



Tuberculosis in Argentina: social and gender inequality

Tuberculosis en Argentina: desigualdad social y de género

Bossio, Juan Carlos¹; Arias, Sergio Javier²; Fernández, Hugo Roberto³

¹Biochemist. Diploma in Public Health. Chief of the Department of Health Programs, National Institute of Respiratory Diseases Emilio Coni, Administración Nacional de Laboratorios e Institutos de Salud "Carlos G Malbrán", Argentina. jbossio@arnet.com.ar

²Biochemist. Master's Degree in Epidemiology. Professional of the Department of Health Programs, National Institute of Respiratory Diseases Emilio Coni, Administración Nacional de Laboratorios e Institutos de Salud "Carlos G Malbrán", Argentina. sergio_arias@arnet.com.ar

³Biochemist. Chief of the Epidemiology Division, Department of Health Programs, National Institute of Respiratory Diseases Emilio Coni, Administración Nacional de Laboratorios e Institutos de Salud "Carlos G Malbrán", Argentina. fernanhg@msn.com

ABSTRACT This article seeks to describe the distribution of tuberculosis in Argentina and analyze the social and gender inequality of the distribution within the period of 1990-2011. In order to accomplish this, the official data from tuberculosis case notifications in the country was used, and the rates were calculated per 100,000 inhabitants by jurisdiction and department, by age group and by sex. The inequality in the distribution was analyzed using the Gini index and the association with social conditions using the concentration index and the effect index; the trend was studied using exponential regression. The results demonstrate that tuberculosis rates are higher between 20 and 34 years of age and are greater in males. There is a marked inequality among jurisdictions (Gini index = 0.273) which is even greater among departments (Gini index = 0.391) and is higher in females (0.411) than in males (0.394). The distribution of tuberculosis was associated with worse social conditions (effect index = -0.212) and this association was stronger in females (effect index = 11.4; 95%CI [6.4; 16.4]). The downward trend in tuberculosis rates observed between 1990 and 2011 has not contributed to reducing the gaps among jurisdictions and departments nor has it reduced the inequality in the distribution of tuberculosis associated with the unfavorable social conditions of the population.

KEY WORDS Tuberculosis; Health Inequality; Social Inequality; Argentina.

RESUMEN Este artículo se propone describir la distribución de la tuberculosis en Argentina y analizar la desigualdad social y de género de la distribución en el período 1990-2011. Para ello, se emplearon las cifras oficiales de notificación de casos de tuberculosis del país, se calcularon tasas por 100.000 habitantes por jurisdicción y departamentos, por grupos de edad y por sexo. La desigualdad en la distribución se analizó mediante el índice de Gini y su asociación con las condiciones sociales mediante el índice de concentración y el índice de efecto; la tendencia se estudió mediante regresión exponencial. Los resultados muestran que las tasas de tuberculosis son mayores entre los 20 y 34 años de edad y son superiores en varones. Existe una marcada desigualdad entre jurisdicciones (índice de Gini = 0,273) y es mayor por departamentos (índice de Gini = 0,391), superior en mujeres (0,411) que en varones (0,394). La distribución de la tuberculosis se asoció a peores condiciones sociales (índice de efecto = -0,212), y esta asociación fue mayor en las mujeres (índice de efecto = 11,4; 95%CI [6,4; 16,4]). La tendencia del problema al descenso entre 1990 y 2011 no ha contribuido a reducir las brechas entre jurisdicciones y departamentos ni tampoco a reducir la desigualdad en la distribución de la tuberculosis asociada a las desfavorables condiciones sociales de la población.

PALABRAS CLAVES Tuberculosis; Desigualdad en Salud; Desigualdad Social; Argentina.

INTRODUCTION

Tuberculosis is today considered one of the most important infectious diseases worldwide, both in terms of the number of new cases produced annually and in terms of the significant number of deaths that continue to occur despite the fact that effective diagnosis technologies and treatments have existed for decades (1,2). Although the appearance of the human immunodeficiency virus (HIV) and the emergence of bacteria resistant in some cases to multiple drugs available for tuberculosis treatment have represented important challenges for disease control, these conditions alone are not sufficient to explain the continued occurrence of tuberculosis cases and deaths worldwide (3-5). Indeed, these circumstances have helped worsen the current situation, which is characterized by great inequality in the distribution of tuberculosis cases among and within countries (6).

Multiple reasons can be found to explain why, even when the means exist to diagnose and treat of the majority of tuberculosis cases, this disease is still a priority in most developing countries (2). The poor living conditions of the population – which affect the nutritional state, the chance of being infected with the tuberculosis bacillus, and the ability of the organism to react to the infection in that population – are responsible for the greater occurrence of tuberculosis in many geographic areas and population groups. Added to this, certain biological factors increase the vulnerability of the organism to infection and disease (7-9).

In unfavorable social conditions with limited or deficient medical care, tuberculosis cases may remain undetected for stretches of time before they are correctly diagnosed and treatment of the disease is started (2). During these periods, tuberculosis cases are sources for spreading the disease among the healthy population, and those sharing more time with sick individuals that are undiagnosed and under no treatment will be more likely to become infected and, potentially, fall ill (5,10,11).

The presence of the tuberculosis bacillus is a necessary but insufficient condition for a person to become infected. Other determinants, such as the individual's state of nutrition and immunity, overcrowded living conditions, poor air ventilation and poor hygiene, among others, increase

the probability that in the presence of the bacillus infection will occur, and that later the disease will develop (12,13).

In Argentina, tuberculosis has been a public health priority for many years, and in all jurisdictions of the country activities aimed at searching for and detecting cases and at providing patients with free medical treatment are carried out (14).

Although there has been a considerable decrease in the number of cases notified annually, tuberculosis continues to affect a significant number of people. The trend observed throughout the last decades has not revealed the rate of reduction one would expect based on the actions implemented to search for and detect cases and provide treatment. Furthermore, the rate of reduction of pulmonary smear-positive tuberculosis (which is the form of disease that spreads the bacillus of tuberculosis and puts the healthy population at risk of infection), has been lower than the overall rate for all cases (15,16).

Both the analysis of the unequal distribution of tuberculosis in the country and the association between this distribution and social determinants are crucial in order to identify areas and population groups that not only account for the majority of tuberculosis cases at present but are also exposed to a greater risk of contracting the disease in the future, given the higher number of cases that spread the disease among the population.

METHODOLOGY

Data on tuberculosis case notifications was gathered from the official figures of the National Institute of Respiratory Diseases Emilio Coni (INER) [*Instituto Nacional de Enfermedades Respiratorias*] based on the data obtained from the Tuberculosis Control Program of each of the 24 jurisdictions of the country. All tuberculosis case notifications (of all forms of the disease), disaggregated by age, sex and place of residence, and all cases of pulmonary smear-positive tuberculosis were analyzed.

