ORIGINAL RESEARCH

Demographic and socioeconomic characteristics of tuberculosis mortality in San Cristóbal de Las Casas, Chiapas, Mexico 1997-2009

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Abstract

Objective: To analyze the demographic and socio-economic characteristics of deceased tuberculosis patients.

Subjects: Individuals who died between 1997 and 2009 in San Cristóbal de Las Casas (San Cristóbal), Chiapas, Mexico and had previously been registered as tuberculosis patients.

Methods: All reports and death certificates from the San Cristóbal civil registry were reviewed. We identified and analyzed cases in which the cause of death was listed as tuberculosis (n=79). Socio-economic data was taken from the death certificate. To analyze the degree of social marginalization, addresses of decedents were geo-coded by Basic Geostatistical Area (BGA).

Results: Most patients dying of tuberculosis had one or more of the following characteristics: 1) they lived in an BGA with high or very high levels of social marginalization, 2) they had low educational attainment; 3) they were peasants, migrants, or housewives, and/or 4) they were not covered by social security.

Conclusion: Most patients dying of tuberculosis are socially vulnerable. In order to prevent further mortality from tuberculosis in the suburbs of San Cristóbal, TB detection and treatment programs must be significantly strengthened amongst marginalized groups.

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Introduction

Globally, 85% of morbidity and 99% of mortality from tuberculosis (TB) occur in countries with high poverty rates.[1] In countries with lower levels of poverty, TB is primarily found among migrants who are often socially marginalized.[2,3] Recent studies also indicate that TB prevalence is higher in urban areas than in rural ones.[4] One possible explanation is that urbanization, especially when it is accelerated, generates conditions conducive to transmission of TB infection and development of clinical disease; these conditions include increased population density, overcrowded living quarters, substandard working conditions, and inadequate wages. Low wages make nutritious food unaffordable and promote the

Map 1. Location of Chiapas in Mexico.

consumption of diets high in fats and sugars, as well as sedentary and other unhealthy lifestyles.[5]

Studies undertaken in various European and Asian countries[6-8] have found that the geographical distribution of the disease is not homogeneous, even within cities. Tuberculosis is found in areas with higher levels of unemployment, poverty, marginalization, and immigration.

In Mexico, Chiapas is one of three states, along with Oaxaca and Guerrero, with the highest levels of social marginalization; it is also one of the states with the highest levels of illiteracy[9] and food poverty.[10] It has the second-highest level of deaths from TB in the country.[11]

One of the areas most affected by TB in Chiapas is the Highlands region.[12] San Cristóbal de Las Casas is the only city in the region and third largest in the state of Chiapas after Tuxtla Gutiérrez and Tapachula. San Cristóbal also is the region with highest number of TB deaths in the state; nearly one out of every ten registered deaths due to pulmonary tuberculosis in Chiapas occurs in San Cristobal.[12]

San Cristóbal's social and demographic conditions favor the transmission of TB. Among these are rapid and unplanned population growth, high levels of immigration, high-poverty urban areas, low levels of enrollment in the social security system, and a large number of indigenous settlements. Studies have identified significant barriers in access to tuberculosis diagnosis and treatment.[13,14] There are also high rates of multidrug-resistant TB (MDR-TB)[15] and tuberculosis mortality.[13]

We undertook to examine the socio-demographic correlates of tuberculosis mortality in San Cristóbal.

Study area

Eighteen of the 19 municipalities in the Chiapas Highlands exhibit a high or very high level of socio-economic marginalization,[16] Fifty-five percent of the population lives in conditions of social marginalization,[9] and six of the 15 municipalities with the highest levels of poverty in the Mexico are in the Highlands.[10]

Several factors combine to foster unequal access to health services in the region. In some areas health services are simply lacking. Political and religious conflicts can complicate access to services where they exist. For those who do reach a healthcare facility, economic and cultural barriers may keep them from receiving appropriate care.[13]

Since 1970, religious and political conflicts have also led to the expulsion of many indigenous peoples from their communities of origin and their emigration to San Cristóbal. During this period San Cristóbal became the educational center of the region, attracting students both from within the state of Chiapas as well as from other Mexican states. These factors have led to accelerated and unplanned urban growth.[17-19] An important proportion of new migrants have established impromptu settlements characterized by poor housing, overcrowding, and a lack of basic sanitation services. Migrants also face significant cultural barriers in accessing health services and are often discriminated against and mistreated by the healthcare system.[19]

Methods

Data source and abstraction

All death certificates from the San Cristóbal municipal registry for the period between January 1, 1997 and December 31, 2009 (n = 8,741) were examined. When the death certificate indicated that the cause of death was TB, the following information was obtained from the certificate: gender, age, place of birth, highest level of education attainment, occupation, place of residence, place of death, time be-

tween TB diagnosis and death, type of TB, coverage by the social security health system, and the individual who had certified the death. All death certificates were reviewed in their entirety and data was entered into a form specially created by the investigators.

