



# **San Francisco County Annual Report on Tuberculosis**

## **2008**

A report prepared by the Tuberculosis (TB) Control Section of the San Francisco Department of Public Health.

Jennifer Grinsdale, MPH - TB Epidemiologist/ Program Manager

Masae Kawamura, MD - TB Controller/ Program Director

**Acknowledgment**

We acknowledge the staff of the San Francisco Department of Public Health, TB Control Section for their dedication to provide high-quality patient care in order to prevent transmission of TB in San Francisco. Additional gratitude is extended to our community and private partners for their testing, reporting, and collaboration in the management of persons at risk for TB.

## Table of Contents

<b>EXECUTIVE SUMMARY .....</b>	<b>4</b>
<b>TUBERCULOSIS CONTROL PROGRAM MISSION AND FUNCTION .....</b>	<b>6</b>
<b>TUBERCULOSIS MORBIDITY.....</b>	<b>8</b>
Figure 1. TB Incidence, San Francisco, 1990-2008 .....	8
Figure 2. TB Case Rates by Census Tract, San Francisco, 2008 .....	9
Table 1. TB Case Rates per 100,000 – U.S., California, and San Francisco, 2004-2008 .....	10
Figure 3. TB Case Rates per 100,000 – U.S., California, and San Francisco, 1990-2008 .....	10
Figure 4. TB Cases by Age Group, 2008 .....	11
Table 2. TB Incidence Rate per 100,000 by Age Group, 2004-2008.....	11
Figure 5. TB Rates by Age Group, 1990-2008 .....	12
Figure 6. TB Cases by Gender, 1990-2008.....	13
<b>TUBERCULOSIS AMONG THE FOREIGN-BORN.....</b>	<b>13</b>
Figure 7. TB Cases by U.S. vs. Foreign-Born Status, 1990-2008 .....	14
Figure 8. TB Cases by Country of Birth, 2008.....	15
Figure 9. TB Cases by Foreign-born Status and Age Group, 2008.....	16
Figure 10. TB Cases by Foreign-born Status and Race/Ethnicity, 2008 .....	17
Figure 11. Foreign-born TB Cases by Time in U.S., 2008.....	18
<b>RACIAL DISPARITIES.....</b>	<b>18</b>
Figure 12. TB Cases by Race/Ethnicity, 2008.....	19
Table 3. TB Cases and Rates per 100,000 by Race/Ethnicity, 2004-2008.....	19
Figure 13. TB Case Rates per 100,000 by Race/Ethnicity, 1990-2008 .....	20
<b>TUBERCULOSIS MORTALITY.....</b>	<b>20</b>
Table 4. TB Mortality, 2004-2008 .....	21
<b>HIV CO-INFECTION.....</b>	<b>21</b>
Table 5. HIV Testing for Case Over the Age of 15, 2004-2008 .....	21
Figure 14. HIV Test Results by Age Group, 2008 .....	22
Figure 15. TB Cases, 1980-2008 .....	23
Figure 16. HIV Positive TB Cases, 1999-2008.....	24
<b>TB IN THE HOMELESS .....</b>	<b>24</b>
Table 6. Primary Nighttime Residence of Homeless Cases, 2003-2008 .....	25
Table 7. Demographics of Homeless Cases, 2005-2008 .....	25
<b>DRUG-RESISTANT TB .....</b>	<b>26</b>

Table 8. Drug Resistance to Anti-TB medications, 2004-2008 .....	26
Figure 17. MDR Drug Patterns, 1999-2008 .....	27
Figure 18. Place of Birth of Cases with Any Drug Resistance, 2008. ....	28
<b>GENOTYPING AND CLUSTERING .....</b>	<b>28</b>
Figure 19. Genotypic Case Clustering, 1992-2008.....	29
<b>CASE IDENTIFICATION AND REPORTING .....</b>	<b>29</b>
Table 9. Method of Case Identification, 2004-2008 .....	30
<b>DISEASE CHARACTERISTICS .....</b>	<b>30</b>
Table 10. Clinical Characteristic of TB Cases, 2004-2008 .....	30
<b>CASE MANAGEMENT .....</b>	<b>31</b>
Table 11. Case Management Objectives and Annual Progress .....	31
<b>APPENDIX 1: TB EPIDEMIOLOGY RESOURCES .....</b>	<b>33</b>
<b>APPENDIX 2: SOURCES AND NOTES.....</b>	<b>33</b>

## Executive Summary

In 2008, 118 new cases of active TB (14.6 cases per 100,000) were diagnosed in San Francisco, representing a 17.5% decrease from 2007 (143 cases) and the lowest TB incidence in San Francisco's history.

### *Age, Race, Ethnicity and Nativity*

The median age of TB cases was 51 years old, with the majority of active TB being diagnosed in persons 25–64 years of age. There were 4 pediatric cases (0–4 years old) diagnosed this year. TB cases among the elderly are stable compared to prior years; however, 16% (6 of 37) of cases in this group died compared to an overall death rate of 9%. All but two deaths were in foreign-born Asians.

In San Francisco, the largest proportion of cases are reported in the Asian population (61%), although in 2008 the disease rate continued to decline as in previous years. The TB rate among the Hispanic population, however, has significantly increased since 2005 due to an ongoing outbreak of cases among day laborers and an increase in foreign-born Hispanics residing in San Francisco. In 2008, the TB rate in the Hispanic population declined to 22.8 cases per 100,000 (from 29.3), but remains high and is similar to the Asian case rate of 27.7 cases per 100,000.

Among black non-Hispanics, the TB rate declined for the first time since 2005, which may be due to a decline in both homeless and HIV co-infected cases reported in 2008. This year the TB rate in this group was 16.5 per 100,000, and while Hispanic and Asian cases tend to be foreign-born, African-American cases occur primarily among U.S.-born individuals. Among white, non-Hispanics, the number of cases has remained relatively stable for the past five years, with a very low case rate of 3.0 cases per 100,000 persons.

As in prior years, 76% of all cases were reported among foreign-born individuals, with over 40% of these cases coming from China. Since 2004, the number of TB cases among U.S.-born persons has remained stable, while cases in the foreign-born have decreased. The epidemiology of U.S.- and foreign-born cases differ significantly, and DNA typing of the TB bacteria indicates TB among the U.S.-born results from recent transmission, while foreign-born TB is primarily due to reactivation of disease due to infection in their country of origin.

### *Homelessness and Substance Abuse*

Fifteen (15) homeless/marginally-housed cases were reported in 2008, making up 12% of all TB cases reported this year. During the latter part of 2007, two large homeless contact investigations were successfully conducted through close collaboration with the Department of Human Services (DHS). Despite the large number of contacts screened, however, we are beginning to see secondary cases occur due to transmission in these settings. Ongoing collaboration with

DHS and owners of public and private SRO hotels is crucial to prevent further outbreaks among the marginally housed.

#### *TB–Human Immunodeficiency Virus (HIV) Co-infection*

Eleven percent (11%) of TB cases were co-infected with HIV in 2008, a slightly higher proportion than in prior years. HIV is common among African American and white, non-Hispanic cases, and is present in 45% of cases from these racial groups. Among those with HIV co-infection, 5 (of 13) were also homeless. HIV infection is strongly associated with homelessness among cases of active TB disease in San Francisco and is a marker of recent transmission.

In 2008, 7.6% of cases reported alcohol abuse, 10.2% reported non-injection drug use, and 3.4% reported injection drug use. These cofactors are often associated with homelessness and HIV infection.

#### *Drug-Resistant TB*

For the last few years, drug resistance has remained relatively steady, with the exception of 2004, when drug resistance to at least one drug increased from 15% to 22% of culture-positive TB cases. In 2008, drug resistance among culture-positive cases declined slightly, from 13% to 11% compared to 2007. While the number of multidrug-resistant (MDR) cases has remained relatively low (1–4 cases per year, and 1–3% of all cases reported annually), these TB strains are usually highly resistant (four or more drugs) and are difficult and costly to manage. There was one case of MDR-TB in 2008, and unlike MDR cases with extensive resistance in prior years, this case was resistant to only isoniazid and rifampin.

#### *Summary*

While the decline in active disease over the last decade is encouraging, the rate of TB in San Francisco is more than three times the 2008 national average of 4.2 cases per 100,000 and twice the 2008 California average of 7.0 cases per 100,000. Some areas of San Francisco have extremely high rates of >100 cases per 100,000.

The TB Control Program in San Francisco continues to face many ongoing challenges that include a high proportion of TB patients who live under poverty thresholds and reside in unstable housing, patients from diverse ethnic and cultural backgrounds, and diminishing resources to control and prevent cases of TB disease.

Due to the large pool of individuals with latent TB infection—an estimated 40,000 people in San Francisco, and one third of the world’s population—and the lack of convenient preventive medications or an effective TB vaccine, it is unlikely that TB will be eliminated in the near future. To manage this disease with the tools currently available, the San Francisco TB Control Program focuses on three fundamental principles: (1) case management of patients with active TB disease in order to assure the cure of all TB cases, interrupt further transmission of TB,

and prevent development of multi-drug resistant TB; (2) timely and thorough contact investigations around infectious TB cases to identify, evaluate, and treat those who were exposed and/or recently infected; and (3) collaborative efforts with a number of public health and community partners, particularly to enhance targeted TB testing, active case finding, and treatment of latent TB infection.

## **Tuberculosis Control Program Mission and Function**

### *Mission Statement*

The mission of the San Francisco TB Control Section is to control, prevent and finally eliminate tuberculosis in San Francisco by providing compassionate, equitable and supportive care of the highest quality to all persons affected by this disease.

### *Background*

Tuberculosis (TB) is an infectious disease that spreads by airborne transmission. TB has a highly variable latency period, defined as the time between acquisition of TB infection and the development of active TB disease. If active TB disease is untreated, the five-year survival rate is approximately 50%, but with effective antibiotic treatment, TB is preventable and curable. As one-third of the world's population has latent TB infection and two million people a year die of TB disease globally, TB remains a serious public health threat worldwide.

The San Francisco Tuberculosis Control Program (SFTBC) has maintained a legacy of TB control despite decades of challenge, with the influx of high TB incident refugee and immigrant groups, the AIDS epidemic, and large homeless and injection drug-using populations. The program has always used systematic evaluation of surveillance and program data to fine tune and adjust activities to meet the changing epidemiology of the city.

### *Program Description*

The San Francisco Department of Public Health (SFDPH) TB Control Section operates a free, full-service clinic at San Francisco General Hospital (SFGH) and oversees a community-managed satellite testing and INH refill site in Chinatown. Partnerships with more than 30 community provider groups target new immigrants, homeless persons, shelter and low-cost hotel residents, injection drug users, and those with medical and exposure risk factors for TB. Referrals of TB suspects and “at risk” skin test– or blood test–positive individuals are accepted from these community clinics for x-ray and evaluation. SFTBC also manages or co-manages >80% of all TB cases in the city. The remaining patients are managed by private providers but are routinely referred to the TB Clinic for contact investigation and directly observed therapy (DOT).

Since the late 1970s, the program has relied heavily on culturally appropriate outreach workers and disease control investigators (DCIs) rather than public health nurses for contact investigation and DOT. For over two decades, case

management has been accomplished by a successful multidisciplinary “team” approach. DOT is used selectively and targets TB cases that are the most infectious and/or unlikely to adhere to treatment. Of the >80% of cases that are managed by the TB Clinic, 93–99% were placed on DOT during the past four years. Two-thirds of the dosing is clinic-based, and the remaining third have their medications delivered and monitored in their homes, shelters, and “hangouts” (i.e., parks, bars, under bridges, etc.). A full range of incentives and enablers, such as juice, sandwiches, fast food vouchers, clothing, toiletries, grocery vouchers, bus tokens and passes, flexible/extended clinic hours, transportation to appointments, referrals to substance abuse sites, shelters, hotel rooms, medical and social services are used to help patients through treatment.

