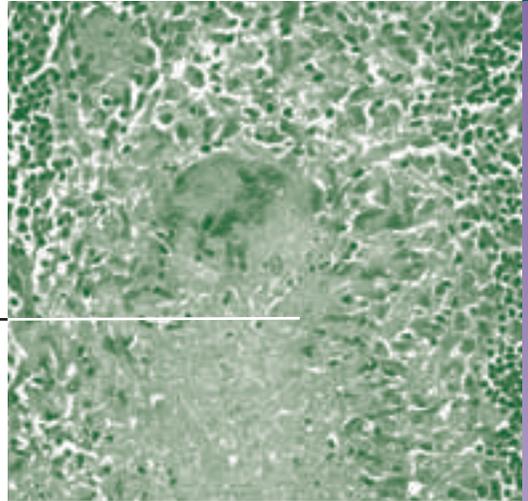


*Public Health - Seattle & King County*  
*Annual*  
*Report on*  
*Tuberculosis*

**2008**



*A report prepared by the Tuberculosis (TB) Control Program,  
Public Health - Seattle & King County*

*Eyal Oren, MS - Lead TB Epidemiologist*

*Margaret Ragland, MS - TB Epidemiologist*

*Masa Narita, MD - TB Disease Control Officer*

**Public Health**   
Seattle & King County

**David Fleming MD**, Director and Health Officer

*Published November 2009*

*Alternate formats of this report are available upon request.*

*Online supplement available: [www.kingcounty.gov/healthservices/health/communicable/TB](http://www.kingcounty.gov/healthservices/health/communicable/TB)*

## PREFACE

---

This publication is both a programmatic and data summary of the Tuberculosis (TB) Control Program's activities in 2008. It is similar to previous publications, but now contains solely program highlights. Additional epidemiological and programmatic data can be found in the online supplement.

From 2008 to 2009, due to King County budget shortfalls, the TB Control Program experienced staff reductions. The Program therefore carefully reassessed service delivery for TB control in King County. Strategies to improve program efficiencies in 2009 and beyond include focused use of resources on cases posing the greatest public health significance, community partnerships for provision of care and management of extra-pulmonary cases, and enhanced partnerships with the private sector to provide directly observed therapy and TB case management.

Along with implementation of these strategies, the TB Control Program will continue to monitor their effects on the community's health



## THE TB CONTROL PROGRAM MISSION AND FUNCTION

### *Tuberculosis Control Program Mission Statement*

The mission of the Public Health - Seattle & King County Tuberculosis Control Program is to prevent the transmission of tuberculosis in King County.

**Background:** Tuberculosis is an infectious disease that spreads by airborne transmission. One unique aspect of TB is that the latency period (i.e. time between acquisition of TB infection and the development of active TB disease) is highly variable. If active TB disease is untreated, the five-year survival rate is approximately 50%, but with effective antibiotic treatment, the cure rate exceeds 90%. As one-third of the world's population has latent TB infection and globally two million people die each year of TB disease, TB remains a serious public health threat worldwide.

The Seattle & King County TB Control Program views local TB control as a community effort, emphasizing public-private partnerships, as part of the collaboration among local, state, and national organizations.

**Priorities:** Following national and international guidelines, the TB Control Program prioritizes its functions in the following order:

1. Ensure persons with active TB are identified, isolated if appropriate, and fully treated until cured.
2. Ensure contacts of persons with infectious TB are screened and offered appropriate preventive therapy.
3. Partner with health care professionals and agencies in King County to identify and treat persons who are at high risk for TB infection and reactivation of TB disease.
4. Monitor TB trends in Seattle and King County.

**Efforts in 2008:** Due to an all time high of reported active TB cases and a large outbreak in individuals from the Marshall Islands the previous year, two full-time public health nurses and an outreach worker were added to the staff in the last half of 2007 with supplemental county funding. Staff funding was extended into 2008 from Washington state 5930 public health funding for a total of 18 months, increasing case management staff to seven public health nurses and five outreach workers. The current system seeks to manage all cases of active TB through case management. However this system is not sustainable in light of its cost and shrinking funding streams. The populations who will be most affected by decreases in TB services are people of color, low income individuals and families, and those who are homeless or marginally housed.