Data management and analysis

Data was entered into a SPSS Version 14 database for analysis. The following categories were used:

Classification of TB: TB cases were classified into three groups: pulmonary, miliary, and meningeal.

Age: The mean and standard deviation was calculated for the analysis of age.

Place of birth and last residence: Place of birth was classified into three groups: those born in a rural municipality in San Cristóbal, those born in the urban area of San Cristóbal, and those who were born outside San Cristóbal, either in a rural or urban area. A similar classification scheme was used for the deceased's residence: residence in a rural municipality of San Cristóbal, within urban San Cristóbal, or outside of the San Cristóbal municipality. For those living outside of San Cristóbal, communities were classified as urban if they had over 2,499 inhabitants; otherwise they were classified as rural.

Migration status: We used the definition of "migrant" adopted by Mexico's National Institute of Migration: any person who resides outside their place of origin, regardless of the time spent in the new area.[20] Using place of birth and last residence, subjects were classified into three categories: those who were born and resided in the city, those who were born outside of San Cristóbal but immigrated to the city, and those who were neither born nor resided in the city but whose deaths had been registered in the city.

Neighborhood type: For residents of urban San Cristóbal, the place of last residence was divided into two types of neighborhood: peripheral neighborhoods and non-peripheral neighborhoods. The first group was composed of neighborhoods established since the 1970s; these were characterized by a lack of infrastructure and basic services and had de-

veloped in response to the mass migration triggered by economic, religious, and political conflicts. The second group was composed of all other neighborhoods. There are no primary sources documenting neighborhood level socio-economic infrastructure and characteristics. Instead we used historical works about San Cristóbal to characterize neighborhoods

The address of last residence was geocoded using *Google Earth 6.2*. Each geocoded point was assigned to the appropriate Basic Geostatistical Area (BGA),[*] Each BGA was classified according to a five-point scale of social marginalization (very low, low, medium, high, very high) indicating degree of shortage of health services, education, housing and access to basic goods.[22]

Place of death: Place of death was divided into three groups: those who died in a private home, those who died in a hospital, and those who died in a rural health center. Time between TB diagnosis and death was analyzed by calculating the mean (in years) and standard deviation.

Socio-economic status: Cases were analyzed according to occupation and level of education as reported on the death certificate. These features were then stratified by gender. Cases were also classified according to whether they had social security health care coverage regardless of the institution with which they were affiliated.

Results

Of the 8,741 deaths between 1997 and 2009, 79 were registered as being caused by TB. The average age of those who died was 47 years (SD = 20, range 14-101 years); 50 (63.3%) were male; 67 cases (84.8%) were from pulmonary TB, 11 (13.9%) from miliary TB, and 1 case (1.3%) from meningeal TB.

With respect to the place of birth, 20.3% were born in urban San Cristóbal, 25% were from a rural village in the San Cristóbal municipality, and the remaining 48% were born in Chiapas but not in San Cristóbal. This latter group came primarily from the

