addition to official commerce, there are transborder networks of informal commerce and also illegal networks, among them the narcotic traffic: according to the Drug Enforcement Administration of the United States 65% of the cocaine consumed in the U.S. enters through the Mexican border, and almost 100% of the heroine produced in Mexico and South America is destined to markets in the United States (United States-Mexico Border Area. Health in the Americas, 2007. Vol II-Countries).

DISCUSSION:
SOCIAL DETERMINANTS IN THE U.S.-MEXICO BORDER REGION IN RELATION TO TUBERCULOSIS

From the previous information related to the social determinants in the Mexico-U.S. border region, it can be inferred that they represent the biggest difficulties for the adequate control of tuberculosis in this geographical area.

The migratory phenomenon from the interior of the country toward the northern zone of Mexico creates multiple red lights: that is, the people who arrive will live in conditions of poverty, poor nutrition, and little access to health services, in spite of the fact that the area exhibits better social indicators related to quality of life in respect to the rest of the country, but this situation is not a reality for new migrants. They will continue to confront the social determinants that favor the development of TB, regardless of the apparent geographical benefit.

As an additional concern, the migratory phenomenon of going from one country to another generates many consequences that favor the development of tuberculosis and that make it more difficult to control. First of all, when they are illegal, migrants at low risk of catching the disease begin moving from one place to another and do not remain in one place in the border region; many times they can't be found and do not seek health services. Others at greater risk could be using drugs or might be living together in overcrowded conditions, including jails. Under these circumstances, it is very difficult to give adequate follow-up to a disease that requires routines of strict, complex, and prolonged management.

The binational reality does not favor adequate measures of control: if a case of tuberculosis is found in Mexico, there will be a TB program to provide treatment and a system of epidemiological surveillance for adequate notification and control is in existence. The same would occur in the U.S.: sick patients and their contacts could be controlled. But what happens when a patient is constantly crossing the border and having to deal with two countries, two cultures, two languages, two legal systems, and two different systems of epidemiological surveillance? Currently after many binational efforts have been implemented and are ongoing, the problem is still not under control and TB is further complicated now with the occurrence of MDT and XDT.

CHAPTER 2
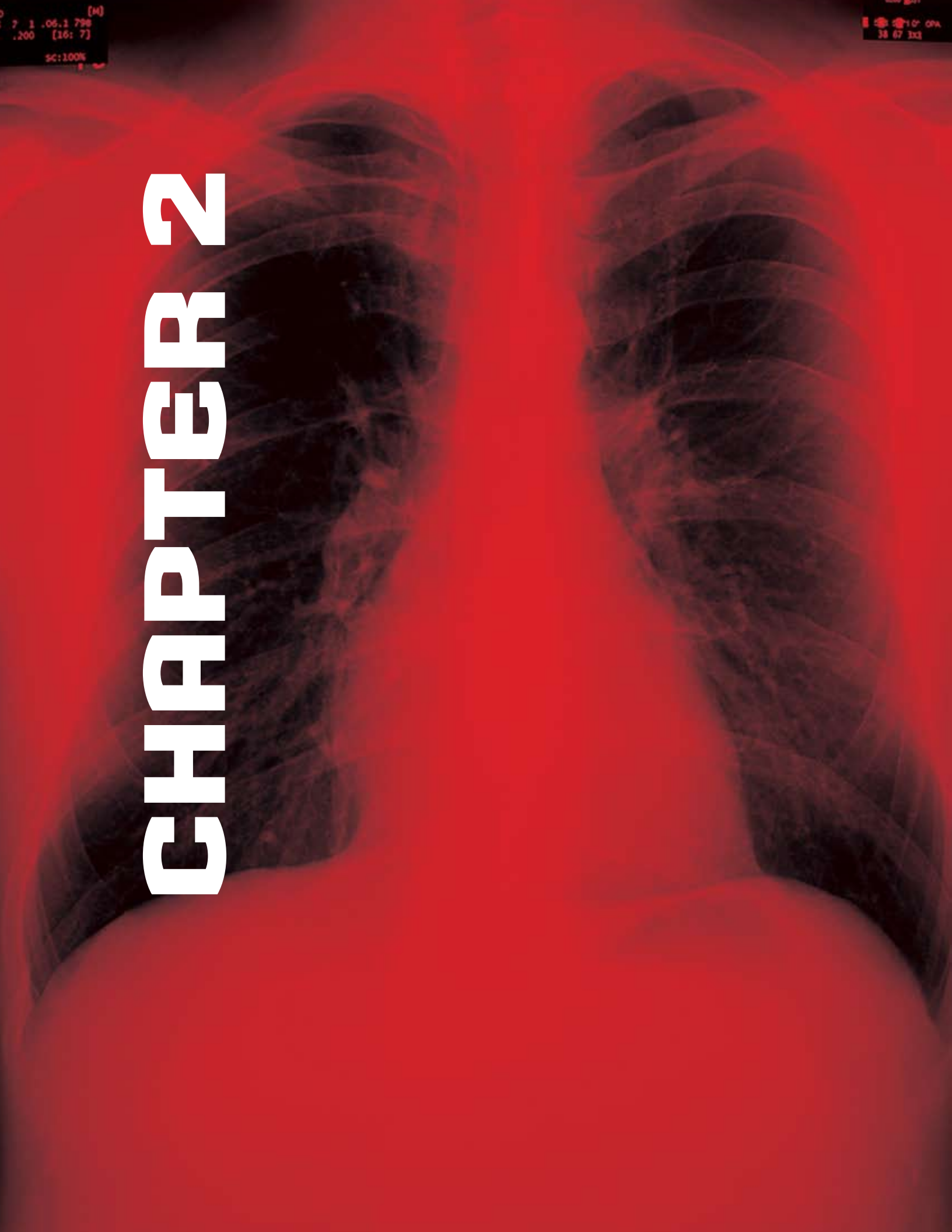
Epidemiology of tuberculosis and Strategies for Fighting It

The present chapter begins by giving an epidemiological overview of TB worldwide, addressing the most relevant aspects. Furthermore, the situation in the Americas is described to advance to a description of the disease in Mexico and the United States as neighboring countries. At the end, the epidemiological situation in border states and the epidemiological particularities of the disease in the U.S.-Mexico border region are addressed. With some variations (particularly depending on the context and the availability of sources of information) the following measures were used: incidence, prevalence, mortality, and illness as associated with HIV. In the case of the border region, it is impossible not to mention that the area still does not function as a binational epidemiological unit that is integrated for purposes of collecting and analysis of data, for which reason the epidemiological information at this level will be limited to a state level of disaggregation. Some epidemiological particularities of the area as whole can be further explored as they appeared in the references.

GLOBAL EPIDEMIOLOGICAL OVERVIEW OF TUBERCULOSIS

In agreement with PAHO/WHO, in 2006 the number of deaths from tuberculosis was estimated to be 1.7 million and 1.33 in 2007. That same year, the number of new cases of tuberculosis in the world was 9.2 million and the figure remained in 2007 (9.3 million). The Organization has permanently alerted the world about the negative impact of this disease on the economic and social development of countries through resolutions emanating from World Health Assemblies (WHA). One that particularly stands out is WHA 44.8 from 1991, which solicited the Member States to place "high priority on the control of tuberculosis" and put forth a detection goal of 70% of cases through positive baciloscopies and with a cure rate of 85% of the cases so detected. Another prominent resolution is WHA 46.36 from 1993, which recommends the strategy of Directly Observed Therapy Strategy (DOTS or TAES in Spanish) with its 5 components as a tool of control. (See Table No. 8)

Table No. 8 • Elements of the TAES/DOTS (WHO) strategy

1. Political commitment for the control of tuberculosis
2. Bacteriological diagnosis of quality and accessibility to the population
3. Permanent contribution of certified quality medicines
4. Standardized short-course treatment and medicine taken under direct observation
5. System of registration and information for monitoring and evaluation of interventions

Source: Resolution WHA 46.36, 1993 WHO.

With the goal of starting a global movement to accelerate social and political action that would help arrest the spread of tuberculosis, in 2005 PAHO/WHO fostered the development of the global plan "Stop TB," which provides international organizations, governments, governmental and nongovernmental organizations, donors, and even interested individuals a platform for contributing to a collective and concerted campaign to detain tuberculosis.

With resolution WHA 58.14 (2005), pledging a sustainable financing for the control and prevention of tuberculosis, advancement toward reaching the goals for 2015 has become a reachable objective and represents a step toward achieving a world without tuberculosis by the year 2050.

At the world level, the incidence rate of tuberculosis cases has shown a general tendency to go down, with a peak of 144 new cases for every 100,000 inhabitants in 2000 and the lowest rate at 136 new cases per 100,000 in 2005. In 2006 the rate has again shown a slight increase, with 139 new cases per 100,000. (See Table No. 9 and Figure No. 7)

Table No. 9 and Figure No. 7 · Incidence rate of tuberculosis in the world

INCIDENCE Rate per 100,000 inhabitants	
2000	144
2001	138
2002	141
2003	140
2004	140
2005	136
2006	139

Rate of incidence of TB at the global level by year (2000 – 2006), and trend overtime
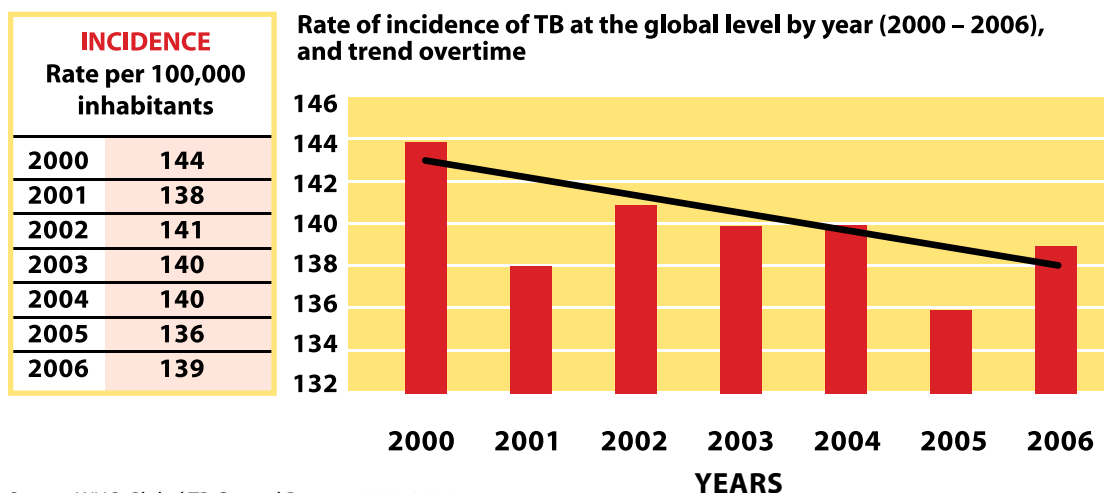
Source: WHO Global TB Control Reports 2000-2008

In relation to the worldwide prevalence of tuberculosis, a general tendency to go down can also be observed from 2003 to 2005, with a slight increase in 2006, as can be observed in Table No. 10 and Figure No. 8.

Table No. 11 and Figure No. 8 • Rate of prevalence of tuberculosis in the world

PREVALANCY Rate per 100,000 inhabitants	
2003	245
2004	229
2005	217
2006	219

Rate of prevalence for TB at the global level for years (2003-2006), and trend overtime
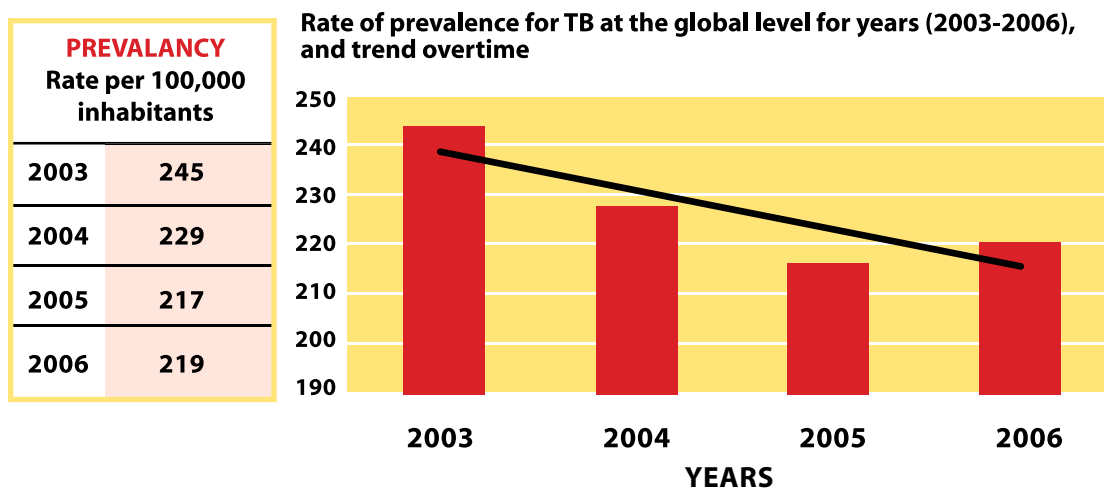
Source: WHO Global TB Control Reports 2000-2008.

The mortality caused by tuberculosis at the world level has had a slight tendency to go down, with 28 deaths for every 100,000 inhabitants in 2003, against 25 deaths per 100,000 in 2006 (Table No. 11 and Figure No. 9).