**Challenges for 2009 and beyond:** The bleak economic picture is forcing the TB Control Program to reassess its service delivery system for the control of TB in King County. In response to projected budget deficits for 2009 and beyond, the TB Control Program proposed the following:

- Focus resources on the management of the highest-priority cases of public health significance:
- Develop and implement a staffing model that redefines the case management model into a team-based, regionalized approach consisting of public health nurses and outreach workers, who provide individualized, direct patient care.

Priority 1	Priority 2	Priority 3
<ul style="list-style-type: none"> <li>• Highly infectious pulmonary TB Cases (i.e. sputum AFB smear positive and cavitation on chest x-ray)</li> <li>• Multi-drug resistant TB cases</li> <li>• HIV co-infected TB cases</li> </ul>	<ul style="list-style-type: none"> <li>• Less infectious pulmonary cases (i.e. sputum AFB smear negative and no cavitation on chest x-ray).</li> </ul>	<ul style="list-style-type: none"> <li>• Extra-pulmonary TB</li> <li>• Recently exposed contacts to infectious TB cases.</li> </ul>

- Enhance alliances with community partners to provide care and management for extra-pulmonary cases (TB infection occurring outside the lungs), building on an existing partnership with Harborview Medical Center’s Infectious Disease Clinic, which has agreed to assist in the management of these cases.
- Enhance partnerships with public health agencies and the private sector to increase the proportion of patients who receive directly observed therapy and case management.
- A focused yet thorough approach to contact investigations; two epidemiologists and five disease intervention specialists work closely with case management teams for complex contact investigations and outbreak response/prevention. The TB Outbreak Prevention team collects, manages and analyzes data for over 1,000 contacts annually.

In order to accomplish our goals, with a shrinking budget, the TB Control Program needs to increase TB expertise in the community through consultation, coordination, and education; and ensure compliance with standards of care and state and federal reporting requirements. 2009 will be a transition year as the TB Control Program begins to identify, develop and implement public/private partnerships for the control of TB in King County.

## DATA SUMMARY

In 2008, King County reported 121 cases of active tuberculosis (TB). For every 100,000 residents of King County, 6.5 developed active TB disease in 2008<sup>1</sup>. The King County TB case rate is notably higher than the US case rate of 4.2 cases per 100,000 population<sup>2</sup>.

### *Age, race, and ethnicity*

The median age of TB cases in 2008 was 37 years.

Nine children (age 0-14 years) were diagnosed, six of whom were diagnosed through contact investigations (i.e. family members or caretakers had active TB). Three pediatric cases, not diagnosed through contact investigations, were diagnosed within one year after emigrating from their counties of birth.

Non-white races continue to have disproportionately high rates of TB. The highest case rate was 34.2 cases per 100,000 among individuals who identify their race as black. Thirty-seven of 43 (86%) black cases in King County were born outside the US. Rates for US-born and foreign-born blacks in King County are 7.1/100,000 and 159.8/100,000, respectively. (2007 American Community Survey data)

The TB case rate in people who identify as Asian and Hispanic was 15.9 and 15.7 per 100,000 population, respectively. Rates among Native Americans decreased from previous years to 11.1 per 100,000 in 2008.

### *Country of birth*

In 2008, 99 (80%) of King County TB cases were born outside the United States, 60 of whom (61% of foreign-born) came from five countries: Somalia, Mexico, Ethiopia, the Philippines, and Vietnam.

### *TB-HIV co-infection*

In order to provide concomitant medical care and minimize morbidity and mortality, it is important to know the HIV status of every person who has active TB. In 2008, HIV test results were obtained for 88% of people with active TB in King County. Among this group, eight people were co-infected with HIV, representing 7% of TB cases. Nationwide, 60% of TB cases in 2008 had HIV test results obtained, and 7% of those with known HIV status were HIV co-infected.

### *Drug resistant TB*

Three individuals were diagnosed as having multidrug-resistant TB (MDR TB) in 2008, and all three remained in King County for TB treatment. One additional person with MDR TB moved to King County during TB treatment. MDR TB is exceedingly costly and difficult to treat. In 2008, no cases of extensively drug-resistant tuberculosis (XDR TB) were reported in King County.

