

## EPIDEMIOLOGY

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# An Epidemiological Review of Tuberculosis in the Puerto Rican Population

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**ABSTRACT.** Past and recent developments related with tuberculosis (TB) epidemiology in the island were reviewed. Characteristics of the disease such as surveillance, incidence, mortality and the relation of TB with HIV infection were included. TB remains an important public health problem in Puerto Rico and in the Americas, particularly, in HIV-infected patients. From 1981 through 1998, a total of 1,000 AIDS/TB cases has been reported in the island accounting for 4.4% of the total of AIDS cases. 82% of the AIDS/TB

cases were males. The incidence was highest among injecting drug users (IDUs) infected with HIV. The overall incidence of TB in recent years seems to reach a plateau. By the contrary, AIDS/TB cases have been increasing. However, problems of under-reporting must be taken into consideration when analyzing morbidity trends. Adequate and innovative solutions to maintain TB control in the community must be promptly implemented. *Key Words: Tuberculosis, HIV, AIDS, Puerto Rico, Epidemiology.*

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**E**pidemiological research of tuberculosis (TB) in Hispanic populations, the fastest growing minority segment in the United States, is critical to undertake comparisons between those living in the U.S. and those in Hispanics countries. In particular, Puerto Ricans are considered a major subgroup of Hispanics residing in major urban areas of the United States such as New York, New Jersey and Florida. Epidemiological data on TB in Puerto Ricans residing in the island will provide a basis for comparison with those residing in the states that may be helpful in formulating hypothesis about leading issues related with morbidity and mortality trends.

The worldwide increase in the incidence of TB in recent years has been related with demographic factors such as global population growth, aging of the world's population, and epidemiological factors such as the impact of the HIV epidemic (1). Other important factors linked with the re-emergence of TB have been the disruption of public health

services and migratory habits (2). However, TB has never ceased to be a serious health problem in Latin America and in some countries of the Caribbean (2).

### TB Incidence in the Americas Region

In 1993, the World Health Organization (WHO) stated that TB infection was a world sanitary emergency. Although TB is a preventable and curable disease, it still constitutes an important public health threat in the Americas region. In 1995, a total of 244,381 TB cases were reported in the Americas region to the WHO and the Pan American Health Organization (PAHO), with an incidence rate of 31.5 cases per 100,000 population (3). This information was reported in 36 countries and 6 territories. Cases in the Americas represent approximately 7.5% of the total number of cases reported worldwide. However, nearly one-third of cases are estimated to be unreported. Incidence rates vary by country; although Chile, Cuba and Uruguay have shown a clear trend to decrease, countries such as Bolivia, Ecuador, El Salvador, Guatemala, Haití, Honduras, Paraguay, Perú and the Dominican Republic, have reported incidence rates that are considered extremely serious (>85 per 100,000 population) (Table 1). Some of these countries have estimated rates similar to African and Asian countries. On the other hand, after decades of decline, TB re-emerged in the United States between 1988 and 1992 with an increase of 16% in the number of reported cases. Most of

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**Table 1.** Tuberculosis Reported Cases and Incidence Rates in Selected Countries in the Americas, 1994-1996

Subregion and Country	1994				1995				1996			
	BK+*		Total		BK+*		Total		BK+*		Total	
	Cases	Rate†	Cases	Rate†	Cases	Rate†	Cases	Rate†	Cases	Rate†	Cases	Rate†
<b>Latin America</b>												
Bolivia	6,905	95.4	9,431	130.3	7,010	86.8	9,614	119.1	6,949	91.5	10,194	134.3
Ecuador	6,674	59.5	9,685	86.3	5,236	44.3	7,893	66.8	4,356	37.2	6,327	54.1
Perú	33,925	145.4	48,601	208.3	32,096	134.6	45,310	189.9	26,800	111.9	41,739	174.3
Chile	1,951	13.9	4,138	29.5	1,851	13.0	4,150	29.2	1,480	10.3	4,038	28.0
Paraguay	873	18.1	1,850	38.3	748	15.3	1,773	36.2	894	18.0	2,148	43.3
Uruguay	381	12.0	666	21.0	348	11.0	625	19.6	426	13.3	701	21.9
El Salvador	2,144	38.0	3,901	69.2	2,241	38.9	2,422	42.0	965	16.6	1,686	29.1
Guatemala	1,944	19.3	2,676	25.9	2,368	22.3	3,368	31.7	2,308	21.1	3,496	32.0
Honduras	2,385	41.1	4,291	78.1	2,438	40.9	4,984	83.5	1,739	29.9	4,176	71.8
<b>Latin Caribbean</b>												
Cuba	914	8.3	1,691	15.3	834	7.5	1,607	14.5	835	7.6	1,579	14.3
Haiti	--	--	--	--	--	--	--	--	3,524	48.5	6,632	91.4
Puerto Rico	--	--	274	7.5	126	3.4	263	7.1	NA	NA	219	6.9
Dominican Republic	3,177	40.9	4,337	55.8	2,187	27.6	4,053	51.2	3,609	45.3	6,006	26.4
<b>North America</b>												
Canada	--	--	2,074	7.4	--	--	1,930	6.5	NA	--	1,840	6.2
United States	14,346	5.5	24,361	9.4	8,013	3.1	22,860	8.7	NA	--	21,337	7.9