Table No. 11 and Figure No. 9 · Annual world TB mortality rate

MORTALITY Rate per 100,000 inhabitants	
2003	28
2004	27
2005	24
2006	25

Rate of mortality for TB at the world level for year (2003 – 2006), and trend
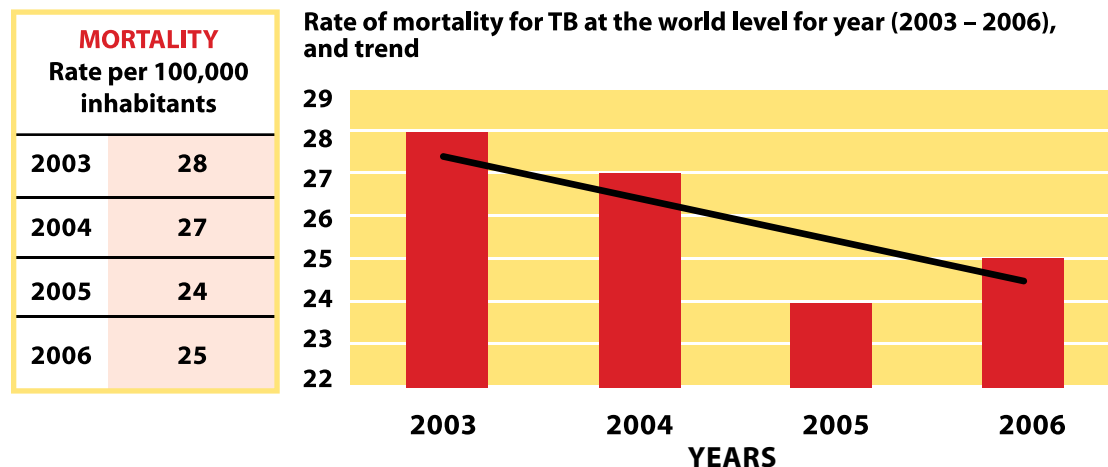
Source: WHO Global TB Control Reports 2000-2008.

The percentage of new cases of TB associated with HIV demonstrate a stable tendency at the world level for the period of 2003 through 2006, as shown in Table No. 12 and Figure No. 10.

Table No. 12 and Figure No. 10 • New cases of TB associated with HIV at the global level

PERCENTAGE of new cases of TB with HIV	
2003	8.3
2004	13
2005	11
2006	7.7

New case of TB associated with HIV at the global level (2003 – 2006), and trend
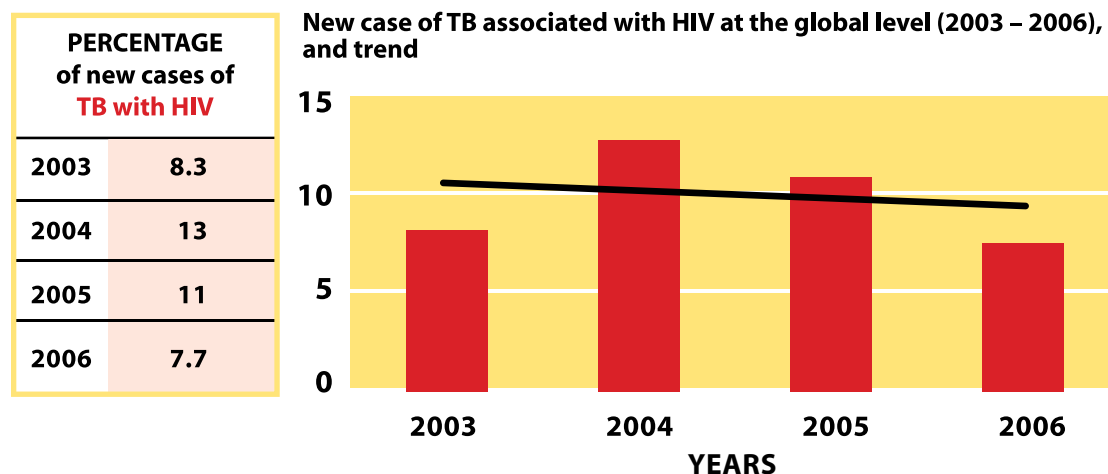
Source: WHO Global TB Control Reports 2000-2006.

DISCUSSION:
EPIDEMIOLOGY OF TUBERCULOSIS AT THE GLOBAL LEVEL

The information above depicts tuberculosis as a disease that is diminishing at the world level. These tendencies, even though encouraging, should not allow the decision makers to let their guards down; they must continue waging this battle, particularly in geographical zones of special complexity and that also present special difficulties for the effective combat of this disease. The U.S.-Mexico border is one of these zones in which the advancements that have already been realized could become stagnant and indeed retreat, if innovative measures are not adopted that are responsive to the determinant binational situation.

Epidemiological overview of tuberculosis in the Americas

In 2004, according to estimates of PAHO / WHO for this region, there were 370,000 new cases and 53 thousand deaths from tuberculosis, with a notable reduction of 20% (74,000) in registered cases in 2007. Yet, Peru and Brazil accounted for 50% of all new cases registered in 2007 and Haiti, Bolivia, Guyana, Peru and Ecuador (in this order) reported the highest incidence rates for the same year.

PAHO / WHO, in conjunction with the National Tuberculosis Control Programs of countries in the Americas, prepared the Regional Plan for the Control of Tuberculosis for 2006-2015, with the vision to build an America free of tuberculosis in 2050. The lines of work of this plan are consistent with the aforementioned "Stop TB" strategy, emphasizing early diagnosis, equitable management of disease in communities, using the DOTS strategy, comprehensive care for cases with emphasis on prevention and control of HIV-associated tuberculosis and multi-drug resistance tuberculosis, strengthening health systems, participation of all providers in the area of health and strengthening research.

In 1996, the Pan American Health Organization, in response to the great epidemiological challenge represented by tuberculosis, declared this disease to be a health priority, a statement that was reiterated by the member countries in resolution CD [Council Directive] 39/20 of the Directive Council, that called together and got the governments of these countries to agree to apply the DOTS strategy. Since then, a regional policy was outlined that seeks to fulfill the following objectives:

a) Extend and/or implement the DOTS strategy.

b) Make the control of TB a health priority for the various governments and,

c) Sensitize the partners and international donating agencies to encourage them to help the countries of the region.

According to the estimates of PAHO/WHO, in 2003 in the Americas there were 502,605 prevalent cases, with a rate of incidence estimated for all forms of TB at 43 per 100,000 inhabitants, with variations from 323 per 100,000 in Haiti to less than 5 per 100,000 in the U.S; these rates also contrast with rates at the world level for the same year, which showed an incidence rate of 140 per 100,000. These data permit us to observe that the incidence in the Americas is much lower overall (43 per 100,000), but we must take into account that this result has been affected by the lower values found in the U.S. and Canada. For 2003, just in the region of Latin America and the Carribean, the incidence rate was 62 per 100,000 inhabitants (Figure No. 11 and Table No. 13)

Figure No. 11• Comparison of incidence rates (per 100,000 people) by region, 2003
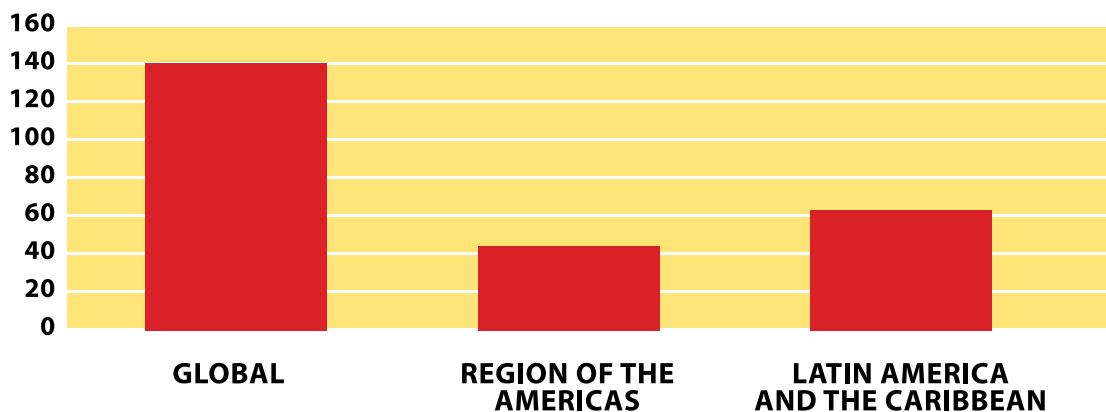
Source: PAHO Tuberculosis Regional Plan 2006-2020.

Table No. 13 • Prevalent cases and deaths of tuberculosis in the region of the Americas, 2003

NUMBER OF CASES PREVALENT 2003	DEATHS FROM TUBERCULOSIS 2003
502,605 CASES	53,803 DEATHS

Source: PAHO Tuberculosis Regional Plan 2006-2020.

DISCUSSION:
EPIDEMIOLOGY OF TUBERCULOSIS IN THE AMERICAS

In the region of the Americas, a situation exists that significantly influences global results: the presence of two countries with very low incidence rates; United States and Canada. The southern border of the former, however, is next to Mexico, a country that still has a long way to go toward achieving control of the disease. This relationship, which encompasses economic, social, and cultural spheres, has generated an independent context that at the same time is interrelated between both countries. This state of affairs could explain the current level of practical difficulty hindering the achievement of the goals for the control and elimination of the disease on both sides of the border, unless the establishment or reinforcement of binationally coordinated strategies are reconsidered; that is, strategies that go beyond those that each country uses on its own.

Moreover, the countries of the Andean Sub region and Southern Cone, including Ecuador and Brazil, continue to face their own challenges to meet the targets for detection and cure recommended by WHO, including universal implementation of the DOTS strategy.

Epidemiological overview of tuberculosis in Mexico and the United States

As we observe in Figure No. 12, the difference in the incidence rates between the two countries is very telling. On one hand, Mexico has incidence rates that have oscillated between 26 new cases for each 100,000 inhabitant in 2003 and 21 new cases per 100,000 in 2006. The United States, on the other hand, has maintained a very stable rate since 2003, with 5 new cases for each 100,000 inhabitants. It is worth nothing that in the case of Mexico, the incidence rate shows a general downward tendency, while in the U.S. the tendency remains stable.

Table No. 14 and Figure No. 12 • Comparison of incidence of tuberculosis in Mexico and in the United States, period from 2003 to 2006

INCIDENCE rate per 100,000 inhabitants		
	MEX	U.S.
2003	26	5
2004	24	5
2005	23	5
2006	21	4

Rates of incidence of TB and trends in U.S. and Mexico, (2003-2006)

■ Incidence in Mexico per 100,000 inhabitants
■ Incidence in United States per 100,000 inhabitants
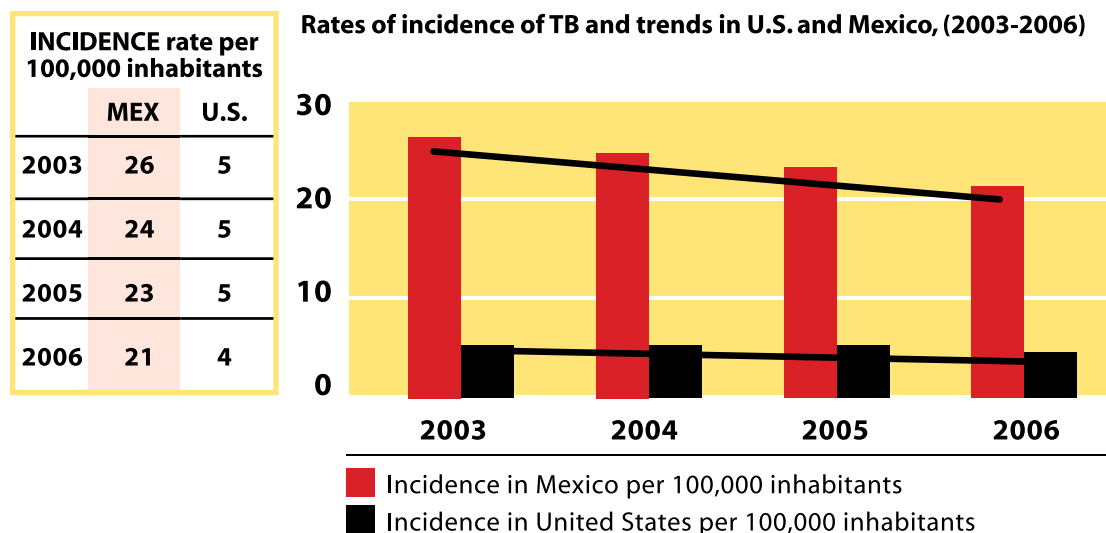
Source: WHO Global TB Control Reports 2000-2009.

With regard to the prevalence of tuberculosis, there were 25 cases for every 100,000 persons in Mexico compared with 3 cases per 100,000 in the U.S. (Table No. 15 and Figure No. 13), which demonstrates a great difference between the two countries. Similar to the data for incidence rates, a clear decrease of prevalence rates in Mexico can also be observed between 2003 and 2005 with a steady decrease trend.

Table No. 15 and Figure No. 13 • Comparison of prevalence of tuberculosis United States-Mexico by year for the period 2003 - 2006

PREVALENCE rate per 100,000 inhabitants		
	MEX	U.S.
2003	33	4
2004	31	3
2005	27	3
2006	25	3

Prevalence rates of TB and trends in U.S. and Mexico, (2003-2006)

■ Rates in Mexico per 100,000 inhabitants
■ Rates in United States per 100,000 inhabitants
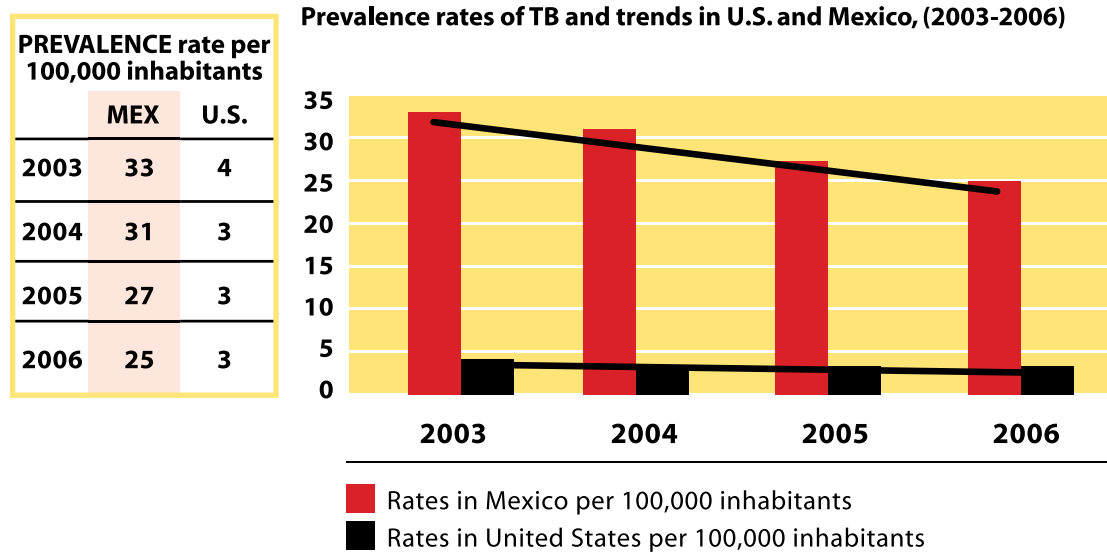
Source: WHO Global TB Control Reports 2000-2008.