### *Collaboration*

Within San Francisco, long-standing cross-program collaboration with HIV and STD sections has resulted in regular cross-program referrals, and more recently, cross-training of staff. TB Control has strong partnerships with over 100 community-based provider groups, organizations (CBOs), and other healthcare agencies that refer patients for evaluation through a formalized process. Collaboration with managed care organizations, San Francisco Health Plan (SFHP) and Blue Cross, has resulted in annual revision of formal agreements, provider training, a series of ads targeting high-risk ethnic groups for TB prevention and educational product development, including flyers providing screening information and office posters. The link between TB and diabetes is a current area of focus.

Recent collaboration with Health and Human Services has enabled the program to implement TB screening protocols (mandatory for shelters in 2005), share database information that is vital to public health function, and maintain an ongoing dialogue about high TB transmission in the populations they serve (shelters and residential hotels). Through quarterly meetings of the city’s TB Taskforce, TB Control has used this forum to educate leaders and key health department staff on the local challenges facing their communities, and to build consensus on new policies. Current policy development includes supportive housing SRO screening and infection control guidelines (currently in draft), and recently completed, health department approved, residential substance abuse screening policies.

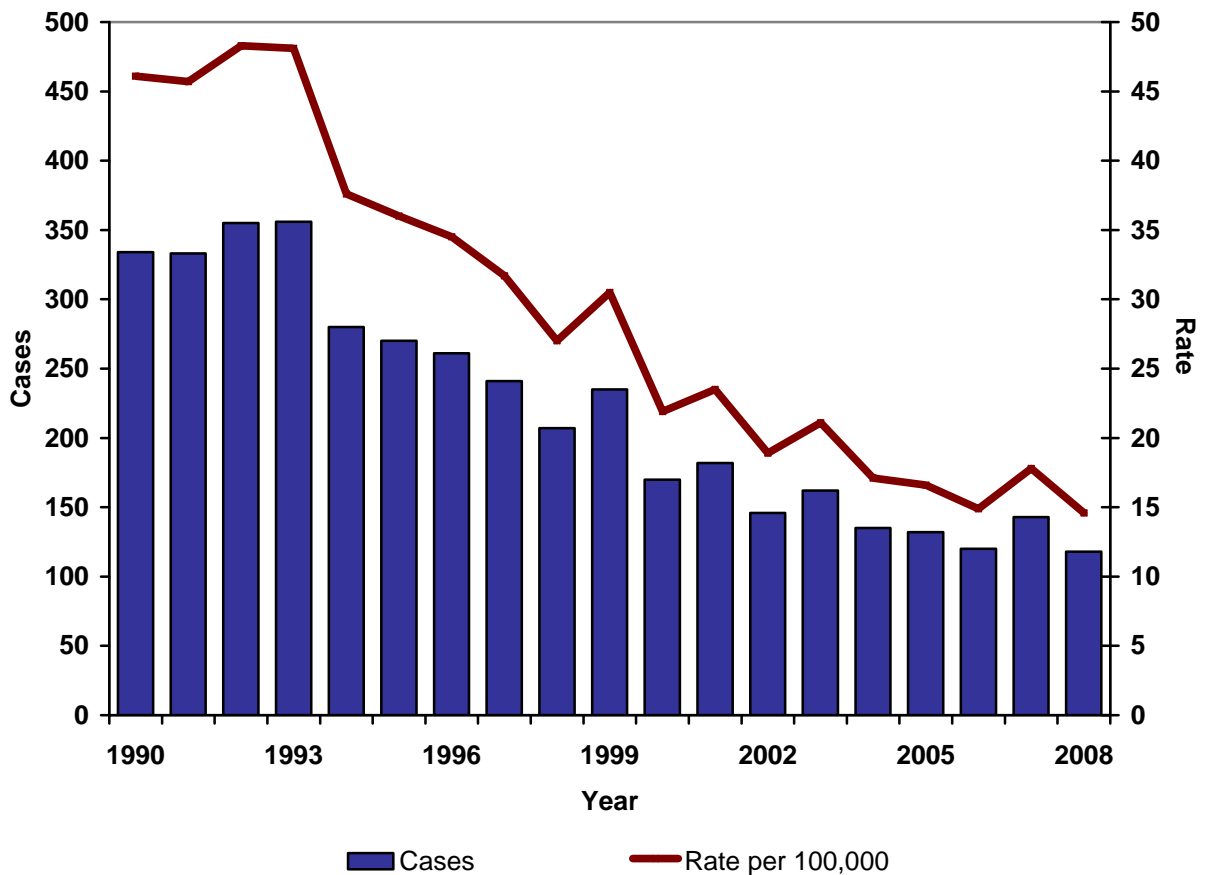
The TB Controller and selected staff are active participants in a variety of TB control groups. Staff participate in the Bay Area Nursing and Bay Area Regional TB Control and Corrections Association (BAN-BARTCA) that involves state TB Control and corrections representatives from ten Bay Area jurisdictions. TB Control and Laboratory staff continue to participate in local, state, and national workgroups to develop guidelines and serve as expert content consultants (i.e., national guidelines on IGRAs, use of nucleic acid amplification diagnostic tests, foreign-born screening, California contact investigation, B-notification, treatment, and LTBI guidelines). Partnership with the University of California, San Francisco (USCF), through collaborative research, and UCSF staffing of TB

Clinic physician positions, has been synergistic in the high level of care provided to TB patients, surveillance, epidemiology, and program interventions. The program trains numerous medical residents and infectious disease and pulmonary fellows annually, thereby continuing to build the capacity of TB knowledge and clinical skills locally.

## Tuberculosis Morbidity

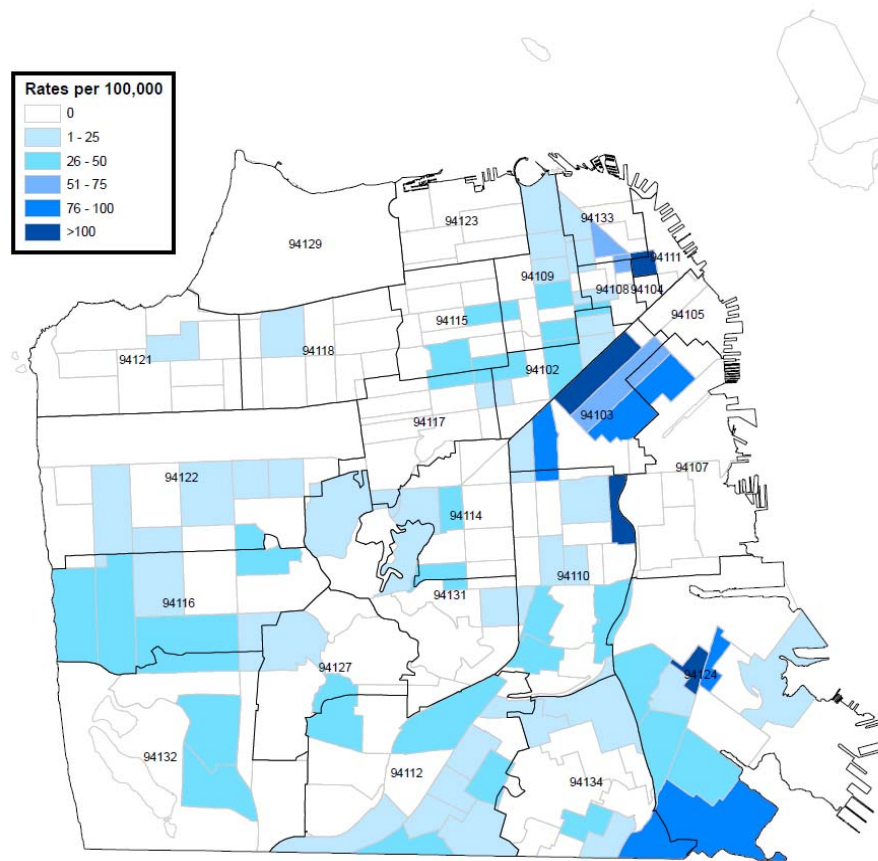
The incidence rate of active TB disease in San Francisco County was 14.6 cases per 100,000 people in 2008, compared to the case rate of 17.8 per 100,000 in 2007. The number of TB cases decreased 17.5%, from 143 cases reported in 2007 to 118 cases reported in 2008 (Figure 1).

**Figure 1. TB Incidence, San Francisco, 1990-2008**



In the South of Market and Chinatown areas of the city, TB incidence is greater than 100 cases per 100,000 persons, These focal points of disease incidence represent the two TB epidemics occurring in San Francisco: one among the homeless and marginally-housed and one among foreign-born persons (Figure 2).

**Figure 2. TB Case Rates by Census Tract, San Francisco, 2008**

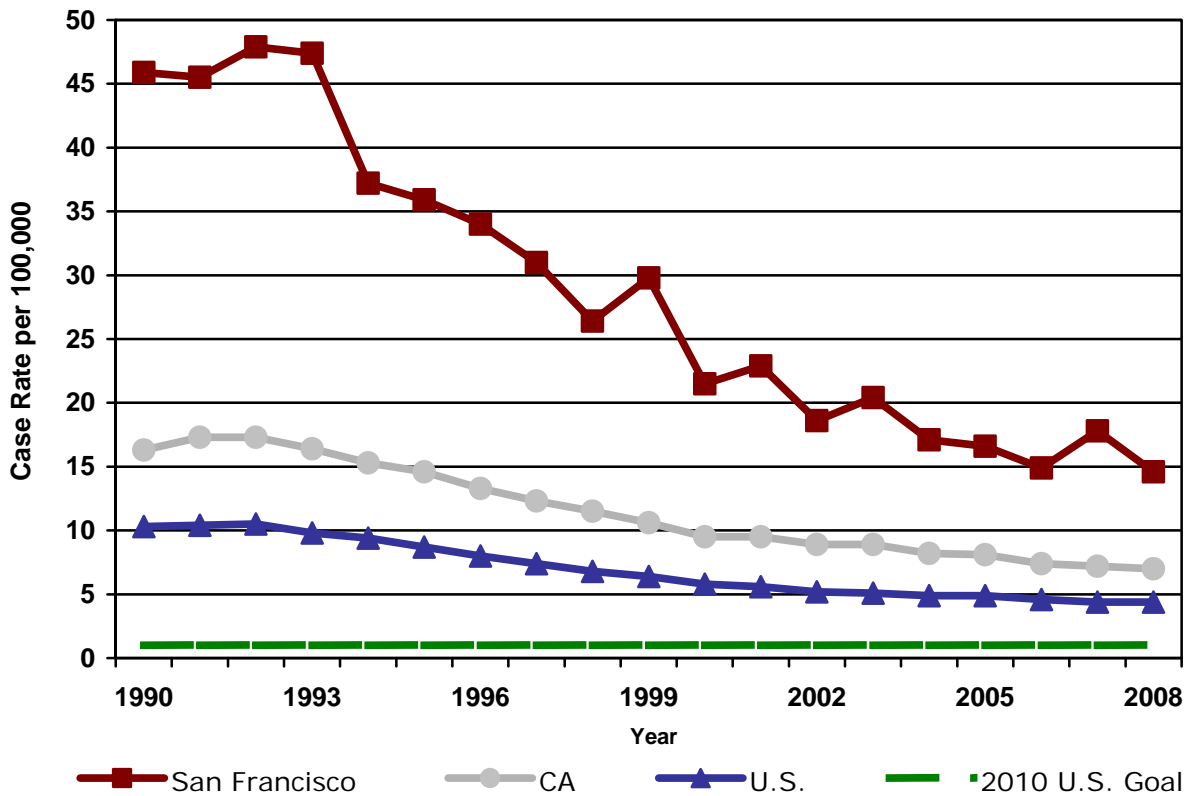


Over the last decade, TB incidence has declined by more than 50% due to intensive efforts to prevent infection and active disease among San Francisco residents. Despite these efforts, the rate of TB in San Francisco is more than three times the 2008 national average of 4.2 cases per 100,000, more than twice the 2008 California average of 7.0 cases per 100,000, and far from the 2010 Health People goal of 1 case per 100,000 (Table 1). Since 1990, the rate of TB decline in San Francisco is occurring faster than in California and the U.S.; however in recent years, the rate of decline has slowed in all parts of the country.

**Table 1. TB Case Rates per 100,000 – U.S., California, and San Francisco, 2004-2008**

		2004	2005	2006	2007	2008
<b>U.S.</b>	Count	14,500	14,067	13,727	13,288	12,904
	Rate	<b>5.0</b>	<b>4.8</b>	<b>4.6</b>	<b>4.4</b>	<b>4.2</b>
<b>California</b>	Count	2,989	2,903	2,779	2,725	2,695
	Rate	<b>8.2</b>	<b>7.9</b>	<b>7.4</b>	<b>7.2</b>	<b>7.0</b>
<b>San Francisco</b>	Count	135	132	120	143	118
	Rate	<b>17.1</b>	<b>16.6</b>	<b>14.9</b>	<b>17.8</b>	<b>14.6</b>

**Figure 3. TB Case Rates per 100,000 – U.S., California, and San Francisco, 1990-2008**

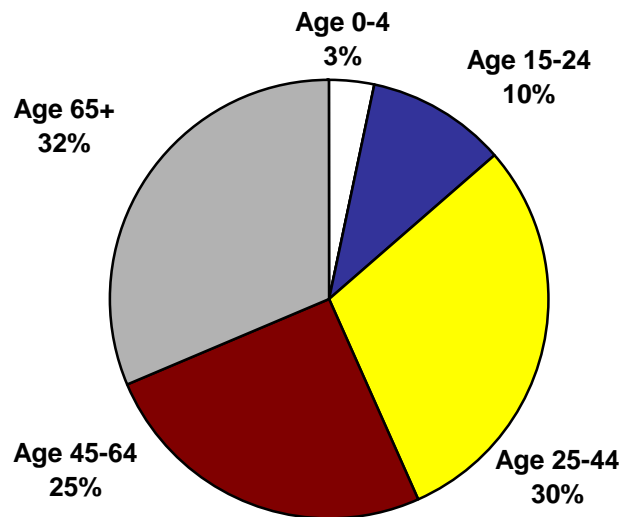


**Age**

The mean age of persons with active TB in 2008 was 51 years old; however, the greatest proportion of TB cases in San Francisco were in persons 65 years of age and older (Figure 4). TB in the this oldest age group represents disease due primarily to reactivation of old infection and occurs most often in foreign-born

persons infected in their countries of origin. TB in the pediatric and adult populations is often due to TB disease that occurs as a result of new infection, either due to infection overseas prior to immigration or through transmission of disease due to ongoing outbreaks. TB case rates in all age groups are declining; however, this rate of decline has leveled off somewhat in recent years. (Table 2, Figure 5).

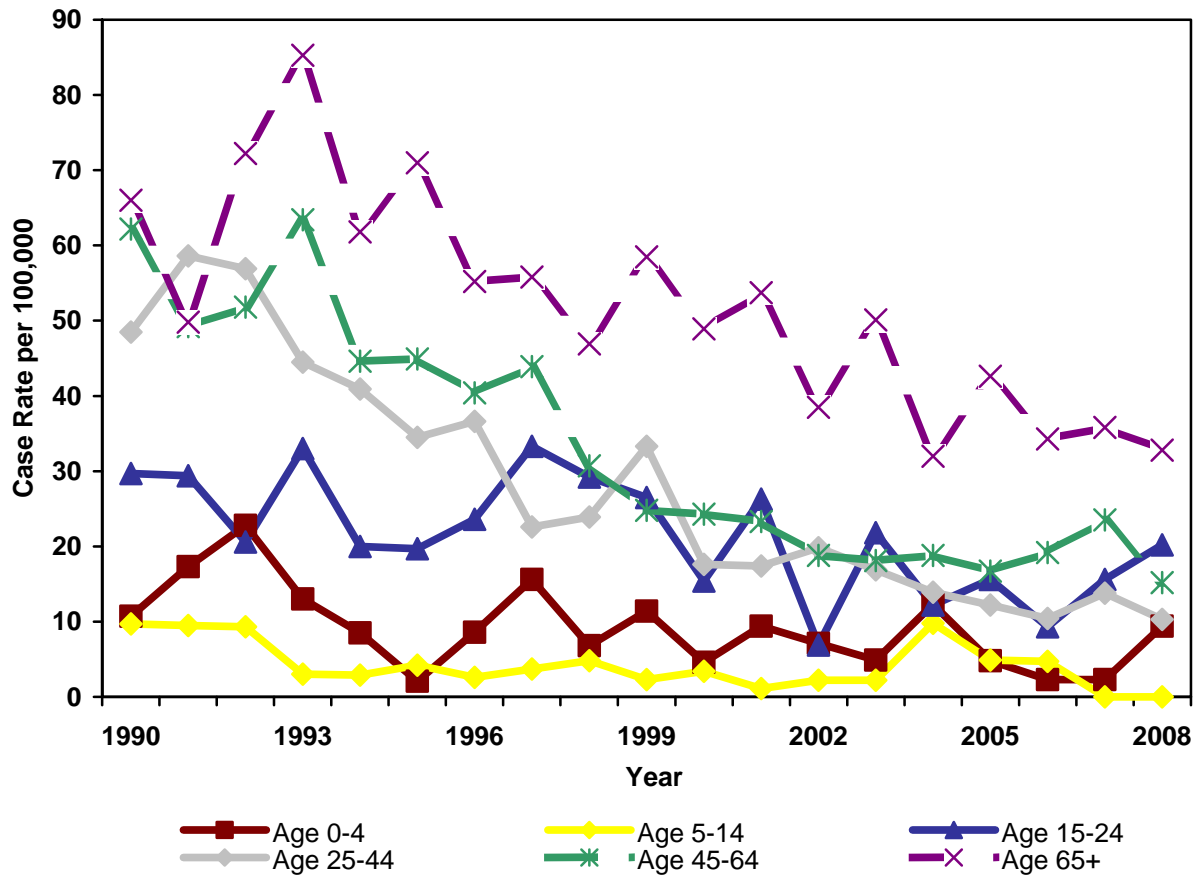
**Figure 4. TB Cases by Age Group, 2008**



**Table 2. TB Incidence Rate per 100,000 by Age Group, 2004-2008**

		2004	2005	2006	2007	2008
<b>Age 0–4</b>	Count (%)	5 (3.7)	2 (1.5)	1 (0.8)	1 (0.7)	4 (3.4)
	Rate	12.3	4.8	2.3	2.3	9.4
<b>Age 5–14</b>	Count (%)	6 (4.4)	1 (0.8)	3 (2.5)	0 (0)	0 (0)
	Rate	9.8	4.9	4.7	0	0
<b>Age 15–24</b>	Count (%)	8 (5.9)	10 (7.6)	6 (5.0)	10 (7.0)	12 (10.2)
	Rate	12.2	15.6	9.3	15.6	20.2
<b>Age 25–44</b>	Count (%)	45 (33.3)	39 (29.5)	33 (27.5)	43 (30.1)	35 (29.7)
	Rate	13.9	12.2	10.4	13.8	10.3
<b>Age 45–64</b>	Count (%)	36 (26.7)	33 (25.0)	39 (32.5)	49 (34.3)	30 (25.4)
	Rate	18.8	16.7	19.2	23.5	15.2
<b>Age 65+</b>	Count (%)	35 (25.9)	47 (35.6)	38 (31.7)	40 (28.0)	37 (31.4)
	Rate	32.0	42.6	34.3	35.8	32.8

**Figure 5. TB Rates by Age Group, 1990-2008**



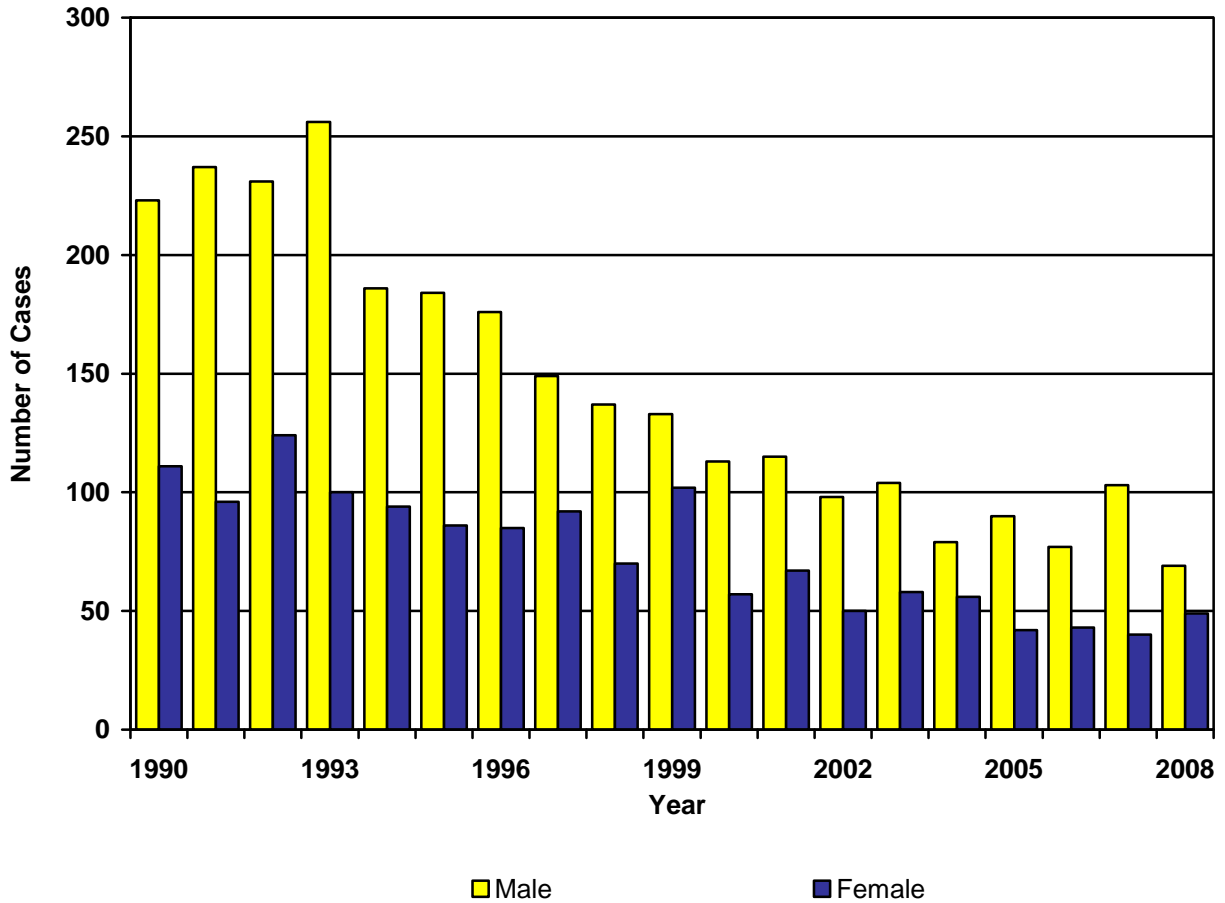
*Children and TB*

In 2008, there were four pediatric TB cases (all under 5 years of age). One was a foreign-born child who developed active TB one year after arrival in the U.S. The other three children were all U.S.-born; however, two siblings who had traveled abroad were diagnosed with active disease upon return to the U.S. The remaining U.S.-born contact was exposed to multiple cases in a residential outbreak among Hispanic day laborers.

*Gender*

Annually, two-thirds of all TB cases in San Francisco are reported among men (Figure 5). While there are no demographic or clinical differences between men and women, 75% of those that die during treatment are men. (See TB Mortality section.)

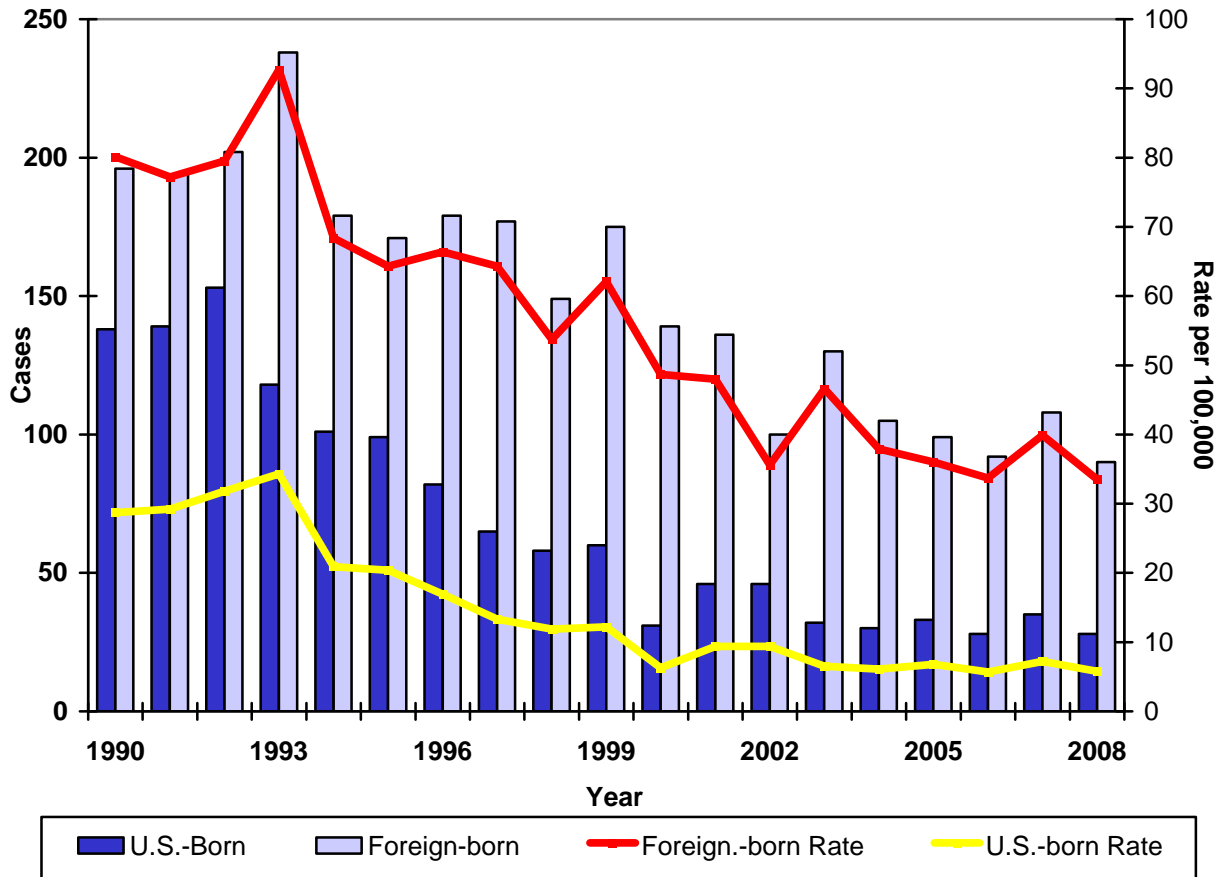
**Figure 6. TB Cases by Gender, 1990-2008**



### **Tuberculosis Among the Foreign-born**

In 2008, 90 cases (76% of all San Francisco cases) were born outside the U.S. (Figure 7). Overall, the number of TB cases among both the U.S.-born (rate of 5.8 per 100,000) and foreign-born populations (rate of 33.5 per 100,000) continue to decline on an annual basis; however, during the past five years, the proportion of cases from each of these groups has remained stable (75% foreign-born, 25% U.S.-born).

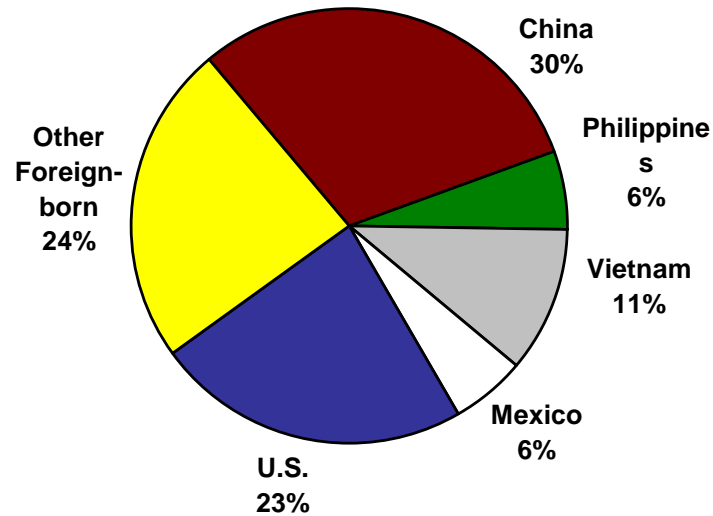
**Figure 7. TB Cases by U.S. vs. Foreign-Born Status, 1990-2008**



*Country of Origin*

In 2008, foreign-born cases originated from 14 different countries. Of these, 61 (68%) came from four countries: China (37), Philippines (7), Vietnam (13), and Mexico (7, Figure 8).

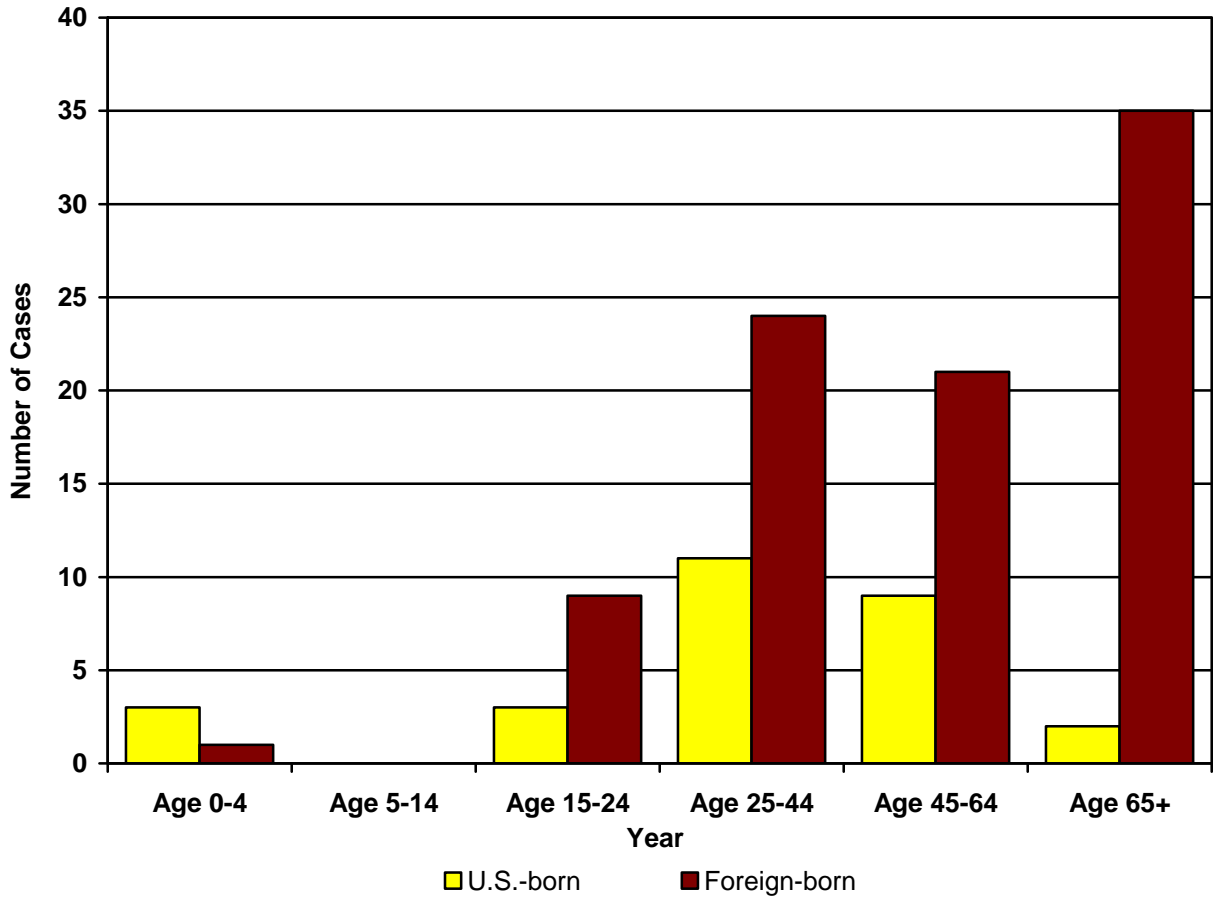
**Figure 8. TB Cases by Country of Birth, 2008**



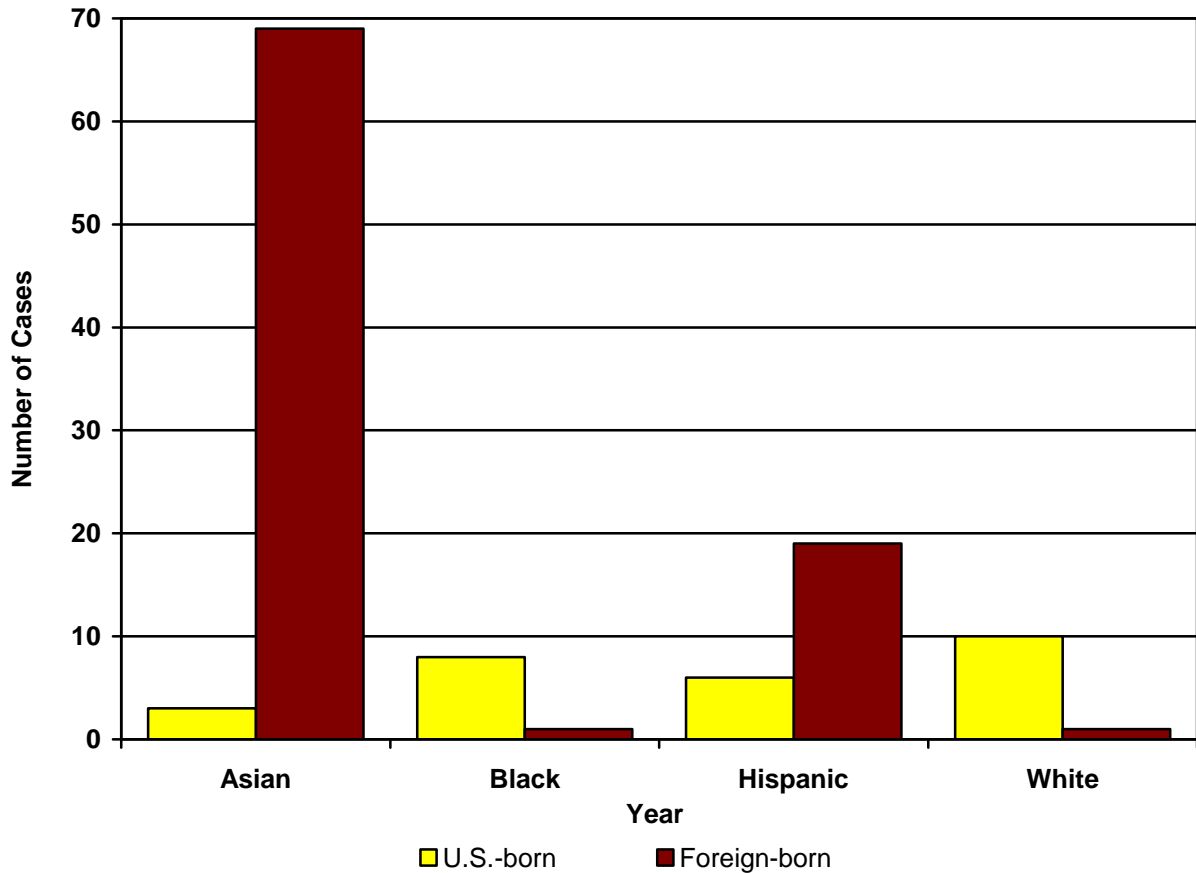
*Age and Race by Country of Birth*

In San Francisco, there are two TB epidemics, one among the U.S.-born and one among the Foreign-born. The U.S.-born epidemic is largely driven by ongoing transmission fueled by the catalysts of HIV co-infection and crowded shelter and SRO living conditions. In 2008, these cases were more likely to be male (60%), under the age of 65 (93%), and black or white non-Hispanic (64%). TB in the foreign-born is a disease of reactivation and is comprised of a completely different demographic makeup. These cases occur most often in Asians (76%) over the age of 45 (62%). In San Francisco, there is little mixing of homelessness and HIV into the foreign-born TB population.

**Figure 9. TB Cases by Foreign-born Status and Age Group, 2008**



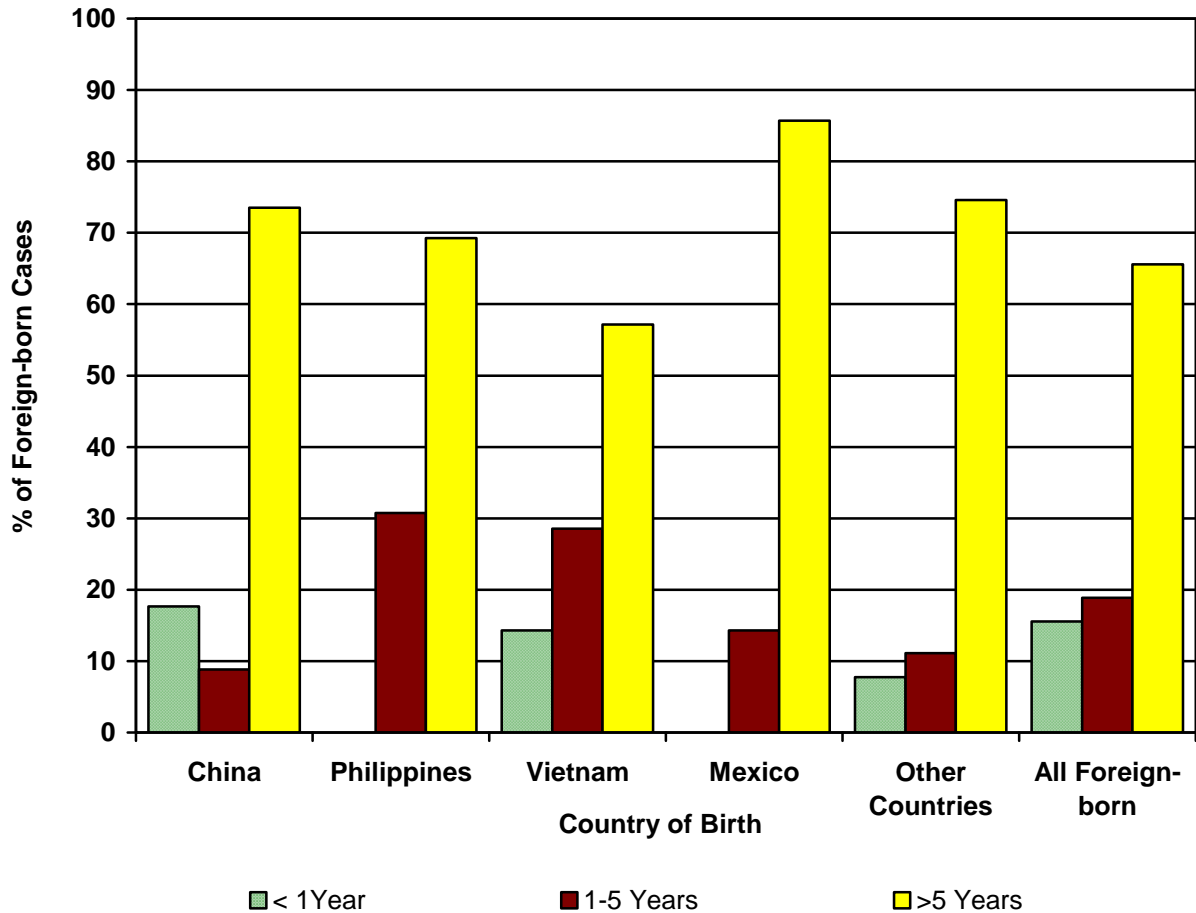
**Figure 10. TB Cases by Foreign-born Status and Race/Ethnicity, 2008**



*Duration of stay in U.S. prior to diagnosis*

The length of time from arrival in the U.S. to diagnosis was available for 100% of TB cases born outside of the U.S. Of this group, 15.6% of cases had been in the U.S. less than one year; 18.9% of the cases had been in the U.S. between one and four years; and 65.6% of cases had been in the U.S. for five or more years at the time of diagnosis. Figure 11 shows the duration of stay in the U.S. at the time of diagnosis and by country of birth. The figure shows that the majority of cases occur greater than five years after entering the United States. However, the proportions vary depending on the country of origin.

**Figure 11. Foreign-born TB Cases by Time in U.S., 2008**

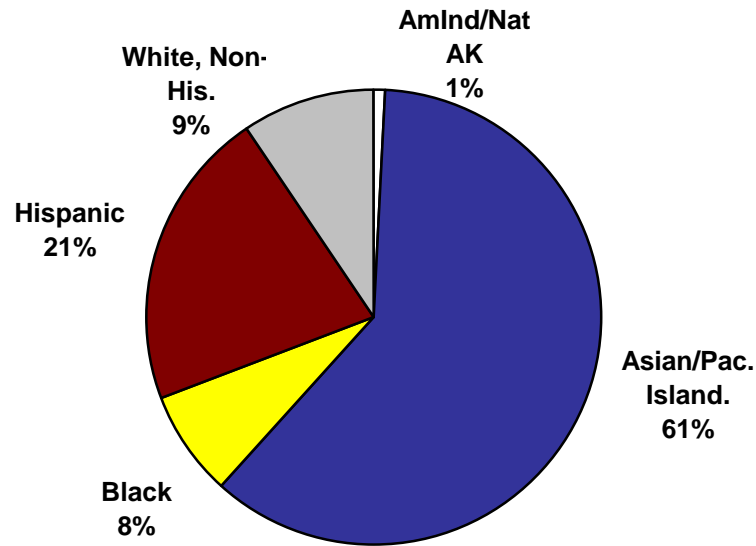


## Racial Disparities

### *Race and Ethnicity*

All non-white race and ethnicities continue to have disproportionately high rates of TB. Asians continued to represent the greatest proportion of all TB cases in 2008 (61%) and the second highest incidence (27.7 per 100,000) in San Francisco (Figure 12, Table 3). While blacks and whites make up 8% and 9% of TB cases, respectively, blacks have a case rate more than five times (16.5) that of whites (3.0). Hispanics represent 21% of all TB cases in 2008. As stated previously, TB in blacks and whites is more likely to be among the homeless and marginally-housed, be HIV positive and be U.S-born. TB among Asians is primarily in the foreign-born, many of whom resided in the U.S. more than five years prior to diagnosis. TB in Hispanics is a mix of U.S.-born (usually pediatric cases) and disease due to recent transmission due to outbreaks.

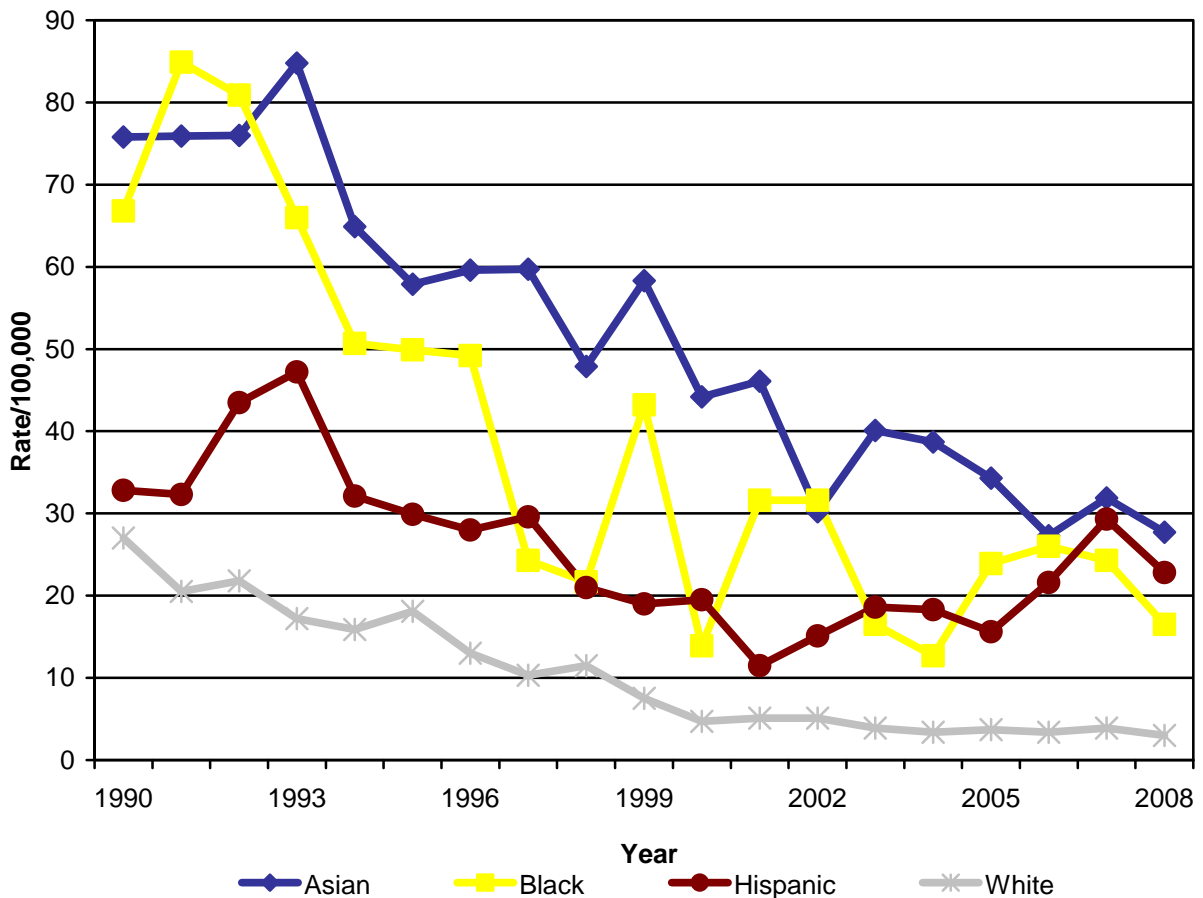
**Figure 12. TB Cases by Race/Ethnicity, 2008**



**Table 3. TB Cases and Rates per 100,000 by Race/Ethnicity, 2004-2008**

		2004	2005	2006	2007	2008
<b>Am. Ind./ AK Nat.</b>	Count (%)	0 (0)	2 (1.5)	1 (0.8)	1 (0.7)	1 (0.8)
	Rate	<b>0</b>	<b>71.1</b>	<b>35.0</b>	<b>35.3</b>	<b>36.8</b>
<b>Asian/ Pac. Isl.</b>	Count (%)	95 (70.4)	86 (65.2)	69 (57.5)	81 (56.6)	71 (60.2)
	Rate	<b>38.7</b>	<b>34.3</b>	<b>27.3</b>	<b>31.9</b>	<b>27.7</b>
<b>Black</b>	Count (%)	7 (5.2)	13 (9.8)	14 (11.7)	13 (9.1)	9 (7.6)
	Rate	<b>12.7</b>	<b>23.9</b>	<b>26.0</b>	<b>24.3</b>	<b>16.5</b>
<b>Hispanic</b>	Count (%)	21(15.6)	18 (13.6)	24 (20.0)	34 (23.8)	25 (21.2)
	Rate	<b>13.9</b>	<b>12.2</b>	<b>10.4</b>	<b>13.8</b>	<b>10.3</b>
<b>White</b>	Count (%)	12 (8.9)	13 (9.8)	12 (10.0)	14 (9.8)	11 (9.3)
	Rate	<b>3.4</b>	<b>3.7</b>	<b>3.4</b>	<b>3.9</b>	<b>3.0</b>

**Figure 13. TB Case Rates per 100,000 by Race/Ethnicity, 1990-2008**



### Tuberculosis Mortality

In 2008, there were 11 deaths among TB cases (9.3% of all cases). Three cases were diagnosed at death and eight died while on treatment. The average age at death was 69 years old and the average time from the start of TB treatment and death was 9 days (range 1–23 days). Private providers managed 10 of the 11 cases (91%). Unlike 2007, only 5 of the 11 (45.4%) deaths were among Asians between the ages of 63 and 95. In 2007, 12 (80% of deaths) were Asian between the ages of 68 and 92.

TB-related mortality is of particular concern in San Francisco, as the death rate of 9.3% is twice the national rate of 4.7%. Between 2005 and 2008, 61 deaths occurred among TB cases. On average, 9–14% of cases per year die with TB. Over the last several years, 69% of deaths were among foreign-born Asians. The average age at death in this group was 80 years old, 74% were male, 81% were diagnosed/managed by private MDs, and the average time from report of the case to TB Clinic to death was 23 days. Review of our TB-related deaths

cases suggests deaths may be preventable due to delays in diagnosis and management errors by private MDs.

**Table 4. TB Mortality, 2004-2008**

		2004	2005	2006	2007	2008
<b>Total Cases</b>	Count	135	132	120	143	118
<b>Dead at Diagnosis</b>	Count (%)	3 (2.2)	5 (3.8)	6 (5.0)	1 (0.7)	3 (2.5)
<b>Died while on Treatment</b>	Count (%)	11 (8.1)	12 (9.1)	11 (9.2)	15 (10.5)	8 (6.8)
<b>Total Deaths</b>	Count (%)	14 (10.4)	17 (12.8)	17 (14.2)	16 (11.2)	11 (9.3)

## HIV Co-Infection

In 2008, Human Immunodeficiency Virus (HIV) testing was offered to 86% of cases over the age of 15 (Table 5). Reasons for not offering testing include being over the age of 75 with no risk factors for HIV (10 of 14 patients, 66.7% of those not offered testing), testing negative within the six-month period prior to diagnosis (2), and dying shortly after being reported to the health department (2). Test refusal is high, especially among cases over the age of 64 (Figure 14).

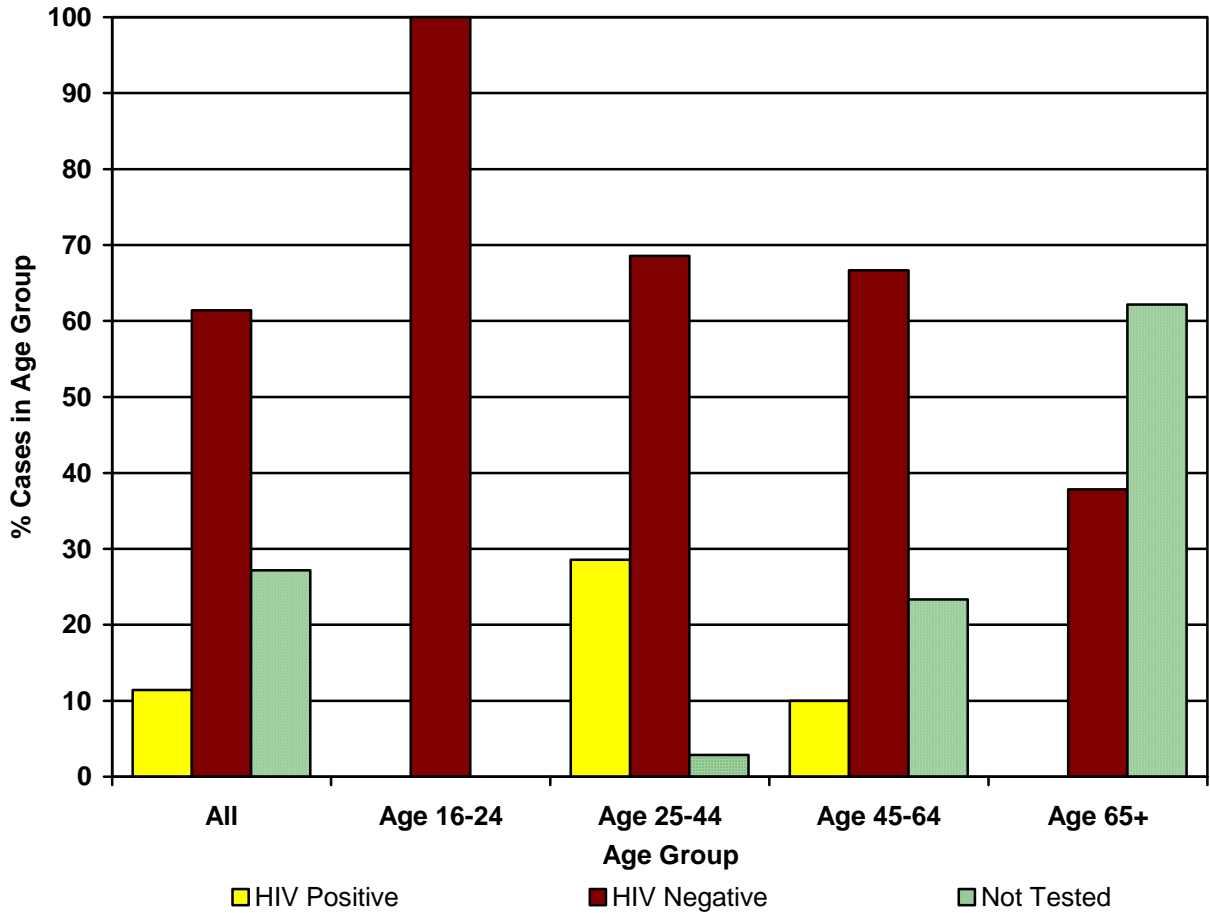
**Table 5. HIV Testing for Case Over the Age of 15, 2004-2008**

		2004	2005	2006	2007	2008
<b>Total Cases Over Age 15</b>	Count	Not Collected	119	107	131	104
<b>Offered HIV Test</b>	Count (%)	Not Collected	94 (79%)	88 (82%)	115 (88%)	89 (86%)
<b>Refused Test*</b>	Count (%)	Not Collected	35 (37%)	26 (30%)	39 (34%)	24 (27%)

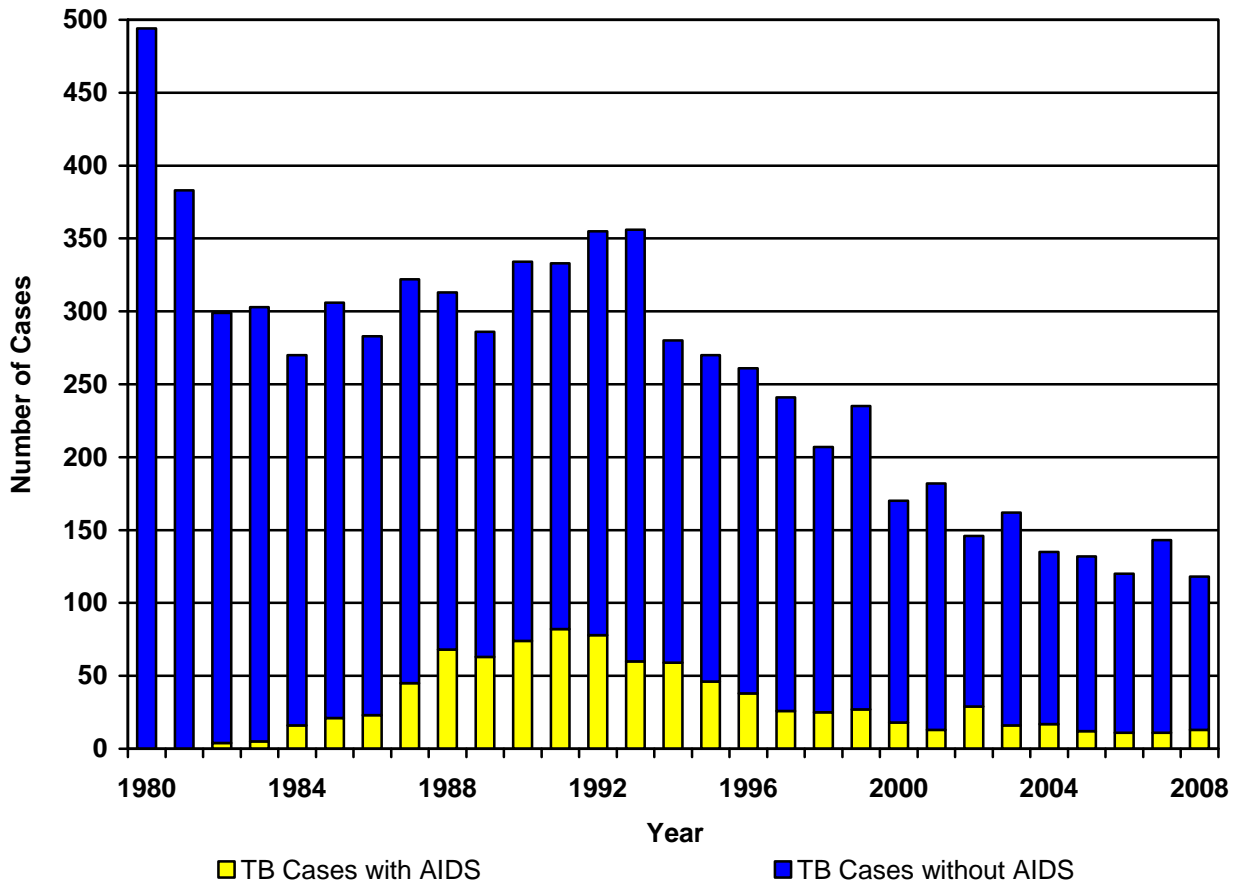
\* % Refused of those offered testing.

In 2008, HIV test results were available for 72.8% of all cases, and 97% of all cases between ages or 25 and 44. As shown in Figure 14, the majority of HIV positive cases are in the 25–44 year old population. Historically, this group has been most affected by HIV/TB co-infection, especially in the mid-80s early-90s, at the start of the HIV epidemic in San Francisco (Figure 15).

**Figure 14. HIV Test Results by Age Group, 2008**



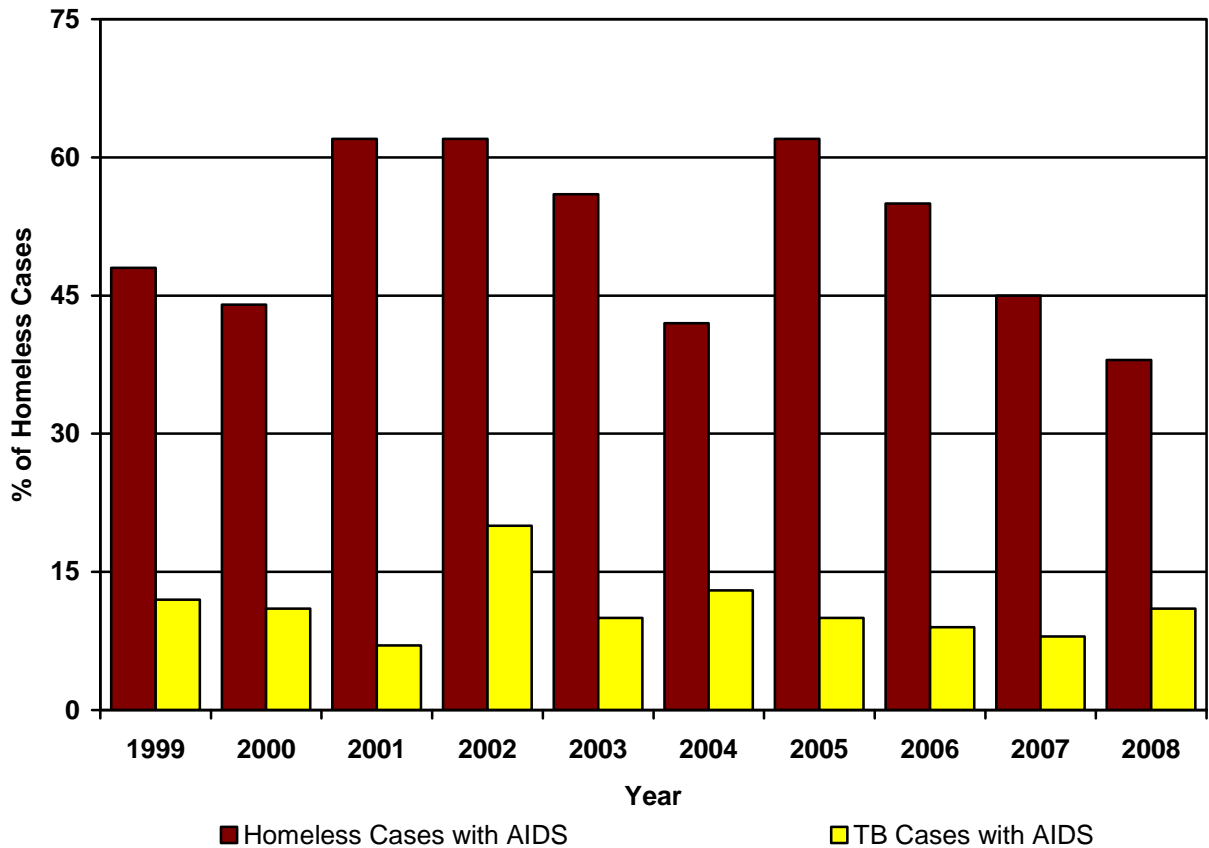
**Figure 15. TB Cases, 1980-2008**



*HIV and Homelessness*

Currently, TB/HIV co-infection is most common among homeless cases as HIV serves as a catalyst for transmission in congregate setting in which immunocompromised persons reside. In 2008, 5 of 14 homeless cases (36%) were HIV positive. This year was unusual in that a lower proportion of HIV co-infected cases occurred in the homeless population due to an outbreak of TB among HIV-positive gay men. In past years, however, 45–62% of HIV/TB cases are reported in the homeless while only 7–20% of all TB cases in San Francisco are HIV-positive (Figure 16).

**Figure 16. HIV Positive TB Cases, 1999-2008**



## **TB in the Homeless**

There were 14 homeless persons diagnosed with active TB in 2008, comprising 12% of all TB cases in San Francisco. Homelessness is defined as people who lack a fixed, regular, and adequate nighttime residence or whose primary nighttime residence was a supervised shelter designed to provide temporary living accommodations.

In 2005, TB screening became mandatory for entry into a San Francisco shelter. This policy led to a dramatic decline in shelter cases that year. Since then, there has been a shift in cases from shelters to single-room occupancy (SRO) hotels, which are not required to provide TB testing to residents (Table 6).

**Table 6. Primary Nighttime Residence of Homeless Cases, 2003-2008**

		2003	2004	2005	2006	2007	2008
<b>Total Cases</b>	Count	21	11	17	22	25	14
<b>Shelter</b>	Count (%)	7 (33 %)	3 (28%)	1 (6%)	4 (18%)	5 (20%)	4 (29%)
<b>SRO</b>	Count (%)	11 (52%)	4 (36%)	11 (65%)	12 (55%)	12 (48%)	6 (42%)
<b>Street/Other</b>	Count (%)	2 (10%)	4 (36%)	5 (29%)	6 (27%)	8 (32%)	4 (29%)

Of the 14 homeless cases in 2008, 12 (86%) were born in the U.S., with the majority of cases being male (65.3%), white (35.7%), or black, non-Hispanic (25.6 %, Table 7). In 2006 and 2007, there was an increase in foreign-born cases, especially in the Hispanic and Asian homeless cases, due to outbreaks in SRO hotels. The index case in the 2006 outbreak was resistant to INH, EMB, and PZA. The increase in foreign-born homeless cases is concerning due to the high rates of drug resistance in Asian and some Central and South American countries.

**Table 7. Demographics of Homeless Cases, 2005-2008**

	2005 N (%)	2006 N (%)	2007 N (%)	2008 N (%)
<b>Total Cases</b>	17	22	25	14
<b>Gender</b>				
Male	15 (88.2)	19 (86.6)	23 (92.0)	9 (64.3)
Female	2 (11.8)	3 (13.6)	2 (8.0)	5 (35.7)
<b>Age Group</b>				
0-4	0	1 (4.5)	0	0
15-24	0	0	1 (4.0)	1 (7.1)
25-44	6 (35.3)	6 (27.3)	8 (32.0)	6 (42.9)
45-64	11 (64.7)	15 (68.2)	11 (44.0)	6 (42.9)
65+	0	0	5 (20.0)	1 (7.1)
<b>Race/Ethnicity</b>				
White, non-Hispanic	6 (35.3)	8 (36.4)	6 (24.0)	5 (35.7)
Black, non-Hispanic	5 (29.4)	8 (36.4)	8 (32.0)	4 (25.6)

	<b>2005</b> N (%)	<b>2006</b> N (%)	<b>2007</b> N (%)	<b>2008</b> N (%)
Hispanic	4 (23.5)	4 (18.2)	9 (36.0)	4 (25.6)
Asian/Pacific Islander	0	1 (4.6)	1 (4.0)	2 (14.3)
Am. Indian/Alaska Native	2 (11.8)	1 (4.5)	1 (4.0)	0
<b>U.S. -born?</b>				
Yes	15 (88.2)	16 (72.7)	17 (68.0)	10 (71.4)
No	2 (11.8)	6 (27.7)	8 (32.0)	4 (28.8)
<b>HIV Result</b>				
Positive	8 (47.6)	6 (27.3)	5 (20.0)	5 (35.7)

## Drug-Resistant TB

### *Primary Drug Resistance*

Drug resistance has remained relatively steady, with the exception of 2004, when drug resistance to at least one drug increased from 15% to 22% of culture-positive TB cases. In 2008, primary drug resistance among culture-positive cases declined slightly, from 13.9% to 10.9% compared to 2007 (Table 8).

**Table 8. Drug Resistance to Anti-TB medications, 2004-2008**

		<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>
<b>Culture-Positive TB Cases</b>	Count	114	109	100	108	92
<b>Any Resistance</b>	Count (%)	26 (22.8)	9 (8.3)	13 (13.0)	15 (13.9)	10 (10.9)
<b>INH Only</b>	Count (%)	12 (10.5)	5 (4.6)	2 (2.0)	5 (4.6)	3 (3.3)
<b>RIF Only</b>	Count (%)	1 (0.9)	0 (0)	0 (0)	0 (0)	1 (1.1)
<b>MDR</b>	Count (%)	3 (2.6)	1 (0.9)	1 (1.0)	2 (1.9)	1 (1.1)
<b>INH, Non-RIF</b>	Count (%)	5 (4.4)	0 (0)	7 (7.0)	4 (3.7)	1 (1.1)
<b>Acquired Resistance</b>	Count (%)	0 (0)	0 (0)	1 (1.0)	0 (0)	0 (0)

### Multi-Drug Resistance

While the number of multidrug-resistant (MDR) cases (defined as resistance to isoniazid and rifampin) has remained relatively low (1–4 cases per year, and 1–3% of all cases reported annually), these TB strains are usually highly resistant (often to four or more drugs) and are difficult and costly to manage. There was one case of MDR-TB in 2008, and unlike MDR cases with extensive resistance in prior years; this case was resistant to only isoniazid, rifampin, and streptomycin.

Figure 17 shows increasing drug-resistant patterns over the last 10 years, with more MDR cases being resistant to all first-line medications (blue) and a number of second-line agents as well (red). In 2003, 2005, and 2006, San Francisco TB Control managed three pre-XDR cases—cases that were one drug away from being XDR (extreme drug resistance is defined as MDR TB plus resistance to one injectable agent and one quinolone agent, green). In 2006, one case, despite excellent adherence, developed MDR-TB through acquired rifampin resistance and then went on to develop XDR-TB.

**Figure 17. MDR Drug Patterns, 1999-2008**

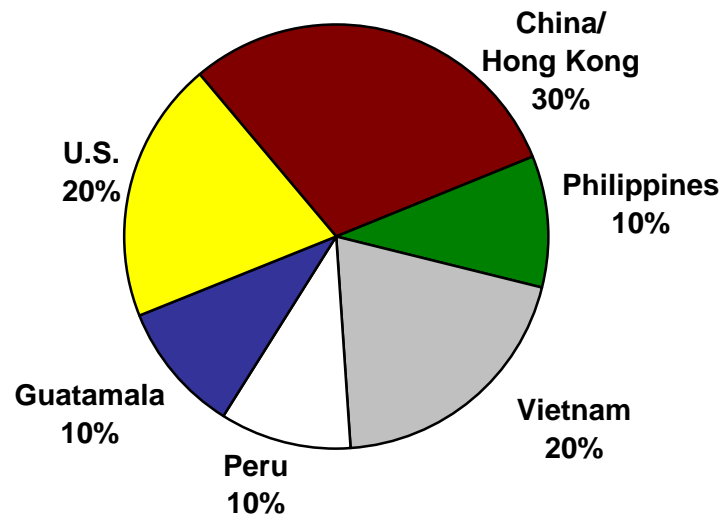
YEAR	INH	RIF	EMB	PZA	Strep	Ethion	PAS	Capreo	Inject.	Quino.
1999	Blue	Blue			Red	Red				
	Blue	Blue		Blue						
2001	Blue	Blue		Blue						
	Blue	Blue		Blue						
2002	Blue	Blue	Blue	Blue	Red	Red	Red			
	Blue	Blue	Blue	Blue				Red		
2003	Blue	Blue	Blue	Blue	Red	Red		Red		
	Blue	Blue	Blue	Blue	Red	Red		Red	Green	
2004	Blue	Blue								
	Blue	Blue								
2005	Blue	Blue	Blue	Blue	Red		Red	Red	Green	
2006	Blue	Blue	Blue	Blue	Red	Red		Red	Green	
	Blue	Blue	Blue	Blue	Red	Red			Green	Green
2007	Blue	Blue								
	Blue	Blue		Blue	Red					
2008	Blue	Blue			Red					

\*Colored boxes represent resistance. Blue/solid=first line anti-TB medications. Red/diagonal line=second line anti-TB medications. Green/diamonds=Injectable/quinolones.

### Drug Resistance in the Foreign-born

In 2008, 80% of all TB cases showing some form of drug resistance were born outside the U.S. Six cases were from Asia and two from Central America. There were two cases of INH resistance in U.S.-born individuals (Figure 18).

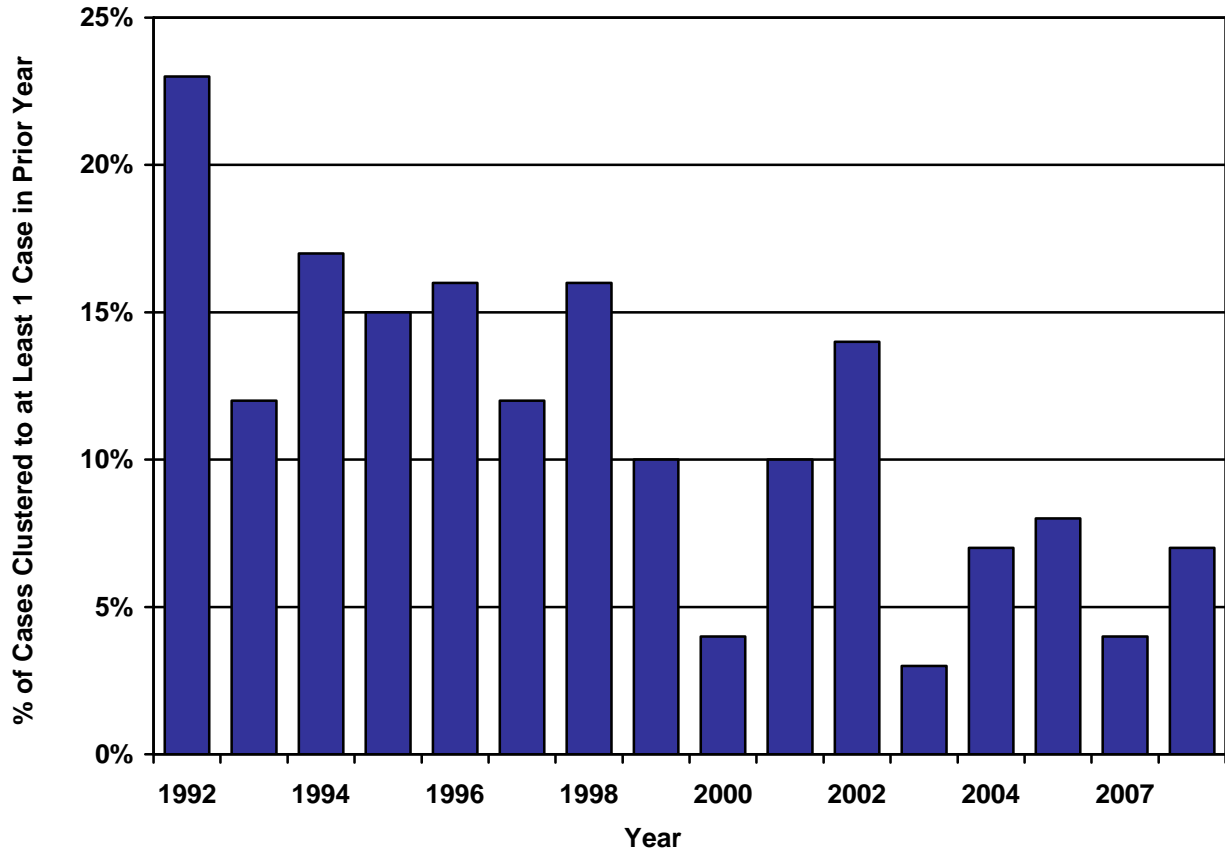
**Figure 18. Place of Birth of Cases with Any Drug Resistance, 2008.**



## **Genotyping and Clustering**

San Francisco TB Control has had a long-standing relationship with an NIH-funded research group that provides molecular genotyping of all culture-positive TB specimens. Molecular typing methods (RFLP and PGRS) are able to distinguish between related and unrelated strains of TB. Cases sharing the same genotype (molecular fingerprint) are usually due to recent transmission and can be used to monitor TB control in a population. Figure 18 shows the percent of TB cases that were due to recent transmission as defined as sharing the same genotype with a case from the prior year. Due to intense TB Control efforts, particularly among the U.S.-born, homeless population, and through control of HIV, TB clustering has decreased from 23% in 1992 to 7% in 2008.

**Figure 19. Genotypic Case Clustering, 1992-2008**



## **Case Identification and Reporting**

California state law requires all cases of active TB be reported to the local health department for oversight and surveillance reporting. In San Francisco, TB cases are identified through passive reporting by local hospitals and physicians and actively through target testing and screening of high-risk populations. In 2008, 29.7% of all cases reported to the health department were found through active case-finding methods—targeted testing, immigration screening and contact investigation (Table 9). This year, San Francisco TB Control tested and evaluated 2,742 community referrals from testing sites serving high-risk foreign- and U.S.-born populations, 1,795 contacts to active TB cases, and 293 legal immigrants to San Francisco.

**Table 9. Method of Case Identification, 2004-2008**

		<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>
<b>Total Cases</b>	Count	135	132	120	143	118
<b>Targeted Testing</b>	Count (%)	Unknown	25 (18.9)	37 (30.8)	20 (14.0)	26 (22.1)
<b>Immigration</b>	Count (%)	12 (8.9)	17 (12.9)	21 (17.5)	14 (9.8)	6 (5.1)
<b>Contact Invest.</b>	Count (%)	13 (9.6)	11 (8.3)	9 (7.5)	8 (5.6)	3 (2.5)
<b>Private MD/ Hospital Referral</b>	Count (%)	Unknown	79 (59.8)	53 (44.2)	101 (69.9)	83 (70.3)

### **Disease Characteristics**

In 2008, 78.8% of the San Francisco cases were pulmonary (with or without extra-pulmonary involvement) and of these, 40.9% were sputum smear-positive. In general, extrapulmonary cases of TB are not infectious; however, cases with pulmonary TB, especially those with smear-positive disease, are infectious and can transmit TB to others. Table 10 shows the primary site of disease and smear and culture status of San Francisco cases for the past five years.

**Table 10. Clinical Characteristic of TB Cases, 2004-2008**

		<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>
<b>Total Cases</b>	Count	135	132	120	143	118
<b>Pulmonary TB</b>	Count (%)	112 (83.0)	107 (81.1)	87 (72.5)	117 (81.8)	93 (78.8)
<b>Extrapulmonary TB</b>	Count (%)	23 (17)	25 (18.9)	33 (27.5)	26 (18.2)	25 (21.2)
<b>Sputum Smear Positive</b>	Count (%)*	36 (26.7)	37 (34.6)	40 (46.0)	41 (35.0)	38 (40.9)
<b>Culture Positive</b>	Count	114	109	100	108	92

(%) (84.4) (82.6) (83.3) (75.5) (78.0)

\*Percent of Pulmonary TB Cases.

## Case Management

In 2008, 90 cases were managed (46.6%) or co-managed (29.7%) by the TB Clinic. Private providers managed the remaining 28 cases (23.7%). To ensure appropriate, timely, and complete treatment for TB, San Francisco TB Control monitors progress on the following objectives. These objectives are in agreement with California and national case-management guidelines. Table 11 shows each objective, year for which the most recent data is complete, yearly goal and progress in meeting the objective.

**Table 11. Case Management Objectives and Annual Progress**

Objective	Year	Goal	Progress
Treatment Completion within 12 Months	2007	≥90%	77%
Overall Treatment Completion	2007	≥98%	96%*
Initiation of a Four-Drug Regimen – Cases <15	2008	≥75%	100%
Initiation of a Four-Drug Regimen – Cases ≥15	2008	≥93%	95%
Initiation of an Adequate Treatment Regimen	2008	100%	97%
Timely Treatment Initiation	2008	≥95%	97%
Appropriate Use of DOT	2008	90%	95%

\* Estimated

### *2007 Treatment Completion*

The TB treatment completion rate is 96% (excluding those that died or moved during treatment) for cases counted in 2007. Among these cases, 114 were eligible to complete treatment within 12 months. Of the 114 patients that completed treatment, only 96 (77% excluding those that died, 81% excluding those that died *and moved*) did so within one year. Seventeen cases had treatment extended beyond 12 months, and all but two had legitimate reasons for extending treatment. Two cases completed therapy within one week of the 12-month

cutoff, and 13 cases had legitimate medical reasons for extending treatment (e.g., adverse reactions and extensive disease). The two cases with treatment inappropriately extended beyond 12 months were both managed by private providers. One patient was overtreated due to INH resistance, and the other was nonadherent for five months, requiring a restart in therapy.

#### *2008 Treatment Initiation*

In 2008, 97% of active TB cases began an adequate treatment regimen. Six patients did not initiate a standard four-drug regimen; however, two of these cases started adequate treatment regimens given their known medical history (prior INH-induced hepatitis and pregnancy). Private providers managed three of the four patients started on inadequate regimens (failure to include RIF for one patient and PZA for two). The third, culture-negative, patient was not started on INH due to a TB Clinic resident's error. Once management errors were known, three of the four patients had their regimens changed. One patient died the day after treatment started. DOT was used for 95% of cases meeting eligibility requirements for this mode of treatment.

## Appendix 1: TB Epidemiology Resources

San Francisco TB Control: <http://www.sfdph.org/dph/comupg/oservices/medSvs/TB/>

California Department of Health TB Services:  
<http://www.cdph.ca.gov/programs/tb/Pages/default.aspx>

CDC Division of TB Elimination: <http://www.cdc.gov/nchstp/tb/>

TB Education and Training Resources:  
<http://www.findtbresources.org/scripts/index.cfm>

Francis J. Curry National Tuberculosis Center: [www.nationaltbcenter.edu](http://www.nationaltbcenter.edu)

WHO Stop TB Partnership: <http://stoptb.org/> and <http://www.who.int/tb/en/>

## Appendix 2: Sources and Notes

This report primarily presents data for verified 2008 TB cases. However, where unavailable, summaries from previous years have been presented.

Since TB is a reportable disease, all 2008 cases are assumed to have been included in this report.

All program data came from the San Francisco TB Control Patient Management Database.

All charts and tables are from the TB Control Section, San Francisco Department of Public Health.

Denominator estimates are courtesy of the State of California, Department of Finance: *State of California, Department of Finance, Race/Ethnic Population with Age and Sex Detail, 2000–2050*. Sacramento, CA, July 2007, and U.S. Census Bureau, 2005-2007, American Community Survey.

Homeless estimates are courtesy of the San Francisco Department of Human Services: *San Francisco Human Services Agency, San Francisco 2007 Homeless Count Final Report*.

California State data are courtesy of the California Department of Public Health.

National data are from the surveillance reports at CDC's Division of TB Elimination Website: *Reported Tuberculosis in the United States, 2008*.