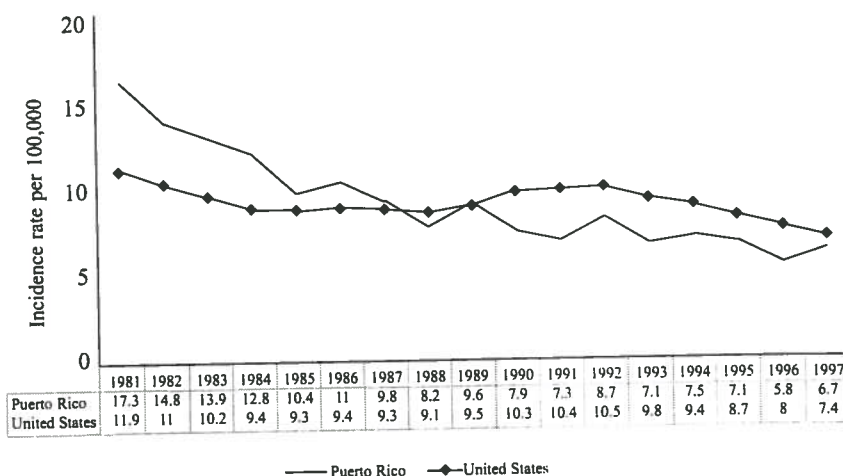
\*BK+=Pulmonary case with positive bacilloscopy.  
NA=Diagnosis by culture not available  
† Incidence rate per 100,000 population.  
Source: Pan American Health Organization. Health in the Americas, 1998.

the cases reported in the Americas from 1994 to 1996 were persons aged 25 to 54 years, and 60% of the cases were males (3).

Tuberculosis has long been a disease of those living in the poorer areas, where the inhabitants share crowded and poorly ventilated homes (4). Thus, it is not surprising that countries in the Americas with the lowest incomes per capita have the highest TB incidence rates.

**TB Surveillance**

In Puerto Rico, after the TB sanatoria were closed, both clinical and public health functions for TB control are performed by the Health Department Public Health Units. The ongoing Puerto Rico health care reform may increase the shifting of TB patients to the private sector. TB patients with low income may



**Figure 1.** TB crude incidence rate in Puerto Rico and U.S., 1981-1997.  
Source: Centers for Diseases Control and Prevention (CDC), Atlanta, GA.

become enrolled in private health insurance companies as a result of government coverage under private

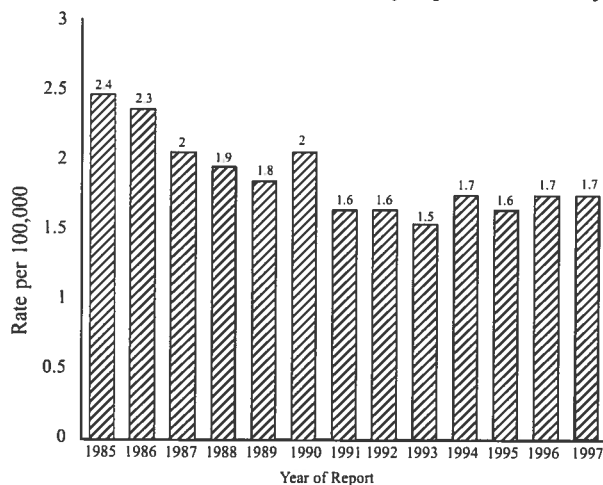
insurance. The shifting of TB patients' care into private health insurance companies which emphasize management of costs, must raise public health concern regarding the ability to maintain an adequate community TB control. Recently, a model contract specification for TB control in managed care organizations has been proposed. The specifications of this model concerns the clinical management and public health issues associated with TB patients (5).