The mortality rates resulting from tuberculosis show a declining tendency in Mexico, with four and three deaths for each 100,000 persons in 2003 and 2006, respectively. (See Table No. 16 and Figure No. 14). For the United States, the mortality rate has remained stable and very low.

Table No. 16 and Figure No. 14 • Comparison of mortality by tuberculosis between Mexico and the United States by year for the period 2003 to 2006

MORTALITY rate per 100,000 inhabitants		
	MEX	**U.S.**
2003	4	2
2004	3	2
2005	3	2
2006	3	2

Mortality rates of TB and trends in U.S. and Mexico, (2003-2006)

■ Rates in Mexico per 100,000 inhabitants
■ Rates in the United States per 100,000 inhabitants
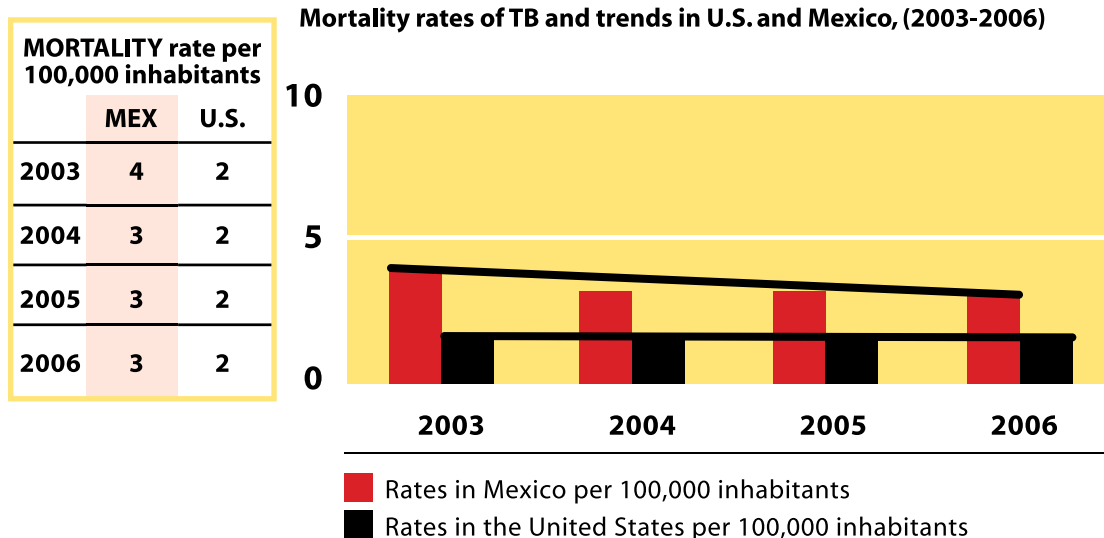
Source: WHO Global TB Control Reports 2000-2008.

In the case of the percentage of new cases of tuberculosis associated with HIV infection, a considerable difference is seen between the two countries, with 8% of cases associated with HIV (2006) in the United States in contrast with 1.7% of tuberculosis cases related to HIV in Mexico (2006). See Table No. 17 and Figure No. 15)

Table No. 17 and Figure No. 15 • Comparison of percentage of HIV infections among people with TB in Mexico and the United States, period of 2003 to 2006

% of new cases TB with HIV positive		
	MEX	**U.S.**
2003		10
2004	1.7	9
2005	1.7	8
2006	1.7	8

Cases of HIV infection among TB cases in U.S. and Mexico, (2003-2006)

■ Percentage in Mexico of new TB cases also HIV positive
■ Percentage in the United States of new TB cases also HIV positive
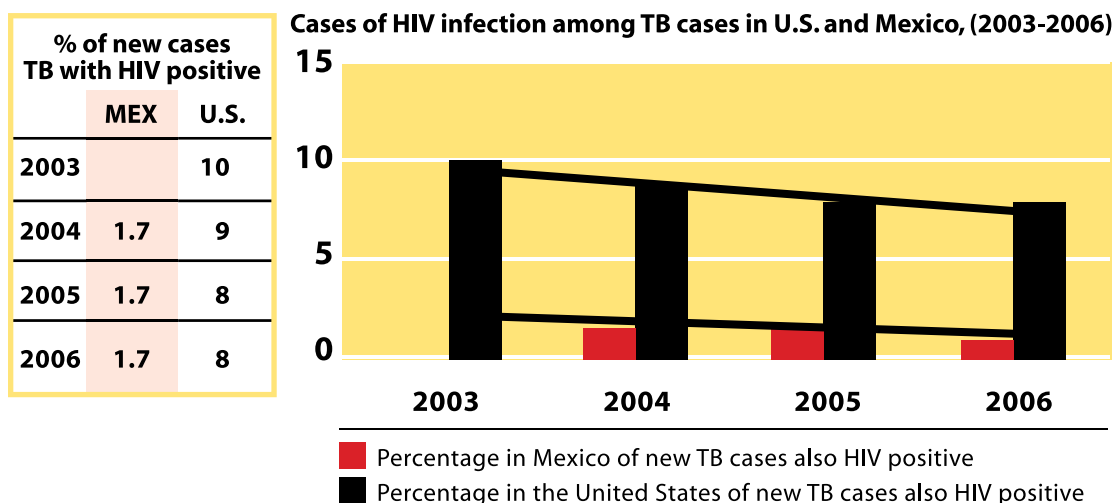
Source: WHO Global TB Control Reports 2000-2008. Source: Reported Tuberculosis in the United States, 2008. Atlanta, GA: U.S. Department of Health and Human Services, CDC, September 2009.

DISCUSSION:
EPIDEMIOLOGY OF TUBERCULOSIS IN MEXICO AND THE UNITED STATES

As we have been able to observe, the TB rates in Mexico demonstrate a tendency to decline, while the tendency in the U.S. is horizontal and very low. Taking into consideration the description of the activity of the social determinants on the border and their interdependence between the two countries, we can infer that the coordinated control and prevention of the disease from a binational perspective would significantly improve the indicators on the Mexican side and facilitate the achievement of total control of tuberculosis in the U.S. The effort of the U.S. to definitively control this disease should not only start inside of the country, but should also begin with an integrated, binational approach that would depend to a great extent on joint decisions and the strategic help it could offer

to Mexico. On the other hand, even while there are encouraging tendencies, Mexico still has a long road to travel in ord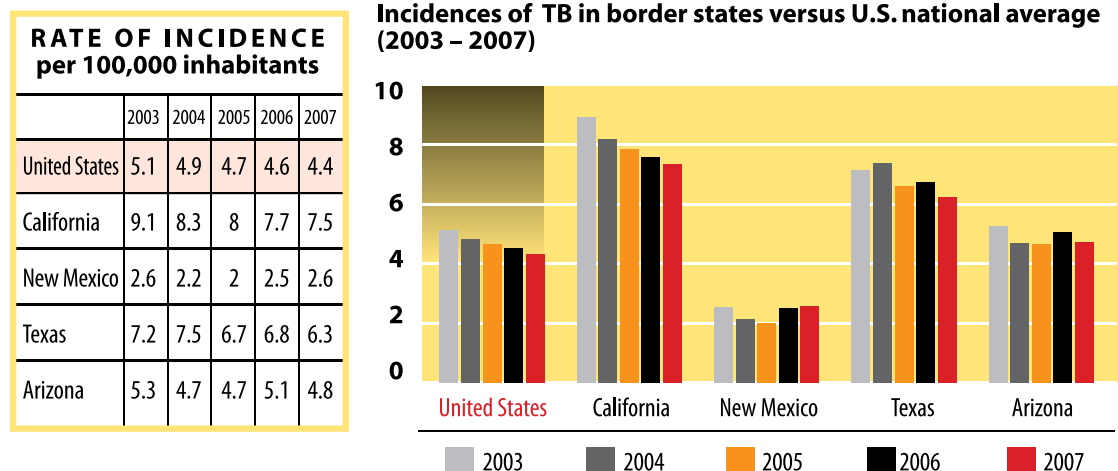er to achieve adequate control of this disease. Improving the social environment for the Mexican population and better coordinating the migratory movements at the binational level will continue to be a challenge, and a factor that will continue to have a great impact on the occurrence of cases of TB.

Epidemiological overview of tuberculosis in the border states of Mexico and the United States

In relation to the incidence of tuberculosis in the southern border states of the U.S. for 2007, California registered the highest rates of incidence of tuberculosis (7.5 per 100,000 inhabitants), followed by Texas, both rising above the national average (5.1 cases per 100,000 population). Also, it notices that New Mexico had an incidence rate of 2.6 in 2007, which is much lower than the national average. (See Table No. 18 and Figure No. 16)

Table No. 18 and Figure No. 16 · Comparison by year for rates of incidence of tuberculosis on the border states and the national average of the United States, 2003 to 2007

RATE OF INCIDENCE per 100,000 inhabitants

	2003	2004	2005	2006	2007
United States	5.1	4.9	4.7	4.6	4.4
California	9.1	8.3	8	7.7	7.5
New Mexico	2.6	2.2	2	2.5	2.6
Texas	7.2	7.5	6.7	6.8	6.3
Arizona	5.3	4.7	4.7	5.1	4.8

Incidences of TB in border states versus U.S. national average (2003 – 2007)

Source: Report on Tuberculosis in the United States by year, CDC.

As Table No. 18 demonstrates, in a classification based on 1 to 50 with the highest rate of incidence (number 1) and the lowest (number 50), the U.S. border states of California and Texas are at the top for the period of the study (high TB rates), while Arizona also occupies a relevant position and New Mexico shows that the problem there is increasing. This situation reveals once again the importance of the problem of TB in the border states in relation to the problem in the U.S. as a whole, with New Mexico still being the exception.

Table No. 19 • Position occupied by the border states at a national level, in relation to the highest rate of incidence of tuberculosis, United States, period from 2003 to 2007
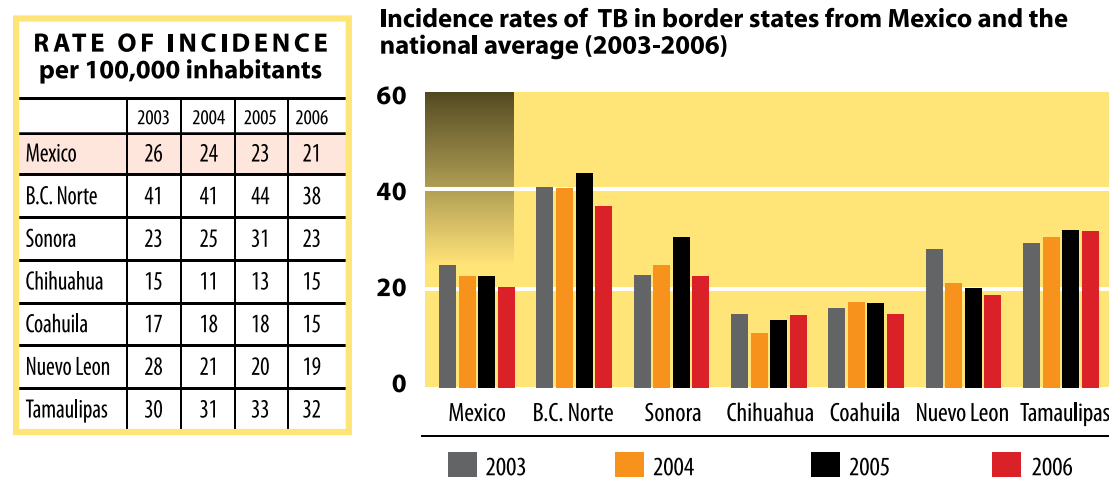
	CALIFORNIA	TEXAS	ARIZONA	NEW MEXICO
2003	Position 2	Position 5	Position 12	Position 32
2004	Position 2	Position 3	Position 13	Position 34
2005	Position 3	Position 4	Position 14	Position 37
2006	Position 3	Position 4	Position 10	Position 30
2007	Position 3	Position 4	Position 12	Position 28

Position 1 (Highest Rate) • Position 50 (Lowest Rate)

Source: Report on tuberculosis in the United States by year, CDC.

With respect to the incidence of TB in the northern states of Mexico, and in agreement with Table No. 20 and Figure No. 17, Baja California presents the highest rates (38 per 100,000 inhabitants), constantly rising above the national average. The estate of Tamaulipas follows with a very elevated rate as well, and in third place is the state of Sonora. Chihuahua, Coahuila, and Nuevo Leon present lower rates than the national average for the period studied. In contrast with the difference among the U.S. border states, the downward tendency is irregular, drawing attention to the fact that after adjusting the method of estimating the cases for Mexico in 2005, the border states did not show the steep descent in the rate of incidence observed in the national average after the year 2004.

Table No. 20 and Figure No. 17 • Comparison of rates of incidence between the border states and the national average, Mexico, period from 2003 to 2006.