Population data, used to calculate notification rates per 100,000 inhabitants, was gathered from estimates and projections of the National Institute of Statistics and Censuses (INDEC)

[*Instituto Nacional de Estadísticas y Censos*] based on national censuses for the years 1980, 1991, 2001 and 2010 for the whole country, by jurisdiction (provinces and the Autonomous City of Buenos Aires) and by department (or county, in the case of the Buenos Aires province), as well as by sex. For 2011, projections based on the inter-census variation for the period 1991-2001, applied to the population of 2010, were used.

Data on the social conditions of the population was gathered from figures published by the INDEC in relation to the National Population Census for the year 2010. The social indicators selected were the population of both sexes living in substandard housing (those living in shacks, shanties, hotel rooms, boarding houses or in structures not intended for housing) and the proportion of illiteracy in the population aged 10 years or older, disaggregated by sex; both indicators are available by jurisdiction (provinces and the Autonomous City of Buenos Aires) and by department or county.

Specific rates per 100,000 inhabitants were calculated in order to analyze the differences in case notification by groups of age, sex and place of residence (jurisdiction and department/counties). Rates were compared using the range, the ratio and the percentage difference between rates.

The analysis of inequality in the distribution of tuberculosis by place of residence was performed using the Gini index, arranging the jurisdictions or departments/counties according to their tuberculosis notification rate. The Gini index was calculated for all tuberculosis cases (for all forms of the disease) in all ages and in those aged 20 to 34 years, according to sex and classification of tuberculosis cases (all forms and pulmonary smear-positive).

The analysis of inequality in the distribution of tuberculosis by place of residence and its association with social conditions was carried out by calculating the concentration index, arranging jurisdictions or departments/counties according to both the proportion of the population living in substandard housing (for both sexes) and the proportion of illiteracy in the population aged 10 years or older (for both sexes, for males, and for females). The effect index was also used, given by calculating the regression coefficient of the

notification rate according to the social variables included. The Pearson coefficient of linear regression was used with a 95% confidence interval.

The trend analysis was carried out by means of the regression of the case notification rate over time, considering an exponential model. The selected start year was 1990, as it is the base year of the Millennium Development Goals (MDG) related to tuberculosis established by the United Nations in the year 2000. The entire period 1990-2011 and two sub-periods (1990-2000 and 2000-2011) were analyzed in order to compare the trends before and after the adoption of the MDGs.

The linear regression coefficient of the logarithm of the notification rate was calculated and expressed as average annual percentage variation with a 95% confidence interval.

The trend of inequality in the distribution of tuberculosis cases by jurisdiction and inequality associated with social conditions was analyzed using the Gini index and the concentration index for the years 1990, 2000 and 2011, representing the start and end year of the analyzed period and the year when the MDGs were adopted.

The software programs used were Epi Info Version 3.5.3 and Excel 2010. All research was carried out in accordance with the Law of Statistical Confidentiality, thereby preserving the confidentiality of those implicated in the data.

RESULTS

Burden of disease

In Argentina, 9,000 to 10,000 new cases of tuberculosis are reported annually. According to the latest official information available, in the year 2011, 9,657 cases were reported by the 24 jurisdictions of Argentina, making for a rate of 23.6 cases per 100,000 inhabitants. The number of cases reported in 2011 was 2.8% higher than that in the previous year (9,393); however, the notification rate experienced a smaller increase (1.7% higher than that of 2010) due to the higher percentage increase in the number of inhabitants of the country.

Although the totality of tuberculosis cases represents the total burden of the disease in the population, cases of pulmonary smear-positive

tuberculosis are of greater relevance due to their impact in the transmission of the disease, as these are the sources of infection for the healthy population. More than half the total of new tuberculosis cases reported in 2011 (55.3%) consisted of pulmonary smear-positive cases (5,338 cases), which represented 13.1 cases per 100,000 inhabitants. The number of smear-positive cases reported in 2011 was also 2.2% higher than in 2010.

Inequality by age and sex

The analysis of tuberculosis by age groups shows that Argentina has a concentration of cases in the population of young adults. In 2010-2011, 35.8% of the total number of reported tuberculosis cases occurred in patients aged 20 to 34 years (Table 1). The tuberculosis rate in this age group was 34.7 per 100,000 inhabitants, the highest tuberculosis rate per inhabitant in Argentina and 76.1% higher than that of the remaining population (19.7 per 100,000 inhabitants). The proportion of smear-positive tuberculosis cases in patients aged 20 to 34 years was greater than that of all tuberculosis cases: in 2011, 60.3% of smear-positive cases belonged to this age group.

Tuberculosis is seen more frequently in men than in women. In the biennium 2010-2011, 57.9% of tuberculosis cases occurred in men, while 42.1% of notifications were for women. This

difference in the number of cases by sex translates into a higher case notification rate in men than women (Table 1).

In both men and women the case notification rate is higher in patients aged 20 to 34 years. However, the distribution of tuberculosis by age is different in men than in women; tuberculosis notification rates in women aged 20 to 34 years are 70% higher compared to those in women aged 40 to 64 years, whereas notification rates in men are only 12% higher in the younger age group. The difference in the burden of tuberculosis in the age group of 20 to 34 years is even greater for smear-positive cases in women: those aged 20 to 34 years show a rate 94% higher than those aged 45 to 64 years; whereas in men, the younger age group shows a rate only 5% higher than those aged 45 to 64 years.

Due to the difference in the disease distribution by age and sex, the tuberculosis rate ratio between males and females is smaller in the younger population and increases with age. While in those aged 45 to 64 years the tuberculosis rate in men is almost double the rate in women, in those aged 20 to 34 years it is only 26% higher in men than that in women (Table 2).

Inequality by place of residence

The distribution of tuberculosis is variable throughout the country, with significant differences among jurisdictions that are even greater

Table 1. Tuberculosis case notification (all forms) according to sex and age groups. Numbers, rates (per 100,000 inhabitants) and percentages. Argentina, 2010-2011.

Age groups (in years)	Females			Males			Total		
	No.	Rate	%	No.	Rate	%	No.	Rate	%
0 to 19	1,669	12.5	20.8	1,952	14.1	17.7	3,621	13.3	19.0
20 to 34	2,992	30.7	37.3	3,833	38.7	34.8	6,827	34.7	35.8
35 to 44	1,099	21.2	13.7	1,527	29.7	13.9	2,628	25.4	13.8
45 to 64	1,474	18.0	18.4	2,609	34.5	23.7	4,083	25.9	21.4
65 or over	780	15.5	9.7	1,070	31.1	9.7	1,852	21.8	9.7
Not specified	11	-	0.1	28	-	0.3	39	-	0.2
Total	8,025	19.3	100.0	11,019	27.6	11.0	19,050	23.4	100.0

Source: Own elaboration using official data from tuberculosis control programs in the 24 jurisdictions of Argentina, consolidated by the National Institute of Respiratory Diseases Emilio Coni, National Administration of Laboratories and Health Institutes, Ministry of Health, Argentina, 2012.