### *Homelessness*

In 2008, 13 people were diagnosed with TB who identified as currently homeless or homeless in the year prior to diagnosis. A larger percentage of homeless patients were younger, compared to previous years, and one-third of patients were co-infected with HIV. The number of homeless people with TB decreased since its peak during an outbreak among homeless people in King County (65 cases from 2002 through 2003). The TB strain that caused the TB outbreak among the homeless in 2002-2003 is still found in active TB cases diagnosed in King County in 2008.

<sup>1</sup> 2007 population data; population data from "1990-2007 Population Estimates: Population Estimates for Public Health Assessment, Washington State Department of Health", Vista Partnership, and Krupski Consulting. December 2007.

<sup>2</sup> CDC. *Reported Tuberculosis in the United States, 2007*. Atlanta, GA: U.S. Department of Health and Human Services, CDC, September 2008.

## TB PROGRAM EPIDEMIOLOGICAL PROFILE

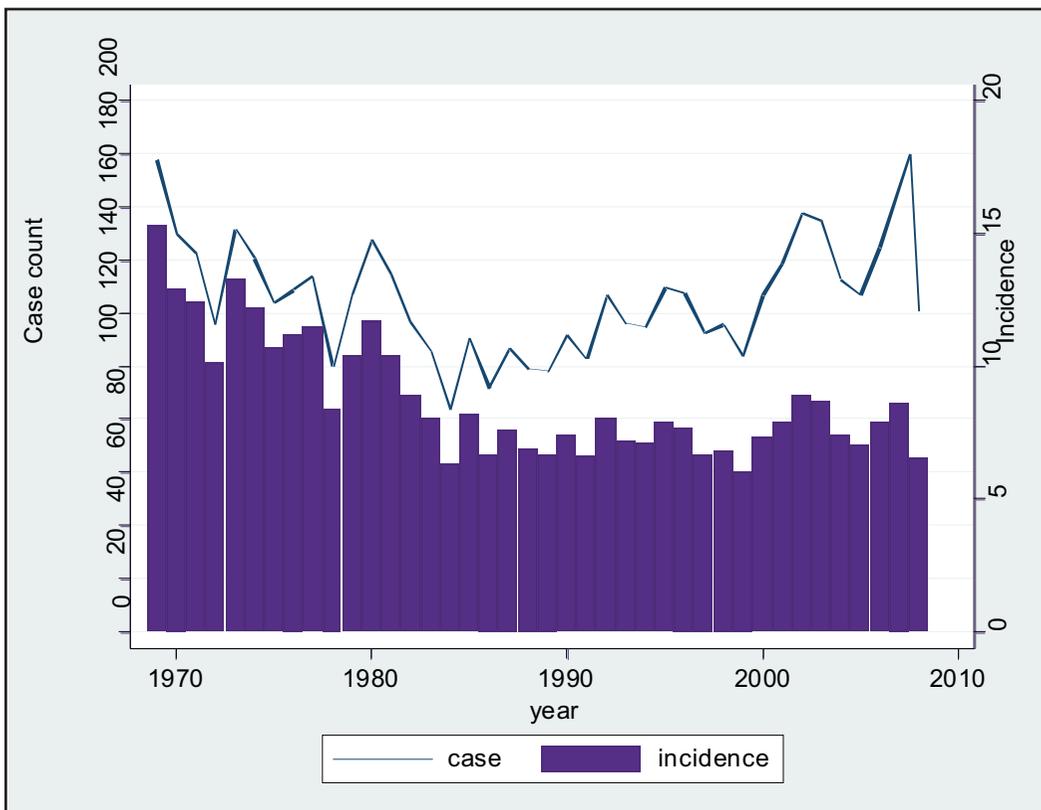
### Contact investigations

In King County contact investigations are conducted for all individuals considered infectious. In 2008, 721 household contacts were evaluated in 58 investigations. In addition, 11 investigations were completed at congregate settings (e.g. worksite, school, or nursing/medical facility) and three additional investigations occurred in shelters/homeless settings associated with three homeless cases. More than 700 contacts were identified at all congregate settings with approximately 575 people evaluated.