RATE OF INCIDENCE per 100,000 inhabitants

	2003	2004	2005	2006
Mexico	26	24	23	21
B.C. Norte	41	41	44	38
Sonora	23	25	31	23
Chihuahua	15	11	13	15
Coahuila	17	18	18	15
Nuevo Leon	28	21	20	19
Tamaulipas	30	31	33	32

Incidence rates of TB in border states from Mexico and the national average (2003-2006)

Source: Basic Indicators 2000-2006 Mexico.

Regarding mortality in Mexico, all the states along the northern border showed rates similar to or higher than the national average (2 per 100,000 inhabitants), during the period of the study (See Table No. 21 and Figure No. 18); but the state that jumped out most in the study, Baja California Norte, presented a rate four times higher than the average. Once again, it can be observed that the border states did not present the abrupt descent indicated in the national average after 2004.
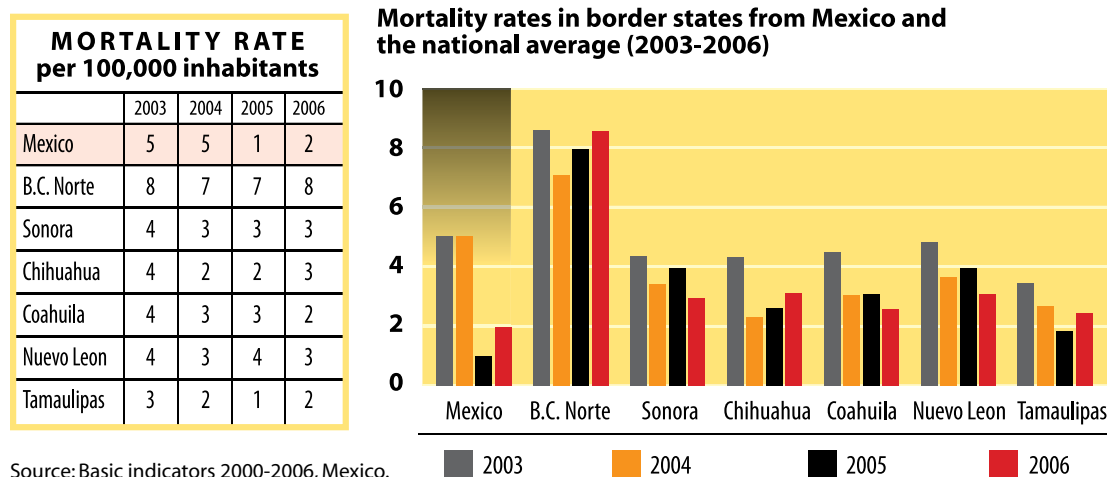
Table No. 21 and Figure No. 18 • Comparison of mortality rates for the border states and the national average of Mexico, period from 2003 to 2006

MORTALITY RATE per 100,000 inhabitants	2003	2004	2005	2006
Mexico	5	5	1	2
B.C. Norte	8	7	7	8
Sonora	4	3	3	3
Chihuahua	4	2	2	3
Coahuila	4	3	3	2
Nuevo Leon	4	3	4	3
Tamaulipas	3	2	1	2

Mortality rates in border states from Mexico and the national average (2003-2006)

Source: Basic indicators 2000-2006, Mexico.

DISCUSSION:
EPIDEMIOLOGY OF TUBERCULOSIS IN THE BORDER STATES OF THE UNITED STATES AND MEXICO

In general terms, the problem of tuberculosis is worse in the border states between Mexico and the United States when the situation is compared with the rest of each country. The numbers indicate that the situation on both sides has a very stable tendency, sometimes seeming to get worse. The situation in California particularly stands out in the U.S. and Baja California Norte in Mexico, which shows the highest incidence rates along the border (for both countries), rates that coincide with the highest concentrations of migrant population located in both states. It is undeniable that the border plays a fundamental role in the success or failure of strategies for the control of tuberculosis at the national level as much in Mexico as in the United States, and it is also undeniable that neither of the two countries will achieve the success they hope for if they seek to control the disease separately. It requires the strengthening of joint actions, coordinated and with a binational vision taking into account the entire border as a functional unit.

Epidemiological overview of tuberculosis in the United States-Mexico border region

This section of the report carefully considers the limitations of the data for the disaggregate analysis at this level. With respect to the counties of the southern U.S. border, the information covered in this report was obtained from the Departments of Health in each state (via Internet). With respect to the border municipalities of Mexico, information was obtained by direct contact with the public health authorities. The data utilized for commenting on the socio demographic aspects and drug resistance come from the publication Tuberculosis along the United States-Mexico Border, 1993-2001, which utilizes information provided by the U.S. health system to describe variables that distinguish the behavior of drug resistance in the persons with TB born in Mexico as opposed to those born in the United States, which helps us understand the specific weight that the migrant population

has on the epidemiology of tuberculosis on the Mexico-United States border. It is indispensible to emphasize once again the need of developing a system that would allow the collection of up-to-date data, based on variables of binational interest that will help develop a system of epidemiological surveillance on both sides of the border zone for purposes of analysis, research studies, and decision-making to achieve better interventions.

According to a great majority of information available for 2006, the border counties in the U.S. presented incidence rates of TB higher than the national average, with the states of California and Texas standing out the most (Figure No. 19),

where the state of Texas showed an incidence rate extremely high for the Frio County, with only 18 cases reported (Texas Department of State Health Services). The counties of La Salle and Culberson also manifested superior to the national average (upwards of 30 per 100,000 inhabitants), and many other counties had rates higher than 20 cases per 100,000. Even though the rates are from areas with small populations, the results show the close relationship between the migrant population, the influence of negative social determinants and the occurrence of TB. These data clearly indicate that the southern U.S. border has a greater problem than the rest of the country in relation to tuberculosis, and even more when analysis of the data is county based.

Figure No. 19 • Comparison of rate of incidence of tuberculosis in border counties and the national average, United States, 2006
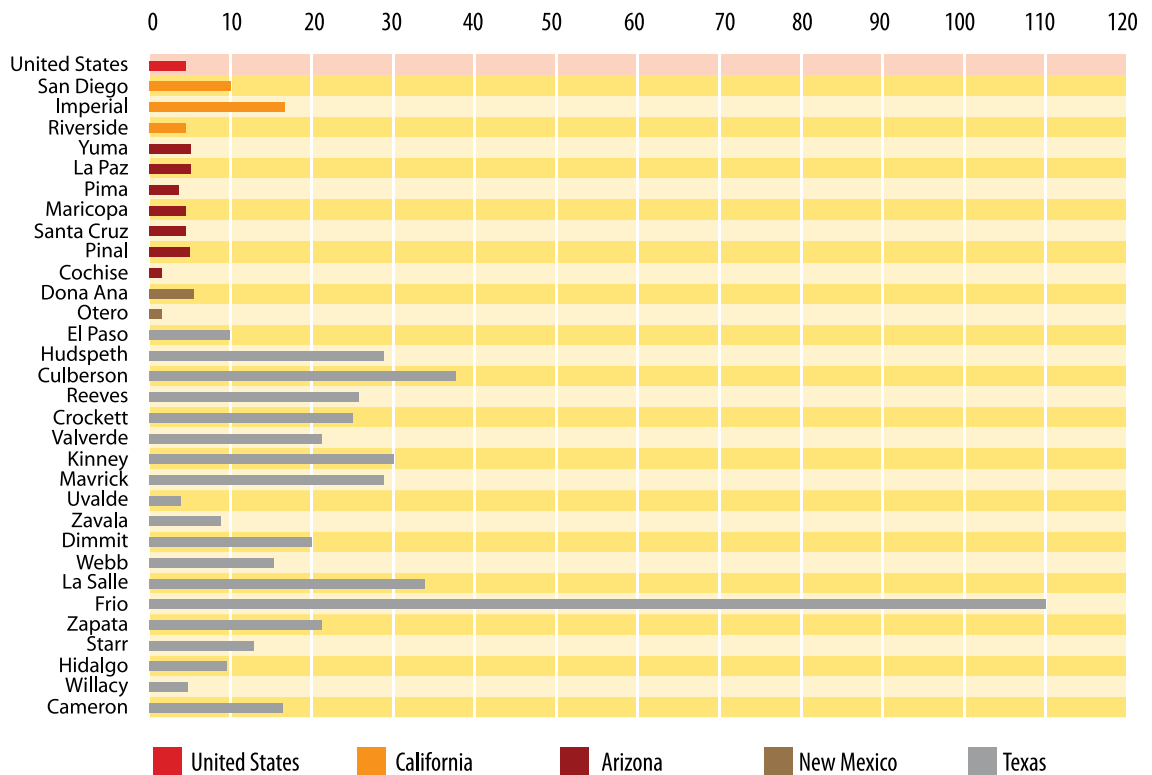
Source: National average: Report on tuberculosis in the United States by year, CDC Rates of incidence in counties: Web pages of the Departments of Health for New Mexico, California, Arizona, and Texas.

Following the same trend shown by the U.S. border countries, in 2006, the vast majority of border municipalities of Mexico showed an incidence rate of pulmonary tuberculosis, far above the national average (Table No. 20). In particular, the high rates recorded by the municipalities in the states of Baja California, Coahuila and Tamaulipas, contrast significantly with the national level, confirming the enormous impact of this disease in these regions of the country. Once again, this situation demonstrates the enormous impact of tuberculosis in the border area as compared to the situation in the rest of the country.

Figure No. 20 • Incidence Rate of Pulmonary Tuberculosis in Mexico Border Municipalities, 2006
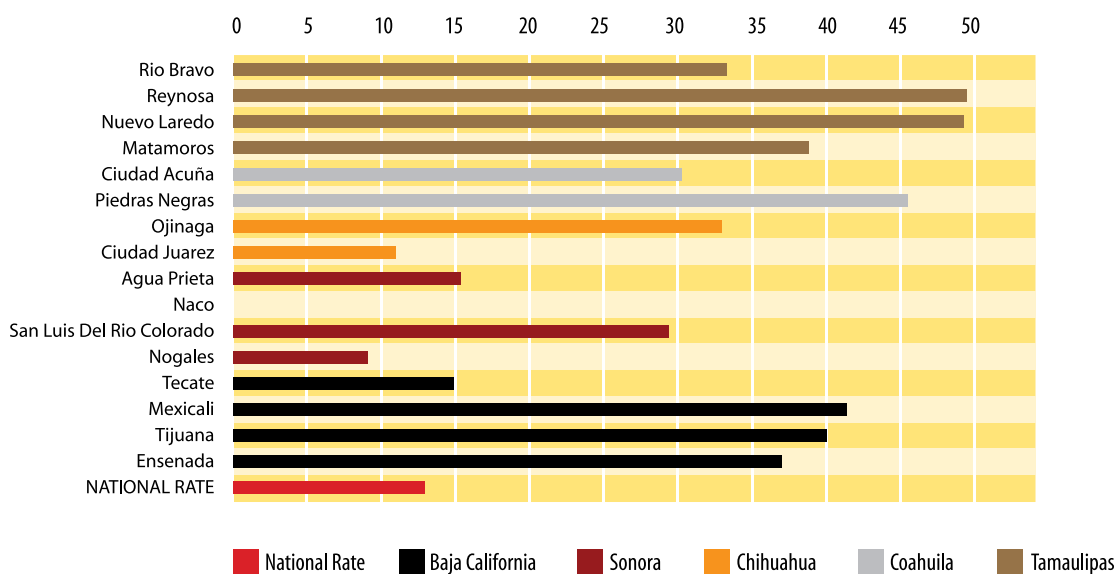
Rate per 100,000 inhabitants

Source: Tuberculosis Module/DGE/SS de Mexico, 2010

Between 1993 and 2001, a total of 181,111 new cases of tuberculosis were reported in the United States, of which 69,232 (38.2% for the period) occurred among persons born outside the U.S. This proportion of cases born abroad the U.S., has shown a constant increase from 1993 (29.5%) to 2001 (49.2%). In this situation, the country that contributed the greatest number of cases was Mexico, with 1,874 (25.3%) of the 7,399 cases reported in 1993 and 1,845 (23.5%) of the 7,865cases reported in 2001. The majority of tuberculosis patients born in Mexico were found in the four border states; these states reported that 76.7% of the total number of tuberculosis patients in their states between 1993 and 2001 were born in Mexico. In the year 2001, the rate of tuberculosis in persons born in Mexico in the four border states altogether was 5 times higher than the rate for persons who resided in these same states, but who were born in the United States; for the 23 counties that are directly adjacent to Mexico, this proportion rose to 5.8. (Table No. 23 and Figure No. 20)

Table No. 22 • Comparison of tuberculosis cases born in Mexico versus those born in the U.S., all inhabitants in the border states of the United States, 2001

A R E A	CASES OF TB BORN IN MEXICO		CASES OF TB BORN IN THE U.S.	
	NO.	RATE PER 100,000 INHABITANTS	NO.	RATE PER 100,000 INHABITANTS
ARIZONA	82	18.8	152	3.4
4 adjoining counties	28	23.2	34	3.4
CALIFORNIA	791	20.1	840	3.3
3 adjoining counties	131	39	112	4.8
NEW MEXICO	8	7.5	42	2.5
3 adjoining counties	2	5.7	4	2.4
TEXAS	388	20.6	938	5.2
14 adjoining counties	142	27.3	106	7.5

Source: Schneider, Eileen; Laserson, Kayla F.; Wells, Charles D. and Moore, Marisa. Tuberculosis along the United States-Mexico border, 1993-2001. Rev Panam Salud Publica [online]. 2004, vol.16, n.1.