Table 2. Tuberculosis case notification (all forms) according to sex and age group. Rates (per 100,000 inhabitants) and rate ratios between males and females. Argentina, 2010-2011.

Age groups (in years)	Rate		Rate ratio (male-female)
	Females	Male	
0 to 19	12.5	14.1	1.1
20 to 34	30.7	38.7	1.3
35 to 44	21.2	29.7	1.4
45 to 64	18.0	34.5	1.9
65 and more	15.5	31.1	2.0
Total	19.3	27.6	1.4

Source: Own elaboration using official data from tuberculosis control programs in the 24 jurisdictions of Argentina, consolidated by the National Institute of Respiratory Diseases Emilio Coni, National Administration of Laboratories and Health Institutes, Ministry of Health, Argentina, 2012.

among counties (in the province of Buenos Aires) and departments (in the remaining provinces).

Differences by jurisdiction

Two-thirds of tuberculosis cases reported in Argentina come from the four largest jurisdictions of the country with more than three million residents: the province of Buenos Aires, the Autonomous City of Buenos Aires, the province of Córdoba and the province of Santa Fe. However, the notification rates of these jurisdictions are dissimilar; while the Autonomous City of Buenos Aires and the province of Buenos Aires show rates higher than the national average (67% and 22% higher, respectively), the provinces of Córdoba and Santa Fe show rates below the national average (58% and 34% lower, respectively).

Tuberculosis notification rates (for all forms) in patients of any age ranged from 58.4 per 100,000 inhabitants in the province of Jujuy to 4.5 per 100,000 inhabitants in the province of Neuquén, a 13-fold difference between the lowest and the highest provincial rates in 2011. In turn, the rate in the province of Jujuy was 2.4 times greater than the overall country rate for the same year (Table 3, Figure 1).

Inequality in the distribution of tuberculosis in the country is shown in the Gini index value, which was 0.273 for the biennium 2010-2011. In this period, the two provinces with the highest

notification rate, which account for 5% of the total population of Argentina, reported 11% of all tuberculosis cases in the country, whereas the three provinces with the lowest rates, which account for 4% of the total population, reported only 1% of all tuberculosis cases in the country. Inequality among jurisdictions was similar for both males and females (Gini index was equal to 0.277 in males and 0.278 in females).

In young people aged 20 to 34 years, the inequality in the distribution and the disparities between jurisdictions are greater. The Gini index for both sexes in the age group of 20 to 34 years was 0.317 for the biennium 2010-2011, and also in this case was similar in males and females:

Table 3. Tuberculosis case notification (all forms) by jurisdiction. Numbers, rates (per 100,000 inhabitants), percentages, and rate ratios (with reference to the national rate). Argentina, 2011.

Jurisdiction	Tuberculosis (all forms)			
	No.	Rate	%	Rate ratio
Buenos Aires	4,433	28.7	45.9	1.2
CABA	1,210	39.5	12.5	1.7
Catamarca	36	8.7	0.4	0.4
Córdoba	339	9.9	3.5	0.4
Corrientes	313	29.0	3.2	1.2
Chaco	83	17.5	0.9	0.7
Chubut	247	23.6	2.6	1.0
Entre Ríos	210	16.2	2.2	0.7
Formosa	211	37.4	2.2	1.6
Jujuy	413	58.4	4.3	2.5
La Pampa	36	10.4	0.4	0.4
La Rioja	20	5.5	0.2	0.2
Mendoza	127	7.1	1.3	0.3
Misiones	179	15.9	1.9	0.7
Neuquén	26	4.5	0.3	0.2
Río Negro	42	6.9	0.4	0.3
Salta	658	51.0	6.8	2.2
San Juan	80	11.0	0.8	0.5
San Luis	36	7.7	0.4	0.3
Santa Cruz	58	24.4	0.6	1.0
Santa Fe	514	15.6	5.3	0.7
Santiago del Estero	126	14.1	1.3	0.6
Tierra del Fuego	19	23.3	0.2	0.6
Tucumán	207	13.5	2.1	0.6
Not specified	34	-	0.4	-
Country total	9,657	23.6	100.0	1.0

Source: Own elaboration using official data from tuberculosis control programs in the 24 jurisdictions of Argentina, consolidated by the National Institute of Respiratory Diseases Emilio Coni, National Administration of Laboratories and Health Institutes, Ministry of Health, Argentina, 2012.

CABA = Autonomous City of Buenos Aires.

0.322 and 0.315, respectively. The Gini index for the age group of 20 to 34 years was 16.1% higher than that for all ages.

In addition to this increased inequality in the distribution of tuberculosis, for young people the order occupied by each jurisdiction in terms of notification rates also changed. For people aged 20 to 34 years, the Autonomous City of Buenos Aires held the highest rate of tuberculosis case notification (all forms) in the country: 82.8 per 100,000 inhabitants, a rate 13.9 times higher than that of the province of La Rioja, which had the lowest rate for this age group and biennium (Table 4, Figure 2). The Autonomous City of Buenos Aires, which accounts for the 7% of the country's population aged 20 to 34 years, reported 17% of all tuberculosis cases in this age group in the biennium 2010-2011.

Considering only young people aged 20 to 34 years who developed pulmonary smear-positive tuberculosis, disparities between jurisdiction

are similar. The two jurisdictions with the highest rate (the Autonomous City of Buenos Aires and Formosa, both with rates of 45.98 per 100,000 inhabitants) account for 8% of the population in that age group and 18% of tuberculosis cases. The five jurisdictions with the lowest rates that represent a similar proportion of population reported only 1% of all tuberculosis cases in young people. The Gini index for the distribution of these cases by jurisdiction was also slightly higher in females than in males: 0.308 and 0.291, respectively.