**Incidence**

The crude incidence rate of TB in the island in 1979 was 29.1 per 100,000 population and decreased to 13.8 per 100,000 population in 1980. During 1979-1980 the TB Program of the Puerto Rico Health Department was reactivated and a thorough investigation of cases led to an increase in the incidence rate in 1980 (22 per 100,000 population) (6). From 1981 to 1997 the incidence rate of TB seems to be decreasing while the AIDS/TB incidence cases has been increasing. From 1981 to 1987, Puerto Rico reported larger TB incidence rates than the U.S. However, from 1988 to 1997, the U.S. reported larger rates than Puerto Rico, suggesting that either the problem in Puerto Rico is already improving or that issues related with the surveillance system may be affecting the case reporting (Figure 1).

**Mortality**

During the first half of the century, TB mortality in the island reached a crude mortality rate of 300 per 100,000 population (6). Since then, crude mortality rates have been decreasing. The TB mortality rates in recent years are shown in Figure 2. The most recently reported mortality



**Figure 2.** Mortality rates of TB by year of report, Puerto Rico, 1985-1997.  
 Source: Tuberculosis Control Program, Puerto Rico Health Department.

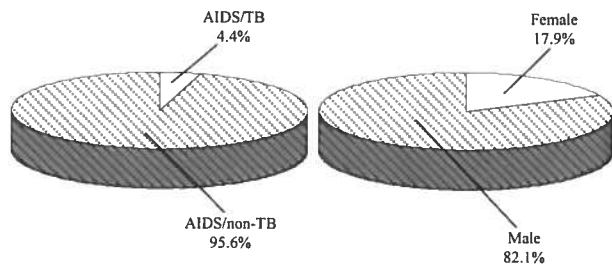
rate was in 1997 with 1.7 deaths per 100,000 population.

**Tuberculosis and HIV**

Currently, HIV is considered a major risk factor for tuberculosis infection. Persons co-infected with HIV and TB may be 100 times more likely to develop active TB than those with simple tuberculous infection (4, 7). In those with HIV infection, nearly all who acquire a tuberculous infection may develop active TB and the active stage will arrive earlier, in the order of days to weeks or months, rather than years or decades (4, 8). The addition of tuberculosis to the AIDS Defining Conditions (ADCs) in 1993 was based on the strong epidemiological link between HIV infection and the development of HIV (4, 9). However, several factors seem to predict the infection of TB among HIV-infected persons. In 1994, a prospective cohort study conducted in U.S. showed that the incidence of TB was higher in the eastern U.S., in patients with CD4 count less than 200 cells/mm<sup>3</sup>, and in PPD-positive patients (10).

From 1981 through 1998, a total of 1,000 AIDS/TB cases (definitive and presumptive) has been reported in Puerto Rico, accounting for 4.4% of the total AIDS cases (Figure 3). Most of the cases (82.1%) were males and 84% had pulmonary tuberculosis (Figure 4). Other frequent ADCs reported among AIDS/TB cases were esophageal candidiasis (32.8%) and wasting syndrome (30.8%) (Figure 4).

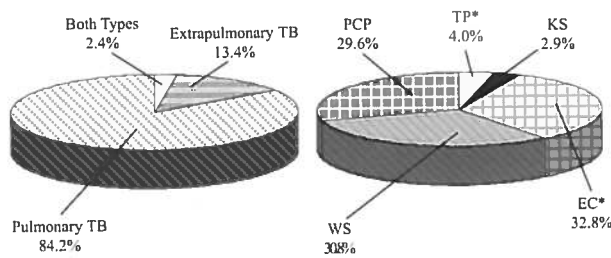
The geographic distribution of these cases is shown in Figure 5. The municipalities with the largest proportion of AIDS/TB cases were San Juan, Ponce, and Bayamón,



**Figure 3.** Reported AIDS/TB cases, Puerto Rico, 1981-1998.  
 Source: AIDS Surveillance System, Puerto Rico Health Department.