Figure No. 21 · Comparison of rates of incidence of TB born in Mexico versus those born in the United States (2001)
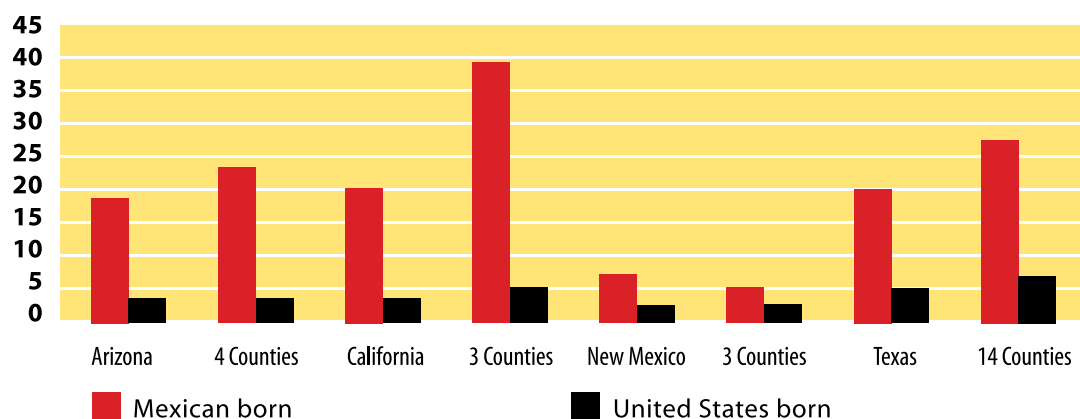
Source: Schneider, Eileen; Laserson, Kayla F.; Well, Charles D. and Moore, Marisa. Tuberculosis along the United States-Mexico border, 1993-2001. Rev Panam Salud Publica [online]. 2004, vol.16, no.1. Rate per 100,000 inhabitants.

Figure 21 also clearly demonstrates the significant risk of tuberculosis among the population born in Mexico and residing the border region on the U.S. side.

Among the border cases involving persons born in the United States as well as those born in Mexico (all residing in the U.S.), the age group that contributed to the greatest tuberculosis incidence on the U.S. side was from people 25 to 44 years of age. Other sociodemographic variables related to TB cases in the U.S. (states on the southern border) are presented in Table 23 and in Figure 21: among them, the cases of tuberculosis related to being in correctional institutions, the use of intravenous drugs, use of non-intravenous drugs, alcoholism, and life on the street. In all of these cases, the largest percentage is related to the U.S.-born population.

Table No. 23 and Figure No. 22 • Comparison of socio-demographic variables between cases of tuberculosis born in Mexico versus cases born in the U.S., all living in U.S. border states, 1993-2001

Sociodemographic variable at the moment of TB Diagnosis	Percentage in border cases born in Mexico	Percentage in border cases born in U.S.
Stay in correctional institution	7.3	12.40
Use of intravenous drugs	2.7	7.9
Use of non-intravenous drugs	6.4	14.4
Alcoholism	16.1	24.9
Living on the streets	6.6	16

Comparison of percentages in variables sociodemographic at the moment of diagnosis of TB (1993-2001)
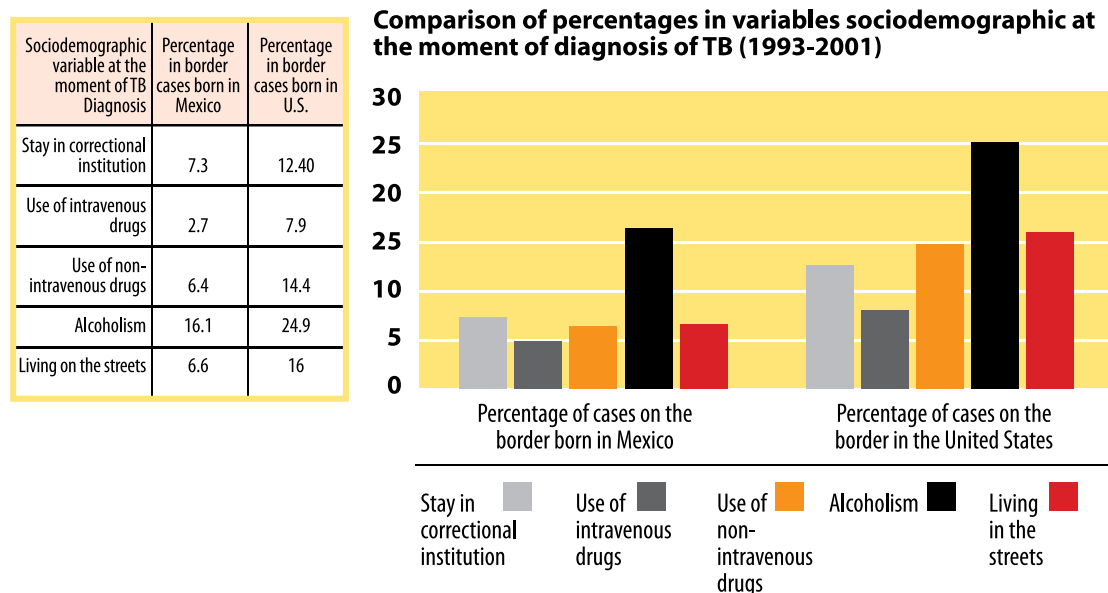

Source: Schneider, Eileen; Laserson, Kayla F.; Well, Charles D. and Moore, Marisa. Tuberculosis along the United States-Mexico border, 1993-2001. Rev Panam Salud Publica [online]. 2004, vol.16, no.1. Rates per 100,000 inhabitants.
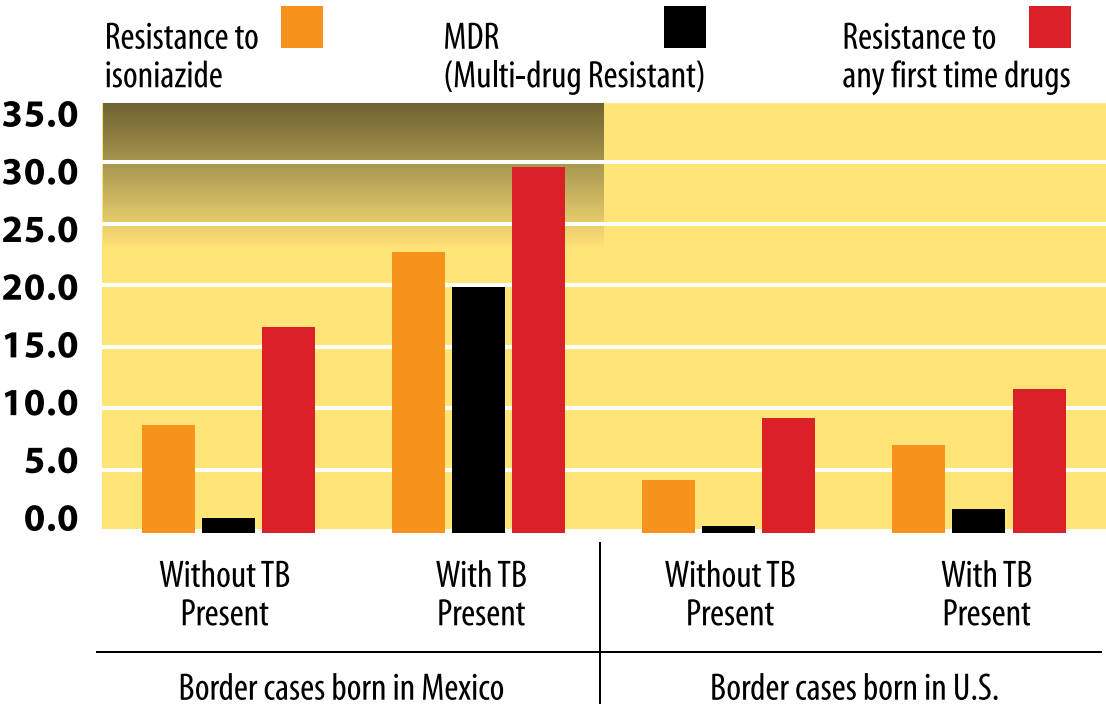
Between 1993 and 2001, in the U.S. southern border states, there were greater rates of drug resistance found among cultures of Mycobacterium tuberculosis in cases involving persons born in Mexico, (whether residing in the border region or elsewhere), in comparison with data for cases of TB involving persons born in the U.S. This was especially true among patients with a previous history of the disease, as can be seen in Table No. 24 and Figure No. 23

Table No. 24 • Comparison of drug resistance rates (%) between cases of tuberculosis born in Mexico vs. cases born in the U.S., all inhabitants in the U.S. border states, 1993-2001

	% OF RESISTANCE IN BORDER CASES BORN IN MEXICO		% OF RESISTANCE IN BORDER CASES BORN IN THE U.S.	
VARIABLES	WITHOUT TB PREVIOUSLY	WITH TB PREVIOUSLY	WITHOUT TB PREVIOUSLY	WITH TB PREVIOUSLY
Resistance to isoniazid	8.6	23.1	4.2	7.2
Multi-drug resistance (MDR)	1.3	11.6	0.5	2.1
Resistance to any first line drug	16.7	29.7	9.4	11.8

Source: Schneider, Eileen; Laserson, Kayla F.; Well, Charles D. and Moore, Marisa. Tuberculosis along the United States-Mexico border, 1993-2001. Rev Panam Salud Publica [online]. 2004, vol.16, no.1.

Figure No. 23 • Comparison of drug resistance between cases of tuberculosis born in Mexico versus cases born in the U.S., all inhabitants in the U.S. border states, 1993-2001

Resistance to isoniazide ▮ (orange) MDR (Multi-drug Resistant) ■ (black) Resistance to any first time drugs ▮ (red)

	Without TB Present	With TB Present	Without TB Present	With TB Present
	Border cases born in Mexico		Border cases born in U.S.	

Rates per 100,000 inhabitants

Source: Schneider, Eileen; Laserson, Kayla F.; Well, Charles D. and Moore, Marisa. Tuberculosis along the United States-Mexico border, 1993-2001. Rev Panam Salud Publica [online]. 2004, vol.16, no.1.

As observed in Figure 23, in the southern border states of the U.S., drug resistance in various ways is much greater in border patients born in Mexico compared with drug resistance among cases (patients) born in the U.S. border.

DISCUSSION:
EPIDEMIOLOGY OF TUBERCULOSIS IN THE UNITED STATES-MEXICO BORDER REGION

The border region clearly shows the complexity and gravity of the problem related to tuberculosis, highlighting the following points:

a) The incidence of TB in the border region is much higher in both sides, in comparison with the national average of each country.

b) In the U.S. border counties and Mexican border municipalities, TB is much frequent than in the rest of each respective country.

c) In the U.S. counties directly adjacent to Mexico, the incidence is even greater than in the rest of the border states.

d) The incidence of tuberculosis in the U.S. border region is directly associated with the origin of its cases, since the great majority involve persons who migrated to the U.S. from Mexico.

e) Age characteristics of tuberculosis cases in the southern U.S. border, is included in the main group of the Mexican population migrating to that country: population between 15 and 44 years (productive and reproductive age).

f) Tuberculosis cases associated with HIV, drug use, and living conditions on the street, are less frequent in inhabitants of the southern U.S. border states who were born in Mexico.

g) The percentages of drug (in various forms) resistance in the southern U.S. border states are greater among persons born in Mexico; a situation closely associated with determinant factors such as poverty, a native language different from English, limited access to health services, and finally the impossibility of beginning or correctly continuing anti-tuberculosis treatment.

Tuberculosis on both sides of the United States-Mexico border region is a phenomenon intimately linked to the processes of migration from Mexico to the neighboring country. Primarily, it is essential that the social determinants and economic that have a negative influence the places of origin of many of the cases be addressed, which could be key to making important steps toward resolving the problem along the border.

With respect to the situation that already exists in the United States-Mexico border region, there is no doubt that a better control of cases will be achieved when a binational system of surveillance, management, and control that is effective and integrated becomes a reality. The presence of such a system would prevent new cases, allow for detected cases to be cured, and reduce failures and costs to avoid scenarios of drug resistance.

CHAPTER 3

Review of Strategies for the Management of Patients with Tuberculosis

Control on the United States-Mexico Border

In this chapter three aspects related to tuberculosis are approached: a general comparative layout of factors related to the management and control of the disease in Mexico and in the United States, a review of the problems related to TB in the border region, and lastly a description of the principal recommendations and strategic actions that have been carried out to overcome these problems.

Comparison of protocols for controlling the disease, United States-Mexico

In Mexico, the majority of work for prevention and control of the disease is based on the content of the Norma Oficial [Official Mexican Standard] 006 SSA2. All state systems of health, including the states of the northern border, are based on this standard for establishing their plans and work strategies. With regard to the U.S., the states' governments play a much more significant role in the monitoring and management of patients. Each state decides which diseases are reported to the health department and what information needs to be shared with the Centers for Disease Control (CDC). The majority of state monitoring programs include the infections enumerated on the list of diseases for "national notification" prepared by the CDC. The policies of each state determine which diseases ought to be followed and reported by doctors, laboratories, and hospitals. Likewise, in spite of the CDC recommendations, U.S states are not obligated to meet a national standard for the diagnosis and treatment of tuberculosis. The states, clinics, and laboratories can establish their own protocols, even though for the large majority, the standard is based on the recommendations from the federal level.