Differences by department

The disparities in the distribution of tuberculosis among departments within the country are greater and reveal departments with much higher notification rates than those of the provinces: two departments in the province of Formosa (Ramón Lista and Matacos) showed tuberculosis

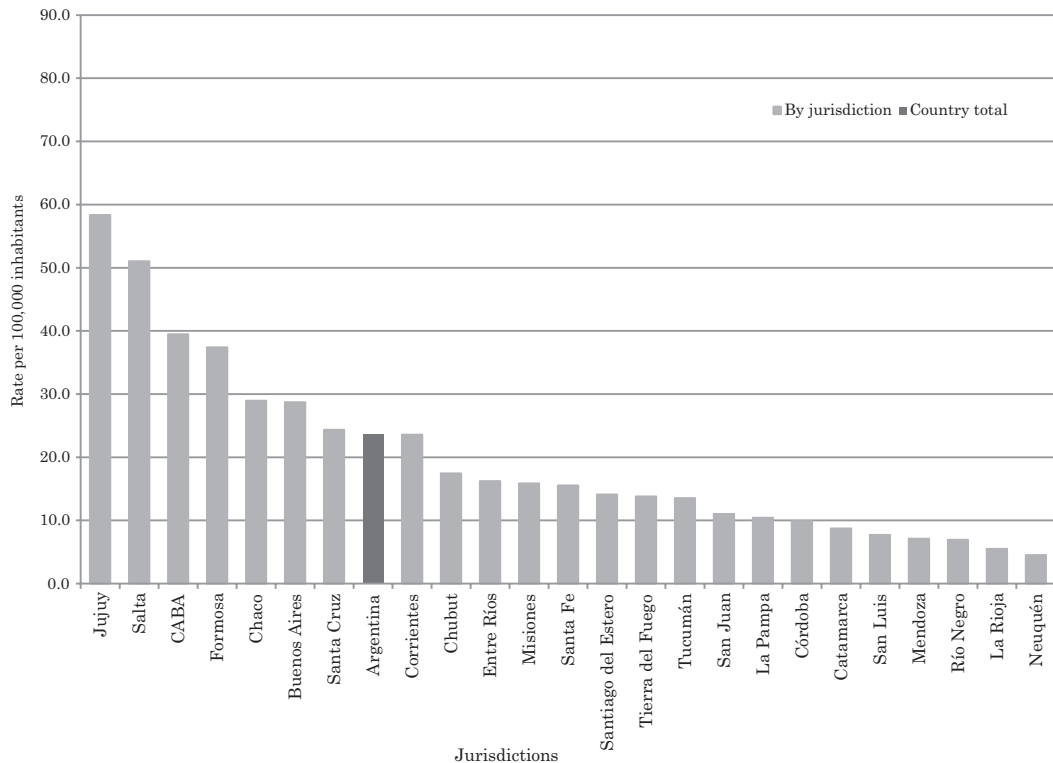


Figure 1. Tuberculosis case notification (all forms) by jurisdiction. Rates (per 100,000 inhabitants). Argentina, 2010-2011.

Source: Own elaboration using official data from tuberculosis control programs in the 24 jurisdictions of Argentina, consolidated by the National Institute of Respiratory Diseases Emilio Coni, National Administration of Laboratories and Health Institutes, Ministry of Health, Argentina, 2012.

case notification rates (all forms) of over 200 per 100,000 inhabitants (250.1 and 241.7, respectively), whereas 84 departments of the country did not report any tuberculosis case during the 2010-2011 biennium, and 33 departments showed rates below 4.5 per 100,000 inhabitants. These last figures are more than 50 times lower than those recorded in the two departments of the province of Formosa (Figure 3). By way of comparison, according to the last report of the World Health Organization on the situation of tuberculosis worldwide, the rates reported in Matacos and Ramón Lista in the province of Formosa are similar to those reported in countries like Bangladesh (225 per 100,000), Ethiopia (261 per 100,000 inhabitants) or Pakistan (231 per 100,000 inhabitants). These countries are among those with the highest burden of the disease in the world.

The inequality among departments measured by means of the Gini index was higher than the

inequality among provinces, with a Gini index equal to 0.391. The 29 departments that accounted for 10% of the total population represented 25.7% of all tuberculosis cases reported in the biennium 2010-2011. In contrast, 149 departments that also accounted for 10% of the country population reported just 1.4% of all tuberculosis cases.

Also, the inequality among departments measured by means of the Gini index was greater for women than for men: 0.411 and 0.394, respectively. The 27 departments with the highest rates that account for 10% of population reported 23.9% of male cases; the 36 departments that account for an equal proportion of female population reported 25.6% of tuberculosis cases.

Disparities in the distribution of tuberculosis can also be seen in urban areas where the chance of the disease spreading is much higher than in departments with more disperse populations. Analyzing the situation in the 24 counties

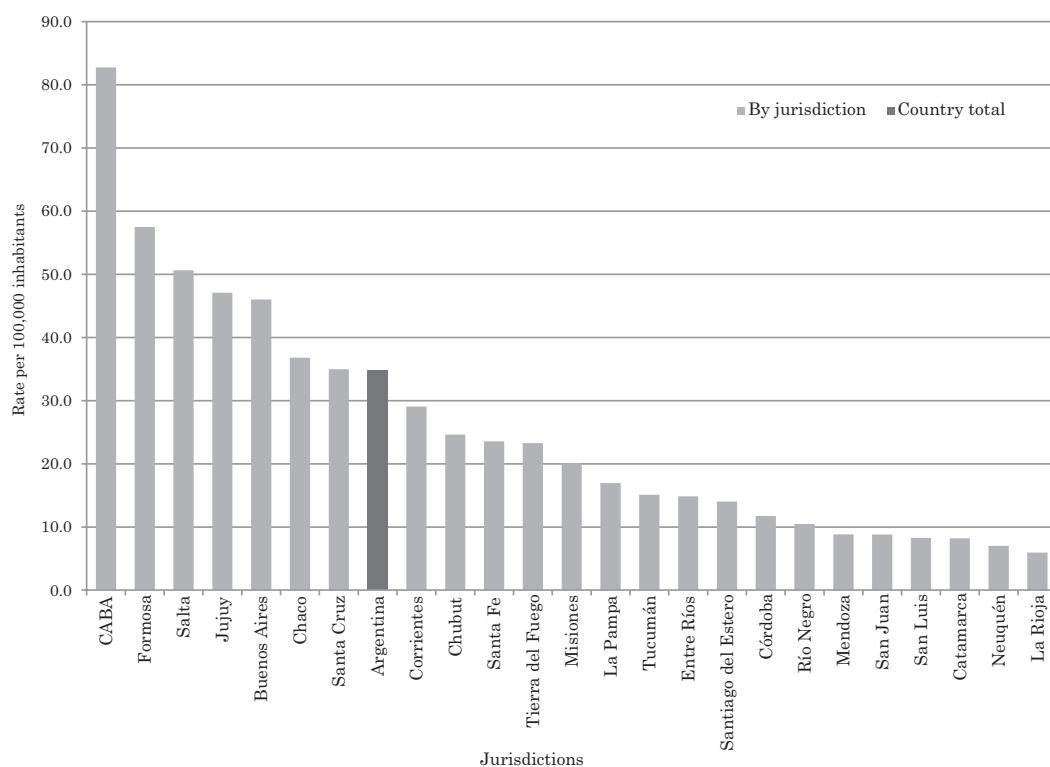


Figure 2. Tuberculosis case notification (all forms) in age group 20 to 34 years by jurisdiction. Rates (per 100,000 inhabitants). Argentina, 2010-2011.

Source: Own elaboration using official data from tuberculosis control programs in the 24 jurisdictions of Argentina, consolidated by the National Institute of Respiratory Diseases Emilio Coni, National Administration of Laboratories and Health Institutes, Ministry of Health, Argentina, 2012.