### Tuberculosis in King County TB morbidity in 2008

The incidence of active tuberculosis (TB) disease in Seattle & King County was 6.5 cases per 100,000 people in 2008, compared to 8.6 cases per 100,000 people in 2007. The number of reported TB cases decreased from 161 cases in 2007 to 121 cases in 2008. Figure 1 shows the TB case count and incidence per 100,000 people in King County from 1969 to 2008.

**Figure 1.** TB case counts and incidence rates (per 100,000), 1969-2008, King County, Washington



### *Incidence in King County, Washington state, and the United States*

The incidence of TB in King County is 6.5 per 100,000, higher than the overall incidence in Washington and the United States. In Washington, TB incidence decreased from 4.4 per 100,000 in 2007 to 3.5 per 100,000 in 2008. (Table 1) as both the number of cases decreased and the county populations increased. Within Washington state, the trend is for 50-60% of the total TB cases to reside in King County.

Dakota) to 9.6 (Hawaii) cases per 100,000 population with a median of 3.0 cases per 100,000. Thirty-four reporting areas had lower TB rates in 2008 than in 2007 while 17 states had higher rates in 2008 than in 2007.

#### **Age**

In 2008, the mean age of TB cases in King County was 41 years (median 37 years) with a range from 1 to 92 years. The highest incidence per 100,000 population was in the 65+ age group (11.6 per 100,000). (Table 2)

**Table 1.** TB incidence (per 100,000 population) 2004-2008 in US, Washington State, and King County.

		2004	2005	2006	2007	2008
<b>US</b>	Count	14,517	14,093	13,767	13,292	12,898
	rate/100,000	<b>4.9</b>	<b>4.8</b>	<b>4.6</b>	<b>4.4</b>	<b>4.2</b>
<b>Washington</b>	Count	245	256	262	291	228
	rate/100,000	<b>3.9</b>	<b>4.0</b>	<b>4.1</b>	<b>4.4</b>	<b>3.5</b>
<b>King County</b>	Count	134	125	145	161	121
	rate/100,000	<b>7.4</b>	<b>6.9</b>	<b>7.9</b>	<b>8.6</b>	<b>6.5</b>

**Table 2.** TB incidence (per 100,000 population) by age group, 2004-2008, King County, Washington

Age Group/Year	2004	2005	2006	2007	2008
<b>0-4</b>	2.8	0.9	1.9	6.4	3.6
<b>5-14</b>	0.5	1.4	0.9	2.8	2.3
<b>15-24</b>	12.1	7.0	7.2	11.9	7.5
<b>25-44</b>	6.9	6.2	9.4	9.7	7.8
<b>45-64</b>	7.2	8.1	7.8	8.4	4.5
<b>65+</b>	14.8	15.6	15.3	9.5	11.6

In 2008, 12,898 cases of TB were reported in the U.S.; this number represents an all-time low. However, while the annual TB rate has steadily decreased, the pace of the decline has slowed in the new millennium as compared to the decline in the mid- to late-1990s.