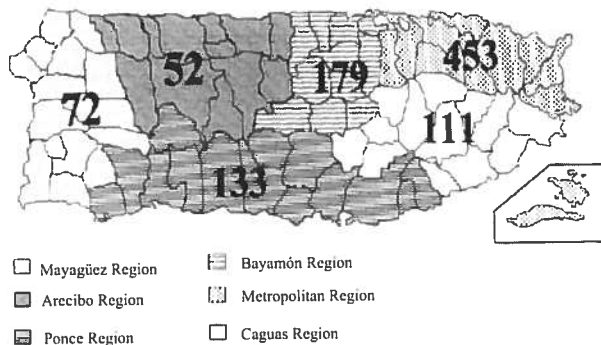
similar to the overall distribution of AIDS cases in the island. Approximately, 66% of the AIDS/TB cases were injecting drug users (IDU). Among males, two-thirds of the cases were IDU, while 45.2% of the females were heterosexuals (Figure 6).

The crude incidence rate of TB in 1970 was 29.1 per 100,000 population, it declined to 13.8 per 100,000



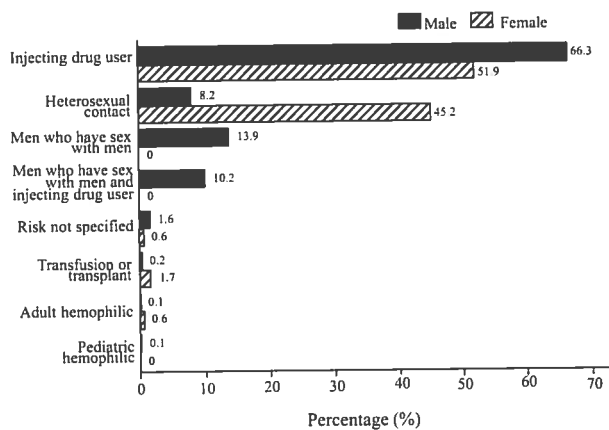
**Figure 4.** Reported AIDS/TB cases by TB site and ADCs, Puerto Rico, 1981-1998.

\* EC=Esophageal candidiasis, TP = Toxoplasmosis  
Source: AIDS Surveillance System, Puerto Rico Health Department.



**Figure 5.** Distribution of reported AIDS/TB cases by Health Region, Puerto Rico, 1981-1998.

Source: AIDS Surveillance System, Puerto Rico Health Department.



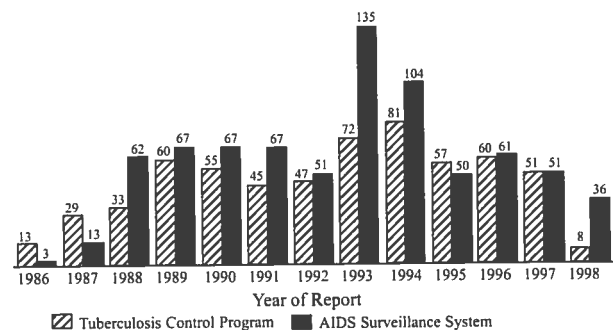
**Figure 6.** Reported AIDS/TB cases by exposure category and gender, Puerto Rico, 1981-1998.

Source: AIDS Surveillance System, Puerto Rico Health Department.

population in 1978, but increased to 22.0 per 100,000 population in 1980, before the peak of the AIDS epidemic. Thus, AIDS/TB cases solely did not explain the increase in 1980. The impact of factors such as migration in TB infection has not been studied in the Puerto Rican population residing in the island. As was previously stated, the TB problem is classified as extremely serious in Haiti and the Dominican Republic. It is well known that legal and illegal migration of people from the Dominican Republic is large and continuous, although official figures are not known. The illegal migration may not impact the official figures of TB, since this population may not be seeking treatment. However, a larger number of those that are ill will remain contagious for a long time and will therefore affect those who have contact with them.

A review of TB surveillance data in the U.S. demonstrated that foreign-born cases accounted for 60% of the total increase in the number of TB cases from 1986 through 1992. Foreign birth had the greatest impact among Asians, Hispanics, females and persons other than those 25 to 44 years of age. HIV infection had the greatest impact on TB morbidity among whites, blacks, males, and persons 25 to 44 years of age. The authors concluded that the effectiveness of TB screening in immigrants needs further evaluation (11).

In Puerto Rico, the proportion of TB cases linked with AIDS are increasing. However, some inconsistencies were found between cases reported with TB and AIDS in the TB registry and cases reported to the AIDS Surveillance System. Figure 7 shows the number of confirmed AIDS/TB cases by year of report to the TB registry and the AIDS Surveillance System. Even when both sources show an increasing trend, the AIDS Surveillance System reported a larger number of cases. This observation may be partially explained by manual errors during the matching process.



**Figure 7.** Reported AIDS/TB cases, AIDS Surveillance System vs. Tuberculosis Control Program, Puerto Rico, 1981-1998.

Source: AIDS Surveillance System, Puerto Rico Health Department. Tuberculosis Control Program, Puerto Rico Health Department.

In recent years the differences are less striking, probably reflecting efforts done by the TB registry to improve the system. In fact, a study conducted in Puerto Rico found that of 159 patients with TB according to the CDC definition, 31 (19.5%) were unreported. Nevertheless, TB diagnosis in the AIDS registry had the highest predictive value of finding TB (94%) (12).

#### Treatment Guidelines

Prompt initiation of effective antituberculosis treatment increases the probability that a patient with HIV infection who develops TB will be cured of this disease (13-15). The most recent CDC guidelines for the treatment and prevention of active tuberculosis among persons with HIV recommend the use of isoniazid once or twice a day over a 9-month period for the treatment of TB infection. (13). In addition, information about drug interaction of patients and the commonly used antiretroviral therapy are also included in such guidelines. As antiretroviral therapeutic regimens become increasingly effective, the complexity and problems associated to other HIV-related illness increase. Health-care professionals need to become familiar with these new guidelines to ensure the use of the most effective management strategies for TB patients infected with HIV (13).

An important issue that must be taken into consideration in tuberculosis treatment is the possibility of multidrug TB resistance, particularly in HIV coinfecting patients. According to the results in a recent study of TB cases reported to CDC from 1993 through 1996, the risk of drug-resistant TB was higher among those with known HIV infection than in the HIV negative population (13, 16). To our knowledge, information on drug resistance for tuberculosis has been scarcely documented in Puerto Rico.

#### Conclusions

In Puerto Rico, the overall incidence of TB in recent years seems to reach a plateau. However, under-reporting must be taken into consideration when analyzing morbidity trends. On the other hand, AIDS/TB cases have been increasing over the years.

Early diagnosis and effective treatment of TB among HIV-infected persons are critical for healing TB, minimizing the negative effects of TB on the course of HIV, and interrupting the transmission of *Mycobacterium tuberculosis* in the community (13).

The shifting of TB patient's care into private health insurance companies under the Health Reform Act must raise concern in the public health community. Adequate and innovative solutions to maintain a satisfactory community control must be promptly implemented, including the review of the model contract specifications

for TB control in managed care organizations recently proposed (5).

#### Resumen

Los progresos recientes y pasados relacionados con la epidemiología de la tuberculosis (TB) fueron revisados. Se incluyeron características de la enfermedad, tales como: la vigilancia, la incidencia, la mortalidad y la relación de la TB con la infección con el VIH. La TB sigue siendo un problema importante de salud pública en Puerto Rico y en las Américas, particularmente en pacientes infectados con el VIH. Desde el 1981 hasta el 1998, un total de 1,000 casos de SIDA/TB han sido reportados en la Isla, comprendiendo el 4.4% del total de los casos de SIDA. Ochenta y dos por ciento de los casos de SIDA/TB fueron varones. La incidencia fue más alta entre usuarios de drogas inyectables infectados con el VIH. La incidencia general de la TB en años recientes parece haber alcanzado un "plateau". Por el contrario, los casos de SIDA/TB han ido aumentando. Sin embargo, problemas de subreporte deben ser considerados cuando se analizan las tendencias en la morbilidad. Nuevas y adecuadas soluciones deben ser implantadas con prontitud para mantener en control la TB en la comunidad.

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