Below in table number 26, it is presented a comparison/contrast of some key points in relation to the protocols for the management and control of TB in both countries:

Table No. 26 • Comparison of the protocols for management of the patient with tuberculosis in Mexico and in the United States

PROGRAMATIC ASPECT	OFFICIAL PROTOCOL MEXICO	OFFICIAL PROTOCOL UNITED STATES
BCG VACCINATION	**Universal application:** Should be administered One dose of 0.1 milliliter intradermally in the deltoid region of the right arm in all of the newborns; subsequently or until 14 years of age, whenever it is considered necessary.	**Limited application:** **1)** infants or children who have a negative tuberculin ski-test and cannot be given primary preventive therapy and are permanently exposed to infectious patients with organisms resistant to INH and RIF and who cannot be removed from the exposure; **2)** Health Care Workers in settings in which: A) There is a high percentage of TB patients infected with *M. Tuberculosis* strains resistant to both INH and RIF, and B) Transmission of resistant INH and RIF strains to HCWs is likely, and C) Comprehensive TB infection control measures have been implemented and have not been successful
ADMINISTRATION AND INTERPRETATION OF THE TUBERCULIN TEST (PPD)	Use 0.1 ml of RT-23 2 TU or PPD-S 5 TU Read the induration in millimeters 72 hours after the application 0-4 mm= no reaction (negative) =+5 mm = positive for the undernourished, newborns, the immunosuppressed, HIV positives or patients with AIDS 10+ mm = positive for the population in general	Apply 0.1 ml of PPD 5 TU intradermally using Mantoux technique Measure the induration in 48-72 hours after the application 0-4 mm or less is considered negative 5+ mm or greater is considered positive for persons with: A) HIV infection B) Recent close contact with infectious Tuberculosis patients, C) Chest x-ray findings consistent with previous untreated tuberculosis

	Limited use of PPD is recommended: - Considered valuable in the diagnosis for children younger than 15 years of age without previous BCG vaccination - In patients with high risk of developing tuberculosis: newborns, younger than 5 years of age, undernourished, immunosuppressed patients, and patients who are HIV positive or who have AIDS - At-risk health workers	D) Persons with organ transplants or for other immunosuppressed patients 10+ mm or more is considered positive in A) Children of 4 years of age B) Recent immigrants from countries with high incidence of TB, C) Persons with IV drug addiction D) Inhabitants and employees in overcrowded situations E) Persons with high-risk medical conditions 15+ mm or greater is considered positive for the general population without a known risk factor
TREATMENT OF LATENT INFECTION OF TUBERCULOSIS (CHEMOPROPHYLAXIS)	For contacts who are less than 5 years of age with or without BCG: Daily administration, for 6 months, INH at 10 mg /kg without exceeding 300 mg per dose: For asymptomatic contacts, young people between the ages of 5 and 14, family contacts who may not have received the BCG vaccination: Daily administration of INH for 8 months. For contacts of persons with HIV or with other immunosuppressed conditions older than 15 years of age: Strictly supervised daily administration of INH for 12 months	Without concern for age, both the persons infected as well as those who are considered to have high risk of developing active tuberculosis should be treated for latent tuberculosis infection: - Daily administration of INH for 9 months; or - Administration of INH 2 times a week for 9 months with treatment strictly supervised (DOT).
DEFINITION AND DIAGNOSIS OF CASES	**By laboratory:** - Bacilloscopy with Acid-Alcohol Resistant Bacillus (BAAR) positive - Histopathological examination - Cultivation of MTB	**By laboratory:** Isolation of the M. Tuberculosis complex from a clinical specimen; and through an amplification testing of the nucleic acid

	By clinical criteria: - Signs and symptoms compatible with tuberculosis, such as abnormal chest x-ray or unstable (worsening or improving), or - Clinical evidence of illness (fever, night sweats, weight loss, hemoptysis) and - Treatment with two or more pharmaceuticals for tuberculosis	**By clinical criteria:** - Evidence of tuberculosis infection based on a simple of positive tuberculin; and - Signs and symptoms of tuberculosis, such as: Abnormal chest x-ray or unstable (worsening or improving), or - Clinical evidence of the illness (for example, fever, night sweats, cough, loss of weight, hemoptysis), and - Treatment with two or more pharmaceuticals for anti-r tuberculosis - Clinical and chest X-ray improvement after treatment initiated
PRINCIPAL METHODS FOR THE DIAGNOSIS	Bacilloscopy with positive BAAR Children vaccinated with PPD 18 mm or more of induration = active tuberculosis	Positive culture for the complex *M. Tuberculosis*
TREATMENT	**Intensive phase:** 60 doses administered from Monday through Saturday, of Rifater (INH, RIF and PZA) and Ethambutol **Maintenance phase** 45 doses (Monday, Wednesday, and Friday) of Rifinah (INH and RIF)	**Induction phase:** INH,RIF,PZA and EMB daily for 8 weeks or daily for 2 weeks and then two times a week for the remaining 6 weeks **Continuation phase** INH,RIF daily or two or three times per week for 16 weeks
DIFFERENCES IN THE COMPOSITION OF RIFATER AND RIFAMATE	Rifater 75 mg Isoniazid (INH) 150 mg Rifampicin (RIF) 400 mg Pirazinamide (PZA) Rifinah 200 mg Isoniazid 150 mg Rifampicin	Rifater 50 mg Isoniazid (INH) 120 mg Rifampicin (RIF) 300 mg Pirazinamide (PZA) Rifamate 150 mg Isoniazid 300 mg Rifampicin
CONTACT INVESTIGATION	Study of symptoms Bacilloscopy of sputum from coughers X-rays in symptomatic adults with positive BAAR and in all those who are less than 15 years old with symptoms	Symptoms screening , PPD, and occasionally x-rays Sputum AFB smear and culture in individuals with abnormal x-rays, symptomatic or not X-ray in case of reactions to PPD (5 mm or more of induration), symptomatic, and in children of less than 4 years of age regardless of PPD skin test results

DRUG-RESISTANT TUBERCULOSIS		*Emphasizing the use of strictly supervised therapy-DOT-for these patients*
PREVENTION	The cases should receive DOTS chemotherapy	Ensure the quality of management of cases of tuberculosis, including periodic review of cases, evaluation and analysis; DOTS for all cases and suspected cases of tuberculosis to ensure the taking of all of the prescribed medicines, and avoid any additional medicine not effective for the treatment.
DIAGNOSIS	Cultivate and test of antimicrobial susceptibility to all of the cases with suspected pharmaceutical resistance and to all contacts cases with positive bacilloscopy and among 100% of DOTS plus supervised treatment by doctor or nurse	Examine bacteriology or histology with confirmation of laboratory for a positive cultivation of *M. tuberculosis* with proof of susceptibility indicating pharmacological resistance.
TREATMENT	Defined by the State Committee of pharmacoresistant correspondents; it should guarantee the provision of totality of the necessary pharmaceuticals for the duration of treatment; examine all those contacts. The treatment should last for at least 18 months	If there were demonstrated resistance to whatever of the first-line pharmaceuticals, seek specialized consultation for the regimen of drugs and individualized recommendations for case management; closely follow the patient with clinical evaluations and frequent tests of sputum; evaluate the response to treatment with special attention in order to detect the increase of additional pharmaceutical resistance; all patients with pharmaceutical resistant tuberculosis should receive DOTS
EVALUATION	Monthly clinical and bacteriological monitoring and cultivation every 6 months; complementary studies for each case in particular defined by the State Committee correspondent.	Monthly clinical and bacteriological monitoring or follow the recommendations of an expert; x-ray needs should be determined for each individual case.

Source: Manual for the Management of Binational Tuberculosis Patients. Migrant Clinicians Network. MMWR, November 4, 2005 / Vol. 54 / No. RR-12

PROBLEMS DESCRIBED RELATED TO THE CONTROL OF TUBERCULOSIS ON THE UNITED STATES-MEXICO BORDER

In Mexico, through the *Programa de Acción Específico para la Tuberculosis 2007-2012* [Program of Specific Action for Tuberculosis 2007-2012] from the Secretariat of Health, the following deficiencies at the national level, which are the same as those found on the northern border, have been noted:

a) Lack of adherence to and knowledge of the current standards on behalf of state health institutions, in particular in the private sector, including the norms and guidelines for the diagnosis of cases, which are required for providing adequate treatment.

b) Insufficient resources, resulting from a lack of investment from the federal entities and the health sector institutions, for the integrated management of patients and the population at risk, as well as the monitoring of the program and the continuation of the personnel trainings.

c) Limited functionality of the mechanisms for monitoring the follow-up of patients within and outside the sector, and a lack of supervision of the patients under treatment schemes in the states.

d) High turnover of operational personnel, which makes the development of sustainable technical and human competencies for providing services to patients and their families difficult to achieve.

e) A marked inadequacy of actions to promote health and communicate risks in order to foster more individual and collective efforts for self-care and social responsibility.

f) Lack of systemization of actions for providing services to vulnerable groups and mobile populations through active search for cases, as well as their follow-up, within prisons, indigenous communities, and groups with a low human development index such as migrants and other at-risk populations.

g) Presence of drug-resistant and extensively resistant cases without health coverage and epidemiological follow-up.

h) Institutional difficulties for the systemization of integrated health care actions for persons with HIV-AIDS and tuberculosis, particularly in border federal entities and mobile groups of greater vulnerability.

i) Elevated dropout rates and failure of treatment due to a lack of therapeutic adherence and deficiencies in the management of the programs, and ineffective mechanisms for evaluation in the states.

j) Limited leadership from those responsible for state programs and deficiencies in interinstitutional coordination.

For its part, in the United States on June 19, 2001, the CDC released a report about the prevention and control of tuberculosis on the United States-Mexico border. This document identifies some factors that complicate the follow-up and management of tuberculosis in this region, which are listed below:

a) High rates of tuberculosis in Mexico.

b) The low socioeconomic status and limited access to health services in the border area.

c) Frequent crossings in both directions on the border for purposes of commerce, work, or pleasure.

d) Socio-cultural and languages differences between the two border populations.

e) Limited coordination for the follow-up of cases among the different offices and health institutions on both sides of the border.

This report established that in order to achieve success in meeting the health challenges represented by the transborder population, it would require local, state, and national collaboration between programs of tuberculosis in both countries.

The "Strategic Plan 2005-2001 of "Ten Against Tuberculosis" (a binational strategy for the control of tuberculosis on the border between the U.S and Mexico., which will be described later) should be also mentioned, which lists the following problems on the U.S.-Mexico border:

a) The available data in relation to tuberculosis on the U.S.-Mexico border are insufficient.

b) A rapid and correct diagnosis of persons with tuberculosis is obstructed by the inadequate capacity of border state laboratories of Mexico and the U.S.

c) Training is necessary on all levels of health professionals and community groups at high risk.

d) Many patients with tuberculosis do not complete their treatment.

RECOMMENDATIONS AND STRATEGIES HISTORICALY ISSUED FOR THE CONTROL OF PULMONARY TUBERCULOSIS ON THE UNITED STATES-MEXICO BORDER

In Mexico, through the *Programa de Acción Específico para la Tuberculosis 2007-2012* [Specific Action Program for Tuberculosis 2007-2012] from the Secretariat of Health, the following strategies were proposed at a national level, which also includes the border states:

a) Strengthening the technical competencies related to the detection, diagnosis, and treatment of medical personnel, paramedics, and laboratory technicians, in units and laboratories of both the health sector and in private practice, to intensify and expand outreach efforts toward general population and vulnerable groups.

b) Consolidation of the public-private alliance through the dissemination "Estándares para la Atención de la Tuberculosis" [Standards for Addressing Tuberculosis] in Mexico.

c) Strengthening the epidemiologic surveillance system at a sector level, through the support of the "Plataforma única de información en Salud" [Consolidated Health Database] Tuberculosis module, including the mortality analysis due to tuberculosis.

d) Integration of a network of experts on tuberculosis with drug resistance and the updating of guidelines for dealing with patients with TB-MDR and -XDR, with interinstitutional participation and involvement of the international organizations.

e) Strengthening the interprogram collaboration with CENSIDA [National Center for the Prevention and Control of HIV/AIDS (Mexico)] in order to address the coinfection of TB and HIV/AIDS.

f) Encouragement of community participation and organized civil society through legal strategies and social mobilization for the empowerment of those affected, their families and communities, with the goal of increasing social co-responsibility in the prevention and control of tuberculosis.

g) Strengthening research efforts related to tuberculosis for improving the operational and decision-making processes of the Program.

In the United States, on June of 1999, representatives of the CDC, in conjunction with officials involved in tuberculosis control in the four U.S. states adjacent to the border with Mexico, conducted a meeting to deliberate about the prevention and management of tuberculosis in the border zone as a preliminary step toward a meeting with Mexican officials that deal with this problem. The proposals that emanated from this meeting are summarized below:

a) Establish and standardize a definition for binational TB case.

b) Establish an electronic database encompassing binational cases of tuberculosis so that all programs can have access to a unified registry of cases.

c) Strengthen collaboration, or create new strategies of collaboration, among the tuberculosis programs on both sides of the border for case follow-up, and establish reference procedures among these programs, creating effective links for patient follow-up. Use already known mechanisms and procedures, such as "Cure TB" and "TB Net."

d) Strengthen the follow-up of tuberculosis cases among detained immigrants by providing training to detention personnel, and strengthen the reference systems to accommodate the language of immigrants to facilitate case follow-up and management.

e) Establish indicators for evaluating the problem of tuberculosis on the border, utilizing for this purpose the follow-up of contacts, the follow-up of binational patients, and the presence of laboratories that provide adequate services.

f) Establish evaluations of the tuberculosis programs, specifically in relation to binational patients.

g) Extend research of tuberculosis on the border in order to have a better understanding of the situation.

h) In general, and as a basic support for reinforcing previous points, establish effective mechanisms for sharing information of all data sources that relate to tuberculosis in the border region.

Between January 2003 and August 2004, members of the Technical Committee of Ten Against Tuberculosis also came together to discuss the different issues related to establishing a strategic plan for the upcoming years. The technical recommendations of this plan would cover the following lines of action:

a) Improve the system of epidemiological surveillance and search for tuberculosis cases.

Objective 1:
By 2005, develop a mutually agreed definition of a binational case of tuberculosis to be used in both the U.S. and Mexico.

Objective 2:
By 2008, increase the timely detection of tuberculosis cases in the binational population by 10%.

Objective 3:
By 2010, design and implement an integrated system of data related to binational tuberculosis that meets the needs of health providers, researchers, and consumers in the U.S. and Mexico.

b) Strengthen the lab infrastructure for the identification and confirmation of tuberculosis cases.

Objective 1:
By 2008, create and maintain a series of border laboratories that will ensure the diagnosis of all tuberculosis cases, including those that are drug-resistant.