Table 4. Tuberculosis case notification (all forms and pulmonary smear-positive) in the age group of 20 to 34 years, by jurisdiction. Numbers, rates (per 100,000 inhabitants), and percentages. Argentina, 2010-2011.

Jurisdiction	Tuberculosis (all forms)			Pulmonary smear-positive tuberculosis		
	No.	Rate	%	No.	Rate	%
Buenos Aires	3,391	46.0	49.7	1,994	27.1	47.8
CABA	1,132	82.7	16.6	629	46	15.1
Catamarca	16	8.2	0.2	11	5.6	0.3
Córdoba	198	36.8	2.9	136	25.3	3.3
Corrientes	57	24.6	0.8	31	13.4	0.7
Chaco	199	11.7	2.9	141	8.3	3.4
Chubut	150	29.1	2.2	118	22.9	2.8
Entre Ríos	89	14.9	1.3	64	10.7	1.5
Formosa	155	57.5	2.3	124	46.0	3.0
Jujuy	164	47.1	2.4	99	28.4	2.4
La Pampa	27	16.9	0.4	19	11.9	0.5
La Rioja	11	5.9	0.2	7	3.8	0.2
Mendoza	76	8.8	1.1	57	6.6	1.4
Misiones	107	20.1	1.6	82	15.4	2.0
Neuquén	20	7.0	0.3	8	2.8	0.2
Río Negro	30	10.5	0.4	20	7.0	0.5
Salta	316	50.6	4.6	174	27.9	4.2
San Juan	30	8.8	0.4	13	3.8	0.3
San Luis	18	8.3	0.3	12	5.5	0.3
Santa Cruz	39	35.0	0.6	22	19.7	0.5
Santa Fe	383	23.5	5.6	278	17.1	6.7
Santiago del Estero	63	14.0	0.9	22	4.9	0.5
Tierra del Fuego	15	23.3	0.2	10	15.5	0.2
Tucumán	117	15.1	1.7	80	10.3	1.9
Not specified	9	-	0.1	9	-	0.2
Country total	6,827	34.7	100.0	4,170	21.2	100.0

Source: Own elaboration using official data from tuberculosis control programs in the 24 jurisdictions of Argentina, consolidated by the National Institute of Respiratory Diseases Emilio Coni, National Administration of Laboratories and Health Institutes, Ministry of Health, Argentina, 2012.

of Greater Buenos Aires, where 3,257 of the 4,423 reported cases in the province of Buenos Aires (73.6%) were situated, the notification rate in La Matanza was 47.41 per 100,000 inhabitants, three times higher than the rate recorded in Hurlingham (15.51 per 100,000). The measurement of inequality according to the Gini index was 0.148.

Inequality in the distribution of tuberculosis among the counties of Greater Buenos Aires is even higher when considering only tuberculosis cases in young people. The notification rate in patients aged 20 to 34 years in La Matanza was 69.07 per 100,000 inhabitants, a rate four times that of Ituzaingó (16.41 per 100,000 inhabitants). In this case, the Gini index was higher:

0.204. Inequality was also greater in females than in males.

The case notification rate in women aged 20 to 34 years was 6.4 times higher in La Matanza than in Ituzaingó: 63.99 and 10.00 per 100,000 inhabitants, respectively. The Gini index measuring the unequal distribution of tuberculosis in women among the counties of Greater Buenos Aires was 0.225, 12% higher than that in men: 0.201. The disparities among counties in the case notification rate in young males aged 20 to 34 years was remarkably lower than in women: the rate in La Matanza (74.24 per 100,000 inhabitants) was 3.6 times higher than that in Morón, the county with the lowest notification rate in males: 20.41 per 100,000 inhabitants.

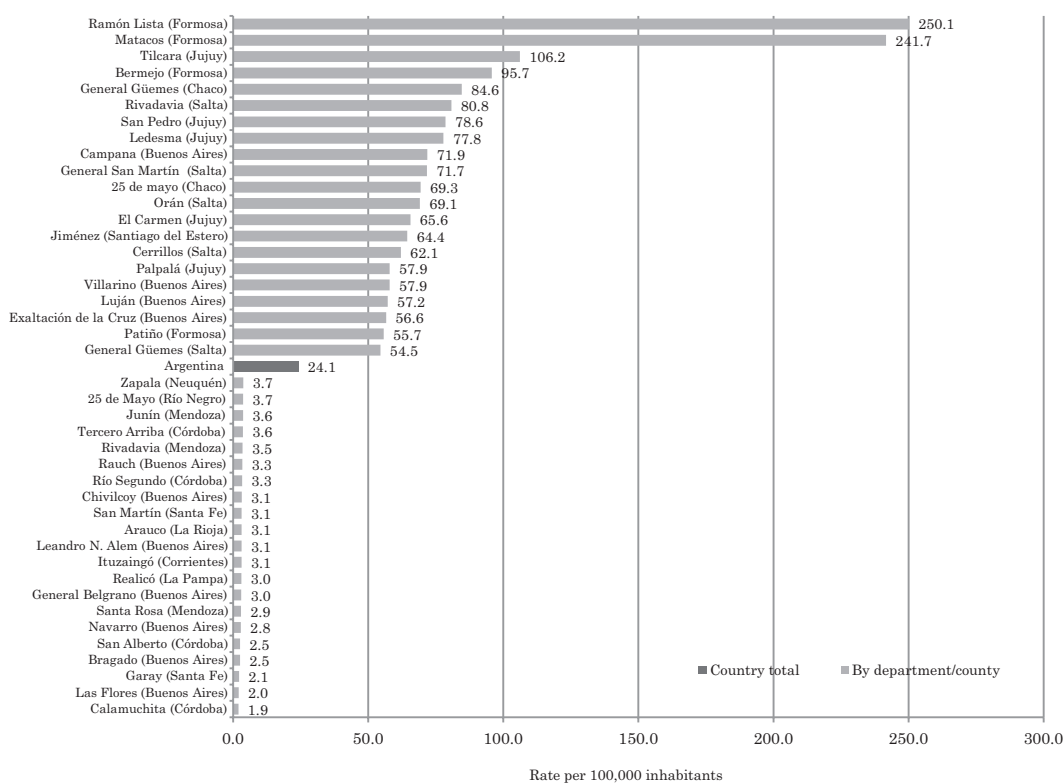


Figure 3. Tuberculosis case notification (all forms) in selected departments/counties (above the 95th percentile and below the 5th percentile, calculated from the 426 departments/counties with at least one notified case in the biennium). Rates per 100,000 inhabitants. Argentina, 2010-2011.

Source: Own elaboration using official data from tuberculosis control programs in the 24 jurisdictions of Argentina, consolidated by the National Institute of Respiratory Diseases Emilio Coni, National Administration of Laboratories and Health Institutes, Ministry of Health, Argentina, 2012.