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[*] See https://ggim.un.org/docs/meetings/International work-shop/02_Mexico_Session 3 Workshop.pdf
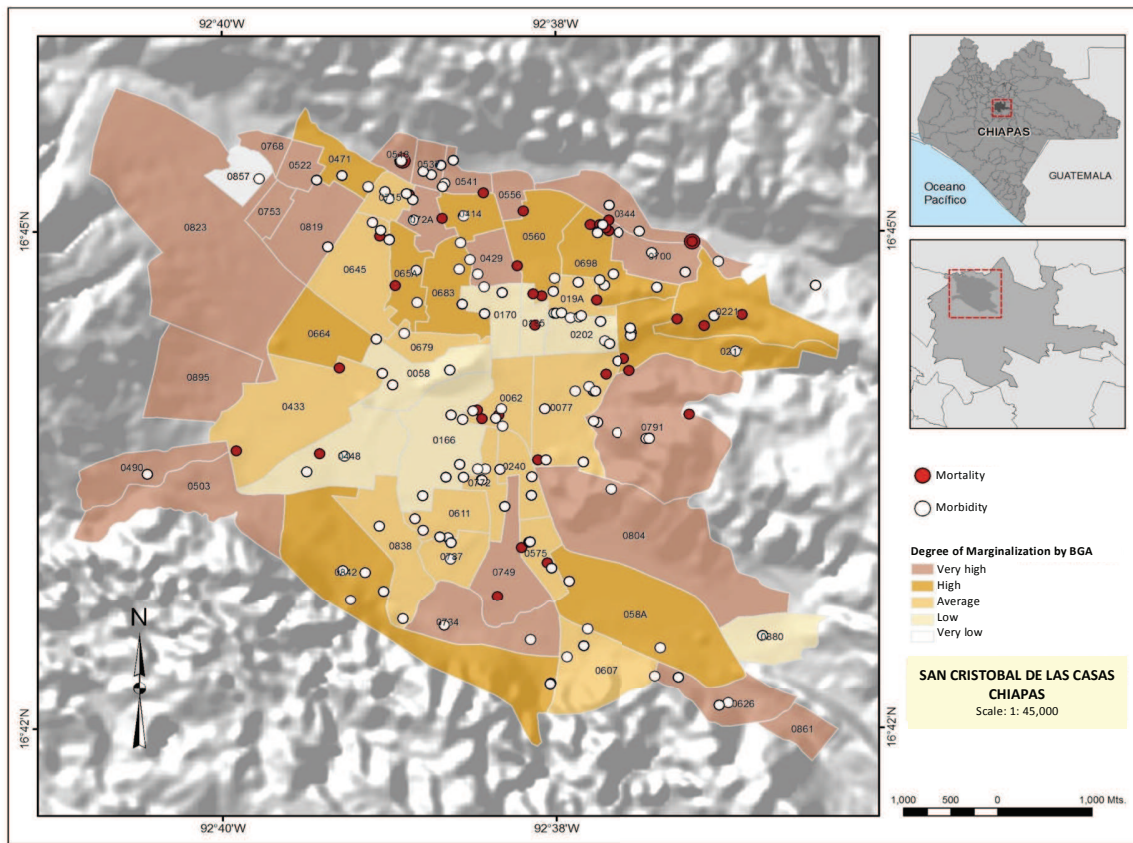
Map 2. Morbidity and mortality by tuberculosis in San Cristóbal de Las Casas (1997-2009) according to degree of urban marginalization.

predominantly indigenous areas of the Chiapas Highlands such as Chamula, Chenalhó, Tenejapa, and Chalchihuitán. In relation to place of residence, 45 cases (57%) were located in the city of San Cristóbal, of which 29 (64.4% of this group and 37% of the total) were migrants, i.e., they were not born in the city of San Cristóbal. These 29 people lived in peripheral neighborhoods.

Of the 79 deaths analyzed, 51 (65%) died at home, 16 (20%) died in the San Cristóbal municipal hospital, and 12 (15%) died at a rural health center; 100% of deaths were certified by a doctor. The average time between diagnosis and death was 4 years (SD = 5. 92 years), with a range of two weeks to 20 years.

With respect to education, occupation, and social security coverage (see Table), it should be highlighted that 89% of the decedents had only a primary school education. Nearly half of the men were

farmers, while 90% of women were housewives; 84% of the decedents were not covered by any of Mexico's social security systems.

Finally, the majority of TB deaths in San Cristóbal (29 of 44) occurred in BGA areas characterized by high and very high marginalization. Unfortunately, because we lacked population data on each BGA for the period studied, we could not estimate tuberculosis mortality rates.

Discussion

This is the first study conducted in Chiapas to analyze the distribution of TB mortality in an urban area. We wanted to see if TB mortality was associated with various social determinants (such as the degree of marginalization) even within a geographic area as small as the San Cristóbal municipality.

Our study is limited to those TB deaths identified by the health services; we have no data on TB cases

**Demographic and socioeconomic indicators of deaths from tuberculosis
registered in San Cristóbal de Las Casas, Chiapas from 1997 to 2009.**

Indicator		n (%)
Place of birth	Rural San Cristóbal	20 (25.3)
	Urban San Cristóbal	16 (20.3)
	Other rural village in the Chiapas Highlands	38 (48.1)
	Other rural village in different regions of the state	4 (5.1)
	Other state	1 (1.3)
Place of residence	Rural San Cristóbal	10 (12.7)
	Urban San Cristóbal	45 (57.0)
	Other rural village in the Chiapas Highlands	24 (30.4)
Migration status	Born and resided in urban San Cristóbal	16 (20.3)
	Immigrant from rural area	29 (36.7)
	Born and resided outside urban San Cristóbal	34 (43.0)
Neighborhood type[†]	Non-peripheral neighborhood	29 (64.4)
	Peripheral neighborhood	16 (35.6)
Highest educational attainment (males and females)	No formal education	41 (52)
	Some primary school	19 (24)
	Primary school completed	10 (13)
	Junior high school	5 (6)
	High school or higher	4 (6)
Highest educational attainment (males)	No formal education	18 (36)
	Some primary school	17 (34)
	Primary school completed	8 (16)
	Junior high school	4 (8)
	High school or higher	3 (6)
Highest educational attainment (females)	No formal education	23 (79.3)
	Some primary school	2 (6.9)
	Primary school completed	2 (6.9)
	Junior high school	1 (3.4)
	High school or higher	1 (3.4)
Occupation (males and females)	Laborer	1 (1.3)
	Employee	4 (5.1)
	Day laborer	25 (31.6)
	Self-employed	12 (15.2)
	Unremunerated family work	1 (1.3)
	Housework	28 (35.4)
	Unemployed	7 (8.9)
	Not reported	1 (1.3)
Occupation (males)	Laborer	1 (2)
	Employee	4 (8)
	Day laborer	24 (48)
	Self-employed	11 (22)
	Unremunerated family work	1 (2)
	Housework	2 (4)
	Unemployed	6 (12)
	Not reported	1 (2)
Occupation (females)	Day Laborer	1 (3.4)
	Self-employed	1 (3.4)
	Housework	26 (89.7)
	Unemployed	1 (3.4)
Social security coverage	No social security	66 (83.5)
	With social security	5 (6.32)
	Not specified	8 (10.12)