Objective 2:
By 2008, secure adequate and trained personnel to carry out the basic tests that laboratories need to perform.

Objective 3:
By 2006, create a legal mechanism for the interchange of samples and resources all along the border.

Objective 4:
Ensure the functioning of committees related to drug resistance for those patients that require it.

c) Increase the promotion of health, training, and communication related to tuberculosis.

Objective 1:
By 2008, the continual training and educational opportunities for all health providers who work in the fight against binational tuberculosis will be available in convenient locations and in a variety of technologies. The health providers include health workers in the public sector, laboratory technicians, information providers, nurses, and doctors.

Objective 2:
By 2008, develop the necessary infrastructure for binational training related to tuberculosis along the whole length of the border of Mexico and the U.S., as appropriate to the jurisdictional needs for training and education.

Objective 3:
By 2007, Ten Against Tuberculosis will develop an inventory of bilingual educational materials for educating professionals and the community with regard to binational tuberculosis.

Objective 4:
By 2007, Ten Against Tuberculosis will develop, test, and support a bilingual campaign for promotion of and awareness related to health that will be directed at community leaders and inhabitants of communities with high rates of tuberculosis.

Objective 5:
By 2005, identify foundations that could help in the efforts of "Ten Against Tuberculosis".

Objective 6:
By 2006, establish a system for better binational exchange of information and links between the states and the border.

d) Improve the management of tuberculosis cases

Objective 1:
By 2008, ensure that services of case management and the complete regimen of pharmaceuticals against tuberculosis be available without barrier to all patients defined as binational cases of tuberculosis, so that all patients can complete the regimen of established treatment.

Objective 2:
By 2007, offer specialized medical attention to all pediatric patients diagnosed with tuberculosis.

Objective 3:
By 2008, develop effective and long-lasting services of specialized consultation that facilitate case management and assure permanent cures for all patients with tuberculosis complicated by the coinfection of TB-HIV, diabetes, and especially TB-MDR.

Objective 4:
For 2008, extend *Medicaid* coverage to assure adequate access to health services, diagnosis, and treatment for patients who receive medical attention for tuberculosis in the U.S., regardless of their migratory status or length of time in the country.

Objective 5:
For 2008, assure that each binational tuberculosis patient, receives complete treatment and that 90% of the contacts be evaluated for tuberculosis within a specific period of time.

Objective 6:
By 2008, assure that all cases of TB-MDR be co-managed by a binational or state official committee.

What follows is a summary of the binational strategies that have, with varying degrees of success, emerged to improve the control of tuberculosis in the border region:

HEALTHY BORDER 2010

This undertaking aims to improve health in the Mexico-United State border region. Established by the Mexico-United States Border Health Commission, this group covers 10 years (2000-2010) with work objectives that stress the promotion of health and prevention of diseases in the region. The Healthy Border 2010 program is a binational initiative that embraces the common elements of the health programs in the United States and Mexico. Its agenda is a subset of the health agenda addressed by Healthy People 2010. The program is based on the National Program of Health Indicators (i.e., the indicators of results).

Through the Healthy Border 2010 program, U.S.-Mexico Border Health Commission identified in 2000 the primary activities that ought to be carried out in the area of health for the region, including specific projects by country as well as binationally, helping in their interventions and in the health policies that they coordinate and also in improving the allocation of resources. Within the components of this program, infectious diseases are addressed, including as a specific objective the reduction of the incidence of tuberculosis.

THE "TEN AGAINST TUBERCULOSIS" (TATB) INITIATIVE

This initiative is a binational effort, which was created by the state secretariats of health of the ten border states during the annual assembly of the United States-Mexico Border Health Association (USMBHA) held in San Diego, California, in June 1995. The goal of TATB has been "to identify and respond to the opportunities and challenges that cannot be solved in a unilateral fashion by either of the countries acting separately." Thus, TATB serves as a facilitator of the activities and the binational efforts of cooperation up and down the border in order to reduce morbidity and mortality cases from this disease and reduce its transmission. The group brings together all responsible professionals from the tuberculosis programs, the epidemiologists, lab technicians, and the heads of state health programs from the ten U.S.-Mexico border states. Also, among members were the representatives from the federal governments, the Pan American Health Organization, the U.S.-Mexico Border Health Commission, the United States-Mexico Border Health and nongovernmental organizations.

TB-NET

This is a multinational project for monitoring the follow-up and referral of patients with tuberculosis among mobile and poorly served populations. The treatment of these populations is complicated by the fact that many people (given the circumstances of their lives) cannot remain in a fixed locality long enough to complete treatment. In the mid-90s, many clinics and public functionaries of health recognized the need for a mechanism of follow-up and coordination for the management and treatment of TB patients who moved between distinct geographical jurisdictions of public health. In 1996, the organization known as "Migrant Clinicians Network," working with a consortium of organizations of public health and financed by a subsidiary of the Texas Department of Health, founded TB-Net with the objective of responding to this situation. TB-Net helps mobile tuberculosis patients complete their treatment in three ways:

a) Provide to different TB clinics a portable treatment of documents that could be carried in the patients' wallets. These documents would provide a practical summary of treatment and can be easily carried by the patients wherever they go. This would allow other TB clinics to continue the treatment.

b) TB-Net maintains a central storehouse of medical documents for those who are enrolled. The provider of medical care for a patient can call TB-Net for free to request an updated copy of patient's documents.

c) The patients can also call TB-Net free of charge to receive help and to locate places that provide treatment and are close to their new destination.

TEXAS-MEXICO PROJECTS

In 1991, the Texas Department of Health established three projects to provide management of TB patients and their contacts who live on both sides of the border. These projects include: 1) "Proyecto Juntos", established to serve the zone of Juarez-El Paso, Las Cruces, New Mexico and that of West Texas and Ojinaga in Chihuahua; 2) the "Los Dos Laredos" project to serve Laredo and Nuevo Laredo; and 3) "Sin Fronteras" in the Lower Rio Grande Valley, which includes the areas of Brownsville-Harlingen-McAllen in Texas and Matamoros-Reynosa in Mexico. The three projects work with binational patients and their contacts and provide laboratory assistance for diagnosis and case management, through cooperative arrangements among programs for controlling tuberculosis on both sides of the border.

ARIZONA-SONORA PROJECTS

In 1991, three cross-border projects were established by the Arizona Department of Health Services in coordination with the "Departamento de Salud del Estado de Sonora" [Sonora Department of Health]. These projects serve the areas of Santa Cruz-Nogales, Cochise-Agua Prieta, and Yuma-San Luis Rio Colorado. The projects monitor multi-drug resistant tuberculosis, provide DOT treatment, coordinate the follow-up of patients who miss medical appointments and who frequently travel across the border, and provide Sonora with laboratory services through the State of Arizona.

THE CALIFORNIA-BAJA CALIFORNIA COMMITTEE

Since the mid-1980, representatives of the public and private programs for the control of tuberculosis in San Diego, California, Imperial County, and Baja California Norte have been reviewing the management of binational cases, planning joint activities (such as binational training), developing activities of professional preparation and media campaigns, etc.

MEXICALI-IMPERIAL PROJECTS

This group carries out two annual events: a health information fair for farm workers in Calexico, California, and a Binational Symposium on Tuberculosis for health personnel in Mexicali, Baja California. At these events, information related to TB is provided. A binational media campaign is developed to disseminate information and teach the population how to recognize the symptoms and promote early evaluation.

CURE TB

This system is operated by the TB Control Program of San Diego, CA county since 1950. It is a system of binational reference designed to improve the care of active TB patients and their high risk contacts. The program provides education and assistance to patients that cross between Mexico and the United States during the course of their treatment. The system also facilitates information interchange among health providers when the patient arrives in different communities.

DISCUSSION:
STRATEGIES FOR THE CONTROL OF TUBERCULOSIS ON THE UNITED STATES-MEXICO BORDER

We know that in the United States-Mexico border region many binational effort have been carried out and continue to be carried out for controlling the problem of tuberculosis. Of these, one that has made the most information available is the "Ten Against Tuberculosis" initiative. This initiative required great collaboration between both countries; the objectives it laid out emphasize the need for integrated binational efforts, which is consistent with findings and needs identified throughout this report. Both the problematic situation and the strategies indicated by different occurrences in both countries offer a very wide panorama of deficiencies that require priority attention and also the courses of action that ought to be developed to address them.

The problem up to now seems to be the lack of continuity, lack of carrying through plans, lack of follow-up for what has been developed, and lack of interinstituional integration. During the composition of this report, it was very easy to identify sources of information with plans of action for approaching TB along the border. What has not been easy is finding documents that show the follow-up, the results, the coordinated efforts, and the integration of experiences that take into account the border area as a functional binational unit.

The border still is very far from functioning as a unit of epidemiological surveillance coordinated with respect to tuberculosis. The same can be said of other objectives addressed by initiatives previously described, whose fulfillment has not been met the timelines that have been laid out.

There are also concerns related to the binational projects. These function to a lesser or greater degree, and there can be no doubt that their contributions are vital for continuing on the road toward the adequate control of tuberculosis. However, integration of projects among the states is still lacking as well as ample and standardized coverage, the ready availability of information is still lacking, and the information that is accessible and integrated for the use of whoever might have an interest in the subject. The intensive promotion of these projects and initiatives so that they that all service providers and general population on both sides of the border know about them is also lacking. In summary, the problem is clear enough and has been described, in addition to the primary courses of action. The challenge is in the coordination and interchange of effective information, the fulfillment of commitments, and developing adequate mechanisms for evaluation and monitoring that would allow us to provide an assessment of the progresses of joint efforts.

CHAPTER 4

Conclusions and Recommendations

Conclusions and Recommendations for the Control of Tuberculosis on the United States-Mexico Border

Through the document, different aspects related to tuberculosis on the border between Mexico and the United States have been reviewed. Following we enumerate the main conclusions that can be inferred from the analyzed material. Later some pertinent recommendations related to different aspects assessing TB in the border area for the use of decision-makers, authorities and those interested in the issue are described.

CONCLUSIONS

Conclusion 1:

One of the principal determinants of the occurrence of tuberculosis on both sides of the United States - Mexico border is immigration from within Mexican territory

In earlier chapters, phenomena has been described that it is now necessary to emphasize: a) the states of northern Mexico have a relatively better quality of life than the rest of the country. Contrary to this situation, the states of the south of the U.S. have levels of poverty greater than the rest of their respective country. Under these conditions, successive population movements have continued from the interior of Mexico toward the north. The north of Mexico at the same time is not sufficiently rich or attractive (socio-economic variables) to shelter (effectively) the population that migrates, and at the same time the south of the U.S., with its relative poverty is sufficiently rich and attractive to attract this migrating population. The total trajectory of this migration is characterized by aspects strictly linked to tuberculosis: poverty, overcrowding, malnutrition, lack of work opportunities, lack of security and better quality of live and little access to the health services. The fact (apparently contradictory) that the states in the north of Mexico have indicators that demonstrate a quality of life higher than the rest of the country, and also report incidence rates of TB greater than the national average, has its probable explanation in the migratory current pushed by the country's social inequities that at present has a tendency to increase, and which in turn, is caused by the poverty and scarcity of opportunities in the states of its origin.

Conclusion 2:

The situation of tuberculosis on the border between Mexico and the United States is worsening because this region does not function as a binational epidemiological unit that is well integrated and coordinated

The problem of tuberculosis conditioned in good measure by the migration towards both sides of the border, has its own aggravating factions: the disease should be attacked in both countries, two health systems, two languages, two economies, two different cultures, two distinct administrative and legal systems, and two different political environments. This dual scenario is where this infectious chronic diseases appears, with and long and difficult case management, in which those affected belong to a mobile and vulnerable population.

Conclusion 3:

There is no system of registering data which in an integrated way provides timely information that is current and useful on both sides of the border

The information exists, but it is fragmented: on the United States side, fragments correspond to the various types of management that each state decides to use, which leads to various types of data and information on the border counties. With respect to Mexico, accessible state information exists, but it is not always current, and information had to be requested at the federal level. All of this is because, nowadays there is not a standardized and agile system of accessible information which shows data of binational interest, and with accessibility for all of those who work on the border.

Conclusion 4:

The actions taken to fight tuberculosis in the United States-Mexico border region are for the most part fragmented

There are multiple actors in the binational scenario of tuberculosis: public institutions, private institutions, the government, non-governmental institutions, binational projects, etc. There is no institution that assumes the day-by-day leadership in a clear cut manner or that provides coordination that truly brings cohesion to the all above mentioned entities and that aligns them with common objectives for the total control of the disease.

Conclusion 5:

There are various valid proposals which have not been carried to completion and which could be resumed

An example that could be mentioned is the initiative of "Ten Against Tuberculosis," which provides a very clear diagnosis of the situation and a reasonable working plan that has not yet been completed.

Conclusion 6:

The total control of tuberculosis in the U.S is intimately tied to the collaborative effort that this country may offer Mexico

In the epidemiological chapter that corresponds to tuberculosis, it was observed that rates of incidence and prevalence of tuberculosis in the border states of the U.S. are low and stable, but without a tendency to diminish. It was also observed that a great part of the problem of tuberculosis in this country has its origin in the population born in Mexico, including drug-resistant cases. The U.S. could approach the problem in an integral and coordinated manner, by bolstering binational collaboration and help from Mexico. Mexico ought to adapt better its own capacities of coordination and work plans so that efforts being carried out in the states of its northern border might be consistent with the efforts the U.S. is trying to undertake for the control of tuberculosis in its border states, particularly among the migrant population.

RECOMMENDATIONS

Recommendation 1:

To advance toward the solution of the problem of tuberculosis on the border between Mexico and the United States the social determinants must be addressed, and the states with the highest degree of migration need to be given top priority

If the problem of tuberculosis in the United States-Mexico border is compared with a tree, we can observe that the branches are extended on both sides of the border, but the trunk and roots are to a large extent not directly connected to the border itself. One of the primary roots of this tree is situated in the states with the higher degrees of migration. In other words, resolving the causal aspects that are the source of migration from Mexico would be like cutting the roots of the tuberculosis tree that extends its branches toward the border. Tuberculosis on the border is tied to the quality of life in all of Mexico; it is related to the economy, the living conditions, the nutritional level, the presence or absence of employment, and better opportunities of life.