Social inequality

The unequal distribution of tuberculosis in Argentina was associated with social conditions, and those departments with the most unfavorable social indicators showed a proportionally greater contribution of cases notifications in relation to the proportional contribution of their population.

The 155 departments with the highest proportion of the population living in substandard housing in 2010 (7.17% or more of their population), which accounted for 20% of the total population of Argentina, reported 29.1% of all tuberculosis cases in the 2010-2011 biennium. In contrast, the 113 departments with the lowest proportion of the population living in substandard housing in 2010 (less than 1.62% of the population), which also accounted for 20% of the total national population, reported 8.4% of all

tuberculosis cases. The concentration index, calculated for the distribution of tuberculosis cases based on the proportion of the population living in substandard housing, was -0.212.

The analysis of inequality in the distribution of tuberculosis in males and females revealed a greater association with adverse living conditions in women than in men. Using the proportion of illiteracy in the population aged 10 years or over and relating this indicator to the tuberculosis notification rate by department revealed a concentration index of -0.108 in females, whereas no association was observed in males, with a concentration index of +0.444.

An equivalent result was obtained by analyzing the relationship between the tuberculosis case notification rate and the percentage of illiteracy in the population aged 10 years or over by means of regression. Each percentage point

increase in illiteracy in women aged 10 years or more corresponded to an 11% increase in the tuberculosis case notification rate in the departments, with a 95% confidence interval from 6.4 to 16.4 (correlation coefficient of 0.75 with a 95% confidence interval from 0.46 to 0.90). The same analysis carried out in males showed no statistically significant results (correlation coefficient of 0.22 with a confidence interval from -0.24 to +0.61).

The relationship between greater tuberculosis case notification and unfavorable social conditions was also observed when analyzing the urban areas with a greater population concentration. Among the 24 counties of Greater Buenos Aires, the concentration index varied between -0.083 for the association between greater tuberculosis case notification and the proportion of population living in houses with no bathroom, and -0.116 for the association with the proportion of illiteracy in the population aged 10 years or over.

Similar to the results observed for inequality, which was greater for tuberculosis case notification in young people than in all ages, a greater association with unfavorable social conditions was also observed in this age group. The concentration index for the case notification rate of digapulmonary smear-positive tuberculosis in people aged 20 to 34 years, according to the proportion of illiteracy in the population aged 10 years or over, was -0.162. The concentration index according to the proportion of population living in substandard housing was -0.139. These figures were 39% higher than those observed in the total number of tuberculosis cases for all ages.

The association between tuberculosis case notification and social conditions was also stronger in females than in males. The concentration index for females was -0.182, 22% higher than that in males (-0.149).

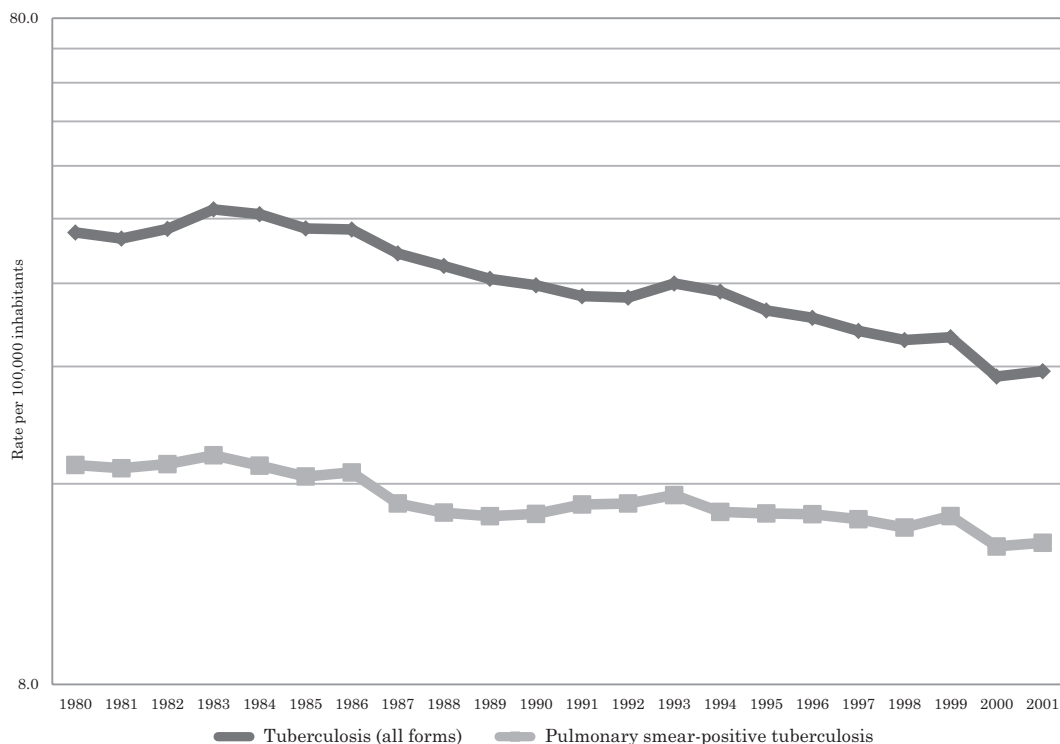


Figure 4. Time trend of tuberculosis case notification (all forms and pulmonary smear-positive). Rates (per 100,000 inhabitants). Argentina, 1990-2011.

Source: Own elaboration using official data from tuberculosis control programs in the 24 jurisdictions of Argentina, consolidated by the National Institute of Respiratory Diseases Emilio Coni, National Administration of Laboratories and Health Institutes, Ministry of Health, Argentina, 2012.

Evolution of the problem of tuberculosis and the trend in inequality

Tuberculosis in Argentina has decreased over the last decades (Table 5, Figure 4). The number of cases of all forms of the disease decreased by 21.8% between 1990 and 2011, and the notification rate decreased by 38.1% in the same period. However, pulmonary smear-positive cases showed a slower decline: the number of cases decreased by only 3.5% and the rate decreased by 23.6%.

The decline in case notifications was greater during the last period (2000-2011), although the difference in the average annual percentage variation for the period 1990-2000 was not statistically significant (Table 6). The pace of decline in the notification of pulmonary smear-positive cases was slower in both periods; a greater average reduction

during the period 2000-2011 was also observed, but again the difference was not statistically significant.

The trend in tuberculosis case notification was different throughout the 24 jurisdictions (Table 6). In the Autonomous City of Buenos Aires, the tuberculosis case notification rate (all forms) increased by 48.7% between 1990 and 2011, and showed an average annual percentage increase of 1.9% (between 1.17% and 2.65%). In the 23 provinces there was a downward trend but the pace of decline was different: in Santiago del Estero the rate reduced 1.27% per year and in Neuquén 8.48% per year.