[†] This refers only to the 45 deaths among urban San Cristóbal residents

that were not diagnosed or registered. Several studies have documented that the under-reporting of TB mortality in some regions of Chiapas (for example, the Highlands) may be as high as 50%.[13,23]

The number of deaths from miliary TB (14%) in San Cristóbal is much higher than that reported in other parts of the world (1-3%).[24] Miliary TB disproportionately affects individuals who are immunosuppressed: persons with HIV/AIDS, malnutrition, diabetes, alcoholism, and/or high levels of social marginalization.[25] San Cristóbal (like most of the Chiapas Highlands region) has several large populations who experience high poverty rates.[10]

There is a high prevalence of malnutrition, diabetes, alcoholism, and HIV/AIDS, as reported by the National Health Information System.[12] The logistical and technical difficulties associated with diagnosing meningeal and others forms of tuberculosis may have led to under-reporting of this disease. This could have implications for the Chiapas health system and limits the conclusions that can be drawn from our data.

Forty-three percent of our subjects lived in a rural Highlands town but died in San Cristóbal; therefore their deaths were registered. This suggests that these individuals went to the city for medical treatment. Appropriate treatment services were probably lacking in their hometown and they could access more specialized care in San Cristóbal. The hospitals with the best equipment in the Highlands region are located in San Cristóbal. Just over a third (36.7%) of all deaths from TB (64% among those who resided in the city) were migrants to San Cristóbal from other (non-Highlands) rural locations. Residence in the rural Highlands clearly constitutes a risk factor for TB death. This is due not only to the poverty that prevails in the region but also to geographical, economic, and cultural barriers, which prevent access to diagnostic and treatment facilities.[26]

Of the 45 deaths in San Cristóbal residents, 29 (64%) were migrants from peripheral neighborhoods. The other 16 people (36%) were natives of the city. The distribution of registered TB death in San Cristóbal is thus uneven; it is more common in peripheral neighborhoods and among migrants. In

Peripheral areas in San Cristóbal de Las Casas, Chiapas, Mexico.

fact, all TB deaths in peripheral neighborhoods occurred in migrants. This group was subject to the double challenge of living in peripheral neighborhoods and being migrants.

Our study supports the extensive academic literature showing that TB deaths are concentrated in populations of greater socio-economic disadvantages, i.e., people with lower levels of education, lacking social security coverage for health services, and male day laborers.[27-29] Also noteworthy is the fact that the women who died from TB had lower educational attainment than their male counterparts. The vast majority of the women who died were housewives. Several studies, such as those undertaken by Bronfman and Castro,[30] suggest that in some contexts, being a housewife is a measure of increased vulnerability, due to economic dependence on men, whether a spouse or other family members. Housewives may also lack the power to make autonomous decisions and traditionally, the housewife must put her family first, not herself.

Thus, gender-based roles may pose a major barrier to accessing health services and maintaining adherence to anti-TB treatment.[31-33]

In the Chiapas Highlands region, where San Cristóbal is located, there is significant evidence that TB is a serious public health problem: the large number of current cases, high mortality rates, discontinuity of treatment, and the incidence of multi-drug-resistance.[13,15] The results of this study clearly identify the most affected population groups in terms of mortality from this disease.

Conclusions

TB mortality as recorded in San Cristóbal during the period analyzed is strongly linked to groups affected by social marginalization: immigrants (mainly from rural areas), residents of peripheral neighborhoods (characterized by a lack of basic services), BGA areas of high and very high marginalization, low education, low-paid work, and those who lack coverage in the social security system. To avoid further TB mortality it will be necessary to strengthen TB detection and control programs in the peripheral areas of the city as well as in the other groups identified in this paper.

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