Recommendation 2:

The border region between Mexico and the United States should be converted into a single unit for purposes of epidemiological surveillance, detection and case management, and control of tuberculosis

It is necessary, for purpose of controlling the disease, to orient all strategic efforts in order to merge the epidemiological scenario into one. It is also necessary to no longer divide the work between two systems of surveillance, two systems of disease prevention, and two systems of disease control. The viability of unifying or of making definitions of a "binational case" more flexible needs to be explored, for purposes of functionality, in order to develop systems of notification of binational cases using standardized definitions for the entire two-sided border region, to create and manage binational databases, to agree upon and utilize binational indicators, and to provide binational follow-ups of pharmaceutical treatments in hoping to achieve a decrease in of treatment failures and the occurrence of drug resistance.

Recommendation 3:

A binational system of collecting data on tuberculosis must be designed to provide information related to the whole border as an epidemiological unit, containing variables of binational interest, and that is accessible to all the parties with a vested interest in the problem

Having a tool such as this, with controlled access, will foster the decision-making process, the prioritization of actions to be taken, and the development of investigations to increase related knowledge to the problem.

Recommendation 4:

A lead institution in charge of overseeing all the efforts carried out in the fight against tuberculosis along the United States-Mexico border is needed, which should be capable of creating the necessary alliances and maintaining common objectives among all participating institutions

Leadership is lacking to moderate the processes of technical consultation and the administrative management of interinstitutional action as well as to facilitate consultations at political level between the governments of the two neighboring countries. It behooves the members of the XXVII Conference of Governors to analyze this situation in more detail.

Recommendation 5:

A process to follow-up the existing strategic plans should be designed and consolidated in order to preserve and document successful experiences, and to reinstate and strengthen those that are most effective

The strategy of "Ten Against Tuberculosis" is a good example.

Recommendation 6:

The monitoring and study of tuberculosis on the border ought to continue in order to have the most complete and up-to-date information available in relation to the current situation

It is without a doubt that there are many unanswered questions related to tuberculosis on the United States-Mexico border that ought to be resolved in the future and that will require continual efforts in the area of research. What is the percentage of infants with tuberculosis? What is the degree of association of tuberculosis to other diseases such as diabetes mellitus, HIV, or the use of drugs? What is the percentage of drug-resistant patients that live in the region and cross the border? What is the actual capacity for offering DOTS? These questions, and many others, require responses in the short and medium term in order to extend the decision-making capacity and to give direction to new strategies of action.

The present study has been completed in just a bibliographic manner and was based on a review of sources of information available to the public, with the limitations that this presents for the analysis of information. It would be advisable to continue this study in a more advanced stage of binational collaboration with a standardized compilation of direct information containing data from both sides of the border region. To this end, a form for achieving such a compilation is presented in Appendix 1 of this document. This preliminary format could be an intermediary instrument, which once filled with appropriate entries, could become a permanent database.

APPENDIXES

APPENDIX 1

SUGGESTED SURVEY FOR COLLECTING DATA RELATED TO TUBERCULOSIS IN THE UNITED STATES-MEXICO BORDER REGION

1. GENERAL DATA FROM THE NOTIFYING UNIT

1.1. State: _____

1.2. Office providing information: _____

1.3. Border municipality/county/state where the data originated:

_____

1.4. Population of the border municipality/county/state for the years 2007 and 2002:

Year: 2007_____   Year: 2002 _____
Source of Information _____

2. NOTIFICATION AND REGISTRY OF PULMONARY TB CASES

2.1 Number of cases of Pulmonary TB notified during the years 2007 and 2002

Year: 2007_____   Year: 2002 _____
Source of Information _____

2.2 Number of existing Pulmonary TB cases for the years 2007 and 2002

Year: 2007_____   Year: 2002 _____
Source of Information _____

2.3 Number of deaths due to Pulmonary TB for the years 2007 and 2002

Year: 2007_____   Year: 2002 _____
Source of Information _____

3. ASSOCIATED DISEASES

Total number of cases of Pulmonary TB associated with **HIV**. 2007 _____

Total number of cases of Pulmonary TB associated with **Diabetes**. 2007 _____

Total number of cases of Pulmonary TB associated with **IV drug use**. 2007 _____

Source of Information _____

4. CONTACT STUDIES

Total contacts **declared**. 2007 _____

Total contacts **examined**. 2007 _____

Source of Information _____

5. DIRECTLY OBSERVED THERAPY (DOTS)

Total cases **under** DOTS. 2007 _____

Total cases **not under** DOTS. 2007 _____

Total cases **without any treatment**. 2007 _____

Source of Information _____

6. BACILISCOPIES PERFORMED, 2007

Baciloscopies used for **diagnosis**. 2007 _____

Baciloscopies used for **control**. 2007 _____

Total number of Baciloscopies performed. 2007 _____

Source of Information _____

7. DRUG RESISTANCE

Total number of patients with multi-drug resistance (MDR). 2007 _____

Total number of MDR patients receiving
treatment from Health Services. 2007

Total number of MDR patients receiving
treatment from binational projects. 2007

_____   _____

Total number of patients with extensive drug resistance (XDR). 2007 _____

Total number of XDR patients receiving
treatment from Health Services. 2007

Total number of XDR patients receiving
treatment from binational projects. 2007

_____   _____

Source of Information _____

APPENDIX 2

The present document is a technical report that in the first stage describes the general situation related to tuberculosis on the United States-Mexico border, based on the data and information available bibliographically. In the production of this report, the following specific themes were covered:

The social determinants that exist on the United States-Mexico border

A bibliographical review was conducted (using the most current data) in order to understand the demographic, socioeconomic, and migratory factors that exist on the border and that influence the occurrence and behavior of tuberculosis, both in terms of its incidence and prevalence and mortality. First, a review of the data was carried out on each side of the border in relation to (national context) each respective country before focusing on the border region through an integrated analysis in relation to a binational context that considers the populations on both sides of the border as a functional unit. However, it must be taken into account that in some cases the parameters and indicators that are followed in the United States are not the same as those used in Mexico, nor are the analytical focuses of interest the same. For example, the educational aspect in Mexico is measured by the percentage of illiteracy in those under the age of fifteen and by the percentage of persons aged 6 to 14 years who attend school, while in the United States, the educational indicator quantifies the number of persons who have completed their secondary studies (High school). In conclusion, the available sources of information are described in each country using different indicators, and even though they address similar concerns, that point does not necessarily mean that they are directly comparable, making a binational analysis more difficult. The complex structure of the social, economic, and cultural context found in each border state must also be taken into account in such analysis.

Epidemiology of tuberculosis on the United States-Mexico border

An overview of the situation and behavior of the disease was carried out using, wherever possible, four indicators: incidence, prevalence, mortality, and the disease as associated with Human Immunodeficiency (HIV). Starting with an overview of the more general information (both global and continental) then later concentrating in the situation existing in Mexico and the United States, and afterwards analyzing the behavior of the disease in the border region. For information at the global level, the Global Reports on Tuberculosis Control disseminated by WHO (2000-2008), among other sources, were used to provide the basis for the completion of the figures in this report. In every case where it was possible, information covering a period of 5 years was included in the epidemiological analysis. In relation to the local information provided for the states, municipalities, and border counties, information that was available bibliographically was gathered. A survey was developed to obtain epidemiological information, which was used in the next stage of this investigation for a direct collection of data with the help of authorities in the states, municipalities, and health organizations. This work will allow the creation of a database and as a result from this, have more complete information, taking into account variables that can be analyzed binationally. (The survey can be viewed in Appendix 1.) The analysis of the epidemiological behavior of tuberculosis along the border included the interpretation of tables and graphs to contextualize the information both nationally and binationally and its relationship to the social determinants.

Review of strategies for TB patient control on the United States-Mexico border

This review primarily focuses on a general and comparative consideration of the principal programmatic points of the protocols for the diagnosis and the management of TB patients in Mexico and the United States. A bibliographical review of the problematic situation was first provided in relation to tuberculosis on the United States-Mexico border, addressing matters such as the strategies and courses of action that have come forth to combat the disease.

Conclusions and recommendations

These were arrived at by using a review of the social determinants, epidemiology and existing mechanisms for controlling the disease as a basis. These three focuses were aligned qualitatively in order to develop pertinent conclusions and recommendations.

APPENDIX 3

THE WORLD'S BURDEN WITH RESPECT TO TUBERCULOSIS AND THE GOALS FOR FIGHTING IT

The World's Burden with respect to Tuberculosis

a) HIV/AIDS, tuberculosis, and malaria cause six million deaths annually, and of these, almost two million are the result of tuberculosis.

b) There is a cure for tuberculosis, but even so, it kills 5,000 persons a day.

c) Ninety-eight percent of all deaths from tuberculosis occur in developing countries, the majority of which are found among young adults in their most productive years.

d) Tuberculosis is the primary cause of death among persons infected with HIV whose immune system has been compromised; 250,000 deaths from tuberculosis are associated with HIV, with the majority of these occurring in Africa.

e) Tuberculosis is one of the primary killers of young women, especially in Africa.

f) If tuberculosis is not controlled, it will kill another 35 million persons in the next 20 years.

g) At the global level, the incidence of tuberculosis continues growing at a rate of 1% annually because of its rapid growth in Africa; in other regions, aggressive efforts against tuberculosis are helping the rates go down or stabilize.

h) Tuberculosis hits the most vulnerable populations the hardest, such as those suffering extreme poverty and undernourishment.

i) Two million people, a third of the world's population, are infected with the tuberculosis bacillus.

j) One of every ten persons infected by the tuberculosis bacillus will develop active tuberculosis.

k) Tuberculosis is contagious and is transmitted through the air, just like the common cold; each individual with contagious pulmonary tuberculosis infects between 10 to 15 persons per year.

l) Tuberculosis is a worldwide pandemic; even though its rates are highest in Africa (a forth of all cases), half of the new cases are found in six Asiatic countries: Bangladesh, China, the Philippines India, Indonesia, and Pakistan.

m) In 2003, 8.8 million new tuberculosis cases were registered, of which 80% are found in 22 countries.

n) The multi-drug resistant tuberculosis (TB-MDR) is present in almost all of the 109 countries recently study by WHO and its associates.

o) Each year 425,000 new cases of TB-MDR emerge; the highest rates correspond to the old USSR and China, where up to 14% of the new TB cases do not respond to conventional pharmaceutical treatment.

The Response to Tuberculosis

The goals with respect to TB are the following:

1. World Health Assembly in 2005, to detect at least 70% of infectious cases of tuberculosis (latest data: 45%) and successfully treat 85% of them (82%).

2. Developed objectives from the millennium for 2015 include reversing the incidence of tuberculosis. For the same year, the Stop TB Alliance has set an accompanying goal of reducing the prevalence and the deaths caused by TB in one half with respect to the figures from 1990.

a) The DOTS strategy, launched in 1995, consists of five elements:

1. political commitment with the control of tuberculosis,

2. bacteriological diagnosis and an effective network of laboratories,

3. short standardized chemotherapy and support to the patient for the duration of the treatment;

4. an uninterrupted supply of pharmaceuticals of standardized quality; and

5. registry and notification for measuring results at both the patient and the program level.

b) More than 20 million patients with tuberculosis have been treated within the framework of DOTS.

c) A total of 182 countries have adopted the DOTS strategy, even though a fourth of the world's population still does not have access to the services it provides.

d) WHO has developed a new and improved world strategy called "Stop Tuberculosis," which aspires to reach out to all patients and intensify the fight against TB. It consists of six basic elements:

    1. to pursue the expansion of the DOTS strategy of quality;

    2. to address the association of TB/HIV and TB-MDR;

    3. to contribute to the strengthening of the health systems;

    4. to incorporate all the providers of health care;

    5. to train patients and communities; and

    6. to facilitate and promote research.

e) The Stop TB Department of WHO, together with the regional and national offices of WHO, works out policies, strategies, and norms; supports the initiatives of the Member States of WHO; evaluates the advances toward meeting the goals of controlling TB, such as the functioning, financing, and impact of the national programs; and facilitates alliances, advocacy, and communication.

f) The Stop TB Alliance, whose office is allied to WHO, is a network consisting of 400 members. It has a Joint Coordinator and six work groups: Advocacy, Communication, and Social Mobilization; DOTS Expansion; TB/HIV; TB- MDR; New TB Drugs, New TB Diagnostics; New TB Vaccines and TB/HIV.

g) The World Service for Medication Acquisition, operated by the Stop TB Alliance, is extending access to pharmacists in anticipation of the further expansion of the DOTS strategy; in just four years, four million treatments for TB patients have been administered.

h) Through the Green Light Committee, the projects of DOTS-Plus can solicit access to high quality medications for TB_MDR management at a reduced price – in some cases up to 99%.

i) The Global Plan Stop TB 2006-2015 details the economic needs and resources needed to reach the goal for 2015; it is based on the Global Plan Stop TB 2001-2005.

j) The Work Plan for the fight against TB in Africa 2006-2007 recommends incorporating this plan to related agendas of development, the reinforcement of DOTS programs, expansion of actions related to the association of TB and HIV, and provide assistance to the alliances in the fight against tuberculosis.

k) In 2005, the WHO declared Tuberculosis an emergency in Africa; and the regional director of WHO called attention to the TB emergency in Europe.

l) In 2005, the global directions of the G8 committed themselves to combat tuberculosis in Africa in the following ways: helping to cover the needs identified by the Stop TB Alliance; covering the economic needs of the Global Fund of the Fight Against AIDS, Tuberculosis and Malaria; and promoting the development of new medications and vaccines.

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