The uneven trends seen among jurisdictions between 1990 and 2011 did not contribute to reducing the inequality among them. The Gini index remained similar: 0.253 in 1990, 0.243 in 2000, and increasing to 0.273 in 2011.

Table 5. Time trend of tuberculosis case notification (all forms and pulmonary smear-positive). Numbers and rates (per 100,000 inhabitants). Argentina, 1990-2011.

Years	Tuberculosis (all forms)		Pulmonary smear-positive tuberculosis	
	No.	Rate	No.	Rate
1990	12,355	38.1	5,533	17.1
1991	12,181	37.4	5,508	16.9
1992	12,596	38.6	5,587	17.1
1993	13,914	41.3	5,948	17.7
1994	13,683	40.6	5,738	17.0
1995	13,450	38.7	5,707	16.4
1996	13,397	38.5	5,787	16.6
1997	12,621	35.5	5,319	15.0
1998	12,276	34.0	5,234	14.5
1999	11,871	32.5	5,234	14.3
2000	11,767	31.8	5,341	14.4
2001	11,464	30.6	5,595	14.9
2002	11,545	30.5	5,668	15.0
2003	12,278	32.0	5,910	15.4
2004	12,079	31.1	5,642	14.5
2005	11,242	29.1	5,575	14.5
2006	11,068	28.4	5,616	14.4
2007	10,683	27.1	5,574	14.2
2008	10,452	26.3	5,469	13.8
2009	10,657	26.6	5,745	14.3
2010	9,393	23.2	5,221	12.9
2011	9,657	23.6	5,338	13.1

Source: Own elaboration using official data from tuberculosis control programs in the 24 jurisdictions of Argentina, consolidated by the National Institute of Respiratory Diseases Emilio Coni, National Administration of Laboratories and Health Institutes, Ministry of Health, Argentina, 2012.

The inequality in the distribution of the totality of tuberculosis cases associated with social conditions also did not show variations between 1990 and 2011: the concentration index value remained the same in 1990 and 2000 (0.122) and increased to 0.136 in 2011.

DISCUSSION AND CONCLUSIONS

Tuberculosis in Argentina is an important public health problem producing approximately 10,000 notified cases throughout the country each year, which represents a burden of disease that significantly affects the population's health.

The real number of cases is likely even greater due to the limitations of disease record and notification systems that do not catch all actually occurring events. These systems tend to under-record diseases to varying degrees, although in the case of tuberculosis in Argentina it has been published that the difference between estimated and recorded cases is relatively small.

By way of comparison with other diseases that are under epidemiological surveillance and have control programs in Argentina, almost 1,300 new AIDS cases are reported annually, as well as more than 4,000 new cases of HIV infection, almost 700 cases of hepatitis B and between 300 to 400 cases of leprosy, to mention just some of the chronic infectious diseases (17,18). Considering the almost

Table 6. Average annual percentage variation (and 95% confidence intervals) of the time trend in tuberculosis case notification. Argentina, 1990-2011.

Jurisdiction	Average annual variation (%)	95%CI
Buenos Aires	-2.0	(-2.4; -1.5)
CABA	1.9	(1.2; 2.7)
Catamarca	-3.6	(-2.4; -1.5)
Córdoba	-3.5	(-4.1; -2.9)
Corrientes	-2.2	(-3.3; -1.2)
Chaco	-1.6	(-2.7; -0.4)
Chubut	-4.4	(-5.2; -3.7)
Entre Ríos	-5.0	(-6.1; -3.9)
Formosa	-3.6	(-4.4; -2.7)
Jujuy	-4.9	(-5.7; -4.2)
La Pampa	-3.6	(-4.9; -2.3)
La Rioja	-8.2	(-9.3; -7.0)
Mendoza	-4.9	(-6.0; -3.8)
Misiones	-3.3	(-4.4; -2.3)
Neuquén	-8.8	(-10.3; -7.3)
Río Negro	-2.7	(-5.4; 0.1)
Salta	-4.3	(-4.9; -3.7)
San Juan	-5.0	(-6.5; -3.4)
San Luis	-4.6	(-6.8; -2.4)
Santa Cruz	-4.5	(-5.2; -3.7)
Santa Fe	-3.1	(-3.4; -2.7)
Santiago del Estero	-1.3	(-2.7; -0.2)
Tierra del Fuego	-7.3	(-9.2; -5.4)
Tucumán	-3.4	(-4.4; -2.4)
Total	-2.5	(-2.9; -2.2)

Source: Own elaboration using official data from tuberculosis control programs in the 24 jurisdictions of Argentina, consolidated by the National Institute of Respiratory Diseases Emilio Coni, National Administration of Laboratories and Health Institutes, Ministry of Health, Argentina, 2012.

CABA = Autonomous City of Buenos Aires

10,000 new cases of tuberculosis reported each year, the importance of this health problem in terms of its magnitude is evident. According to the information available, in comparison to the chronic pathologies mentioned tuberculosis is the event under epidemiological surveillance that produces the largest number of new cases each year within the country; indeed, the number of new cases of tuberculosis each year is greater than the sum total of all of the new cases of all these other pathologies combined.

It is evident that criteria for establishing priorities in attending to public health issues must include consideration of the magnitude of the issue; from this perspective, tuberculosis is a problem that should be prioritized.

Furthermore, it is important to highlight that tuberculosis in Argentina is a significant health issue not only due to its magnitude but also because an analysis of the characteristics of the affected groups within the country reveals the special impact that this issue has in the most vulnerable population (such as women and the population facing adverse social conditions) and the population of young people (aged 20 to 34 years).

The problem is distributed unequally; disparities are significant for the population of young people in the country, with those aged 20 to 34 years being particularly affected. This situation represents a substantial impact on a population group that is considered the driving force of the economy within society, and the disease may in many cases affect family dynamics.

Inequality also exists in the distribution by province and the disparities are much greater when analyzed by departments. Provinces and departments with more adverse social and economic conditions suffer a heavier burden of disease than those with better conditions. Also of importance was the finding that a greater concentration of tuberculosis exists in highly urbanized areas with large populations, such as Greater Buenos Aires.

Moreover, a detailed analysis shows inequality by gender. Although tuberculosis occurs more frequently in men, examining the combined data by gender, age and social condition reveals the inequality in the distribution in women. Finally, through the elements and characteristics included in this analysis, the association between

greater concentration and production of tuberculosis cases and the adverse social and economic conditions of the population was affirmed.

Both the social vulnerability of the population most affected by the disease as well as the magnitude mentioned previously are criteria that should be considered when establishing health priorities in terms of actions for disease control.

The magnitude of this airborne disease, in addition to its particular impact in special population groups with high mobility and vulnerability, demonstrates the higher risk of infection in the most socially disadvantaged population. This situation is further complicated by the fact that the disease debilitates economic development and maintenance and increases the discrimination and stigmatization to which these groups may be subjected (2,16).