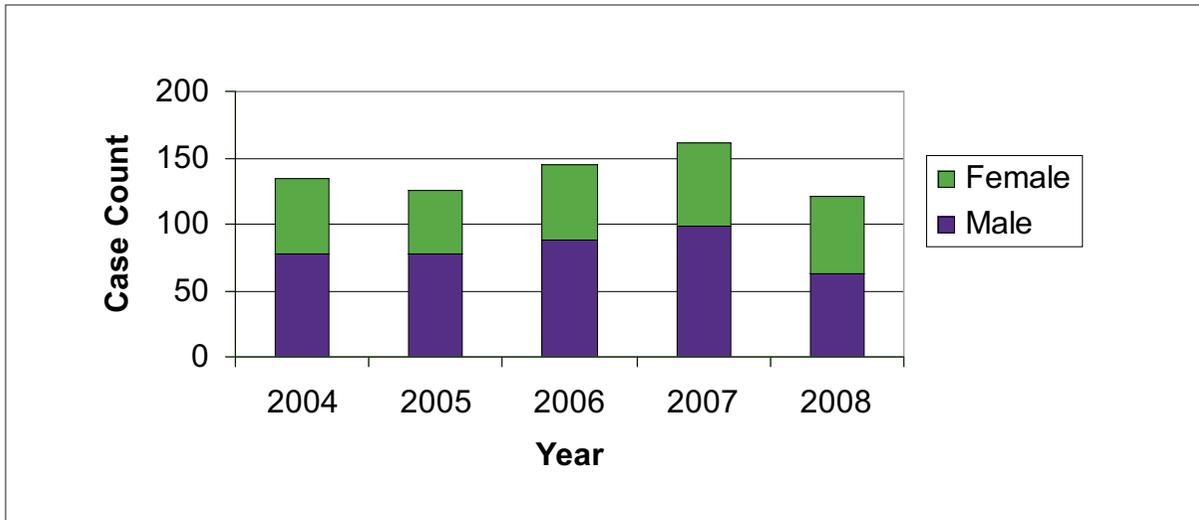
In 2008, TB rates in the 51 reporting areas in the U.S. (50 states plus the District of Columbia) ranged from 0.5 (North

In Washington state, in 2008, the greatest proportion of people who had TB was in 25 to 44 year olds (36%) with 45 to 64 year olds comprising 21% and persons 65 and older making up 20% of cases.

The highest TB incidence in Washington in 2008, was seen in individuals aged 65 and older with 5.8 cases per 100,000 population.

Nationally, in 2007, the year with the latest data available, the greatest proportion of cases was seen among 25-44 year olds (32%), followed by 45-64 year olds (30%) and adults aged 65 and older (19%).

However, the highest incidence of TB is seen in adults aged 65 and older, 6.8 cases per 100,000 individuals. Individuals 45-64 years of age had the second highest case rate, 5.3 cases per 100,000 individuals.

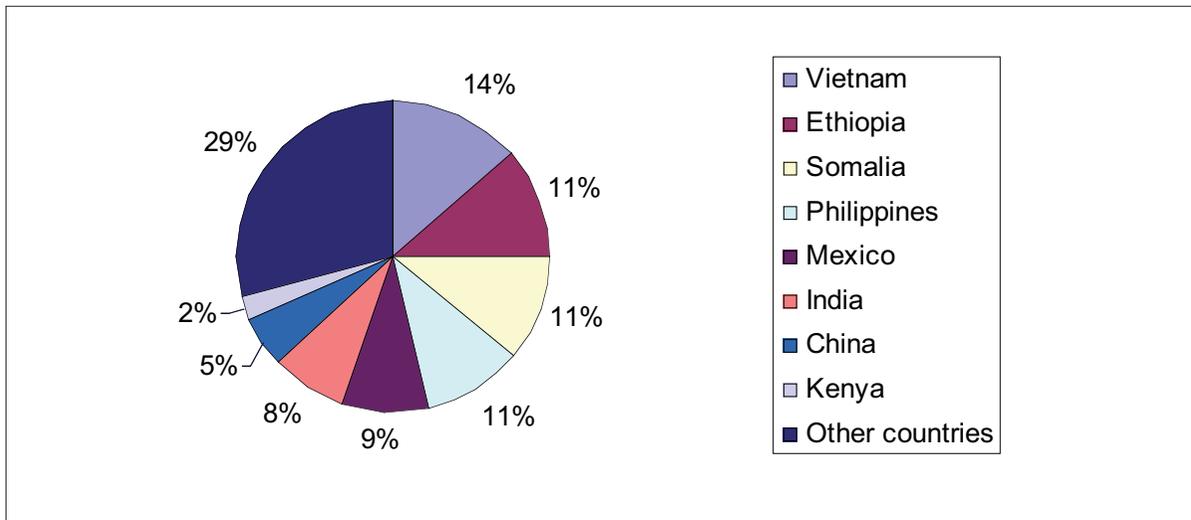
**Figure 2.** TB case counts by gender, 2004-2008, King County, Washington**Gender**

Males comprised 52% of all King County TB cases in 2008, representing proportionately slightly fewer male cases than in recent years (Figure 2). The TB incidence among males was 6.6 cases per 100,000 and 6.2 per 100,000 among females.

In Washington, males were 53% of all TB cases in the state continuing the downward trend in proportion of male cases observed in recent years. Nationally, males represented 61% of all TB cases in the United States in 2007.

<sup>3</sup> Centers for Disease Control and Prevention and the US Census Bureau define "US-born" if "he or she was born in the United States or associated jurisdictions or was born in a foreign country but at least 1 parent was a US citizen." All other individuals are classified as "foreign-born".

**Figure 3.** Country of origin among foreign-born TB cases, 2004- 2008, King County, Washington



***TB among people born outside the United States***

**Country of origin**

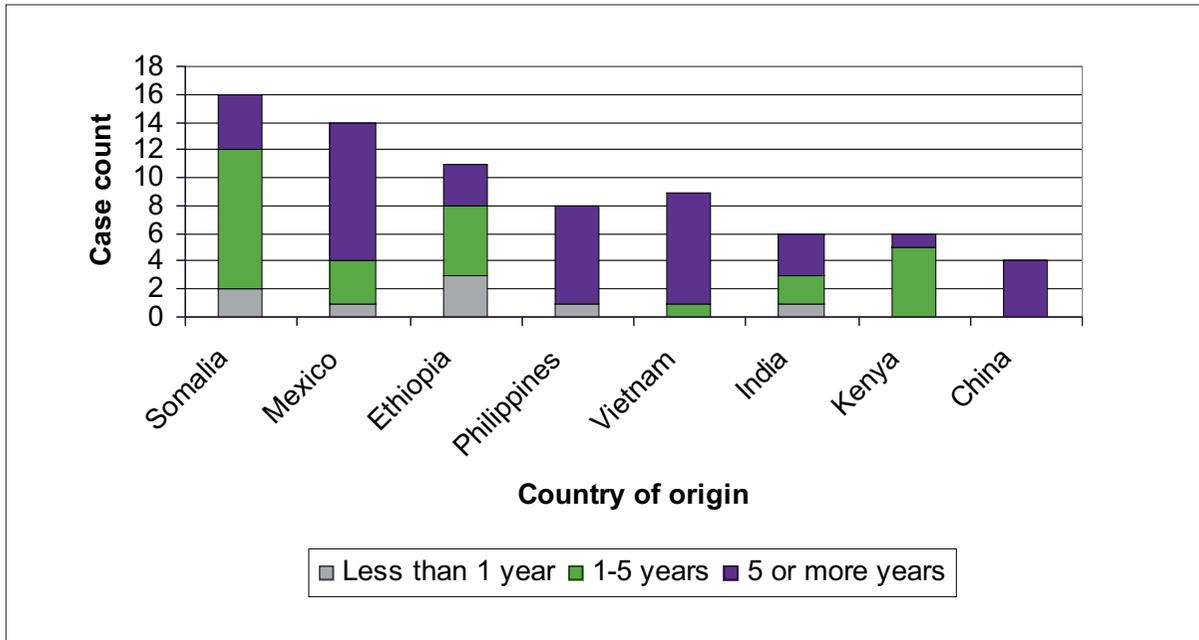
In 2008, 99 people diagnosed with TB in King County were among people born outside the U.S. (foreign-born).<sup>3</sup> These individuals were born in 22 countries and 61% came from five countries: Ethiopia, Mexico, Somalia, the Philippines, and Vietnam. In 2008, 34% of people with TB in King County were born in East Africa, 21% in Southeast Asia, 15% in Central America, and 29% from other countries outside the United States.

King County continues to experience a higher proportion of foreign-born cases (82% of all cases) than the U.S. as a whole (60% of cases were foreign-born in 2008). Though the proportion of foreign-born TB cases in the U.S. has steadily increased in recent years (29% in 1993 to 58% in 2007), the TB rate among foreign-born persons in the U.S. has had a steady decline from 34.0/100,000 in 1993 to 20.2/100,000 in 2008 (a 40.6% decline since 1