Through the inequality visible in places of urban concentration and in populations with high mobility, the conditions of the disease and of those affected – who are themselves sources of spreading the disease – also show that although tuberculosis particularly affects the vulnerable population, the entire society is at risk of developing the disease and this risk increases with the number of cases regardless of where they occur.

The evolution of problem should also be considered. Even though tuberculosis decreased in magnitude during the period 1990-2011, the pace of decline does not represent a significant achievement in terms of disease control and is not compatible with a reduction of inequality in the distribution of the disease. Although Argentina has an overall average rate of reduction of 2.5%, other countries in the Americas show much more significant reductions in disease incidence, such as Chile (6.7%), Cuba (8.0%), or USA (6.0%); other Latin American countries like Brazil also show a greater or at least a similar reduction to that seen in Argentina (3.0%) (1).

Reaching a trend compatible with disease control – one of the Millennium Development Goals which Argentina endorses – implies not only an increase in the overall pace of decline of tuberculosis, but also an even greater decline in groups with worse social conditions, so as to produce the reduction in inequality in the distribution of tuberculosis that was not observed in the last decades (6,15,19).

The importance of the problem, the inequity within the affected population and the slow pace of decline suggest that Argentina needs to strengthen actions oriented at tuberculosis, including the implementation of strategies recommended for fighting against tuberculosis and encouraging community involvement in order to analyze, plan strategies and solve the problem.

Finally, it is important to state that deepening the analysis of the plentiful and diverse available information regarding tuberculosis notification, treatment outcomes and mortality is necessary in order to better understand the issue and therefore establish better solutions.

BIBLIOGRAPHIC REFERENCES

1. World Health Organization. Global tuberculosis control: surveillance, planning, financing. Geneva: WHO; 2011.
2. Alianza Alto a la Tuberculosis, Organización Mundial de la Salud. Plan Mundial para Detener la Tuberculosis 2006-2015 (WHO/HTM/STB/2006,35). Ginebra: Organización Mundial de la Salud; 2006.
3. Dye C, Maher D, Weil D, Espinal M, Raviglione M. Targets for global tuberculosis control. *International Journal of Tuberculosis and Lung Disease*. 2006;10(4):460-462.
4. Glaziou P, Floyd K, Raviglione M. Global burden and epidemiology of tuberculosis. *Clinic in Chest Medicine*. 2009;30(4):621-636.
5. Caminero-Luna JA. Guía de la tuberculosis para médicos especialistas. París: Unión Internacional Contra la Tuberculosis y Enfermedades Respiratorias (UICTER); 2003.
6. Lonnroth K, Castro KG, Chakaya JM, Chauhan LS, Floyd K, Glaziou P, Raviglione MC. Tuberculosis control and elimination 2010-50: cure, care, and social development. *Lancet*. 2010;375(9728):1814-1829.
7. Hargreaves JR, Boccia D, Evans CA, Adato M, Petticrew M, Porter JD. The social determinants of tuberculosis: from evidence to action. *American Journal of Public Health*. 2011;101(4):654-662.
8. Lonnroth K, Jaramillo E, Williams BG, Dye C, Raviglione MC. Drivers of tuberculosis epidemics: the role of risk factors and social determinants. *Social Sciences & Medicine*. 2009;68(12):2240-2246.
9. Creswell J, Jaramillo E, Lonnroth K, Weil D, Raviglione M. Tuberculosis and poverty: what is being done. *International Journal of Tuberculosis and Lung Disease*. 2011;15(4):431-432.
10. Chaulet P, Raviglione M, Bustreo F. Epidemiology, control and treatment of multidrug-resistant tuberculosis. *Drugs*. 1996;52(Suppl 2):S103-S107.
11. Palmero DJ, Laniado-Laborin R, Caminero-Luna JA. Latin American guidelines for the diagnosis and management of drug-resistant tuberculosis. *Archivos de Bronconeumología*. 2008;44(10):578.
12. Murray M, Oxlade O, Lin HH. Modeling social, environmental and biological determinants of tuberculosis. *International Journal of Tuberculosis and Lung Disease*. 2011;15(Suppl 2):S64-S70.
13. Rasanathan K, Sivasankara-Kurup A, Jaramillo E, Lönnroth K. The social determinants of health: key to global tuberculosis control. *International Journal of Tuberculosis and Lung Disease*. 2011;15(Suppl 2):S30-S36.
14. Bossio J, Arias S, Veronesi I, López R, Colombini R. Notificación de casos de tuberculosis en la República Argentina: Período 1980-2010. Santa Fe: Departamento Programas de Salud, INER "Emilio Coni", ANLIS "Carlos G. Malbrán"; 2011.
15. Dye C, Lonnroth K, Jaramillo E, Williams BG, Raviglione M. Trends in tuberculosis incidence and their determinants in 134 countries. *Bulletin of the World Health Organization*. 2009;87(9):683-691.
16. Lönnroth K, Raviglione M. Global epidemiology of tuberculosis: prospects for control. *Seminars in Respiratory and Critical Care Medicine*. 2008;29(5):481-491.
17. Secretaría de Promoción y Programas Sanitarios. Boletín Integrado de Vigilancia N° 107 [Internet]. Buenos Aires: Ministerio de Salud; 2012 [cited 20 Sep 2012]. Available from: <http://www.>

msal.gov.ar/images/stories/boletines/BoletinIntegradoDeVigilanciaVersion_N107-SE05.pdf.

18. Sociedad Argentina de Dermatología. XIII Conferederal de lepra de la República Argentina: enfermos de lepra de Argentina al 31/12/2011 [Internet] 2012 [cited 12 Sep 2012]. Available from: <http://www.sad.org.ar/lepra/docs/TABLAXIII-31-12-2011.pdf>.

19. Guimarães RM, Lobo AD, Siqueira EA, Borges TF, Melo SC. Tuberculosis, HIV, and poverty: temporal trends in Brazil, the Americas, and worldwide. *Jornal Brasileiro de Pneumologia*. 2012;38(4):511-517.

CITATION

Bossio JC, Arias SJ, Fernández HR. Tuberculosis in Argentina: social and gender inequality. *Salud Colectiva*. 2012;8(Suppl 1):S77-S91.

Received: 15 September 2012 | Accepted: 9 October 2012



This work is licensed under the Creative Commons Attribution-NonCommercial 4.0 International License. Attribution — You must attribute the work in the manner specified by the author or licensor (but not in any way that suggests that they endorse you or your use of the work). Noncommercial — You may not use this work for commercial purposes.

The translation of this article is part of an interdepartmental collaboration between the Undergraduate Program in Sworn Translation Studies (English < > Spanish) and the Institute of Collective Health at the Universidad Nacional de Lanús. This article was translated by Alejandra Arismendi and Silvina de Vedia, reviewed by Mariela Santoro and modified for publication by Vanessa Di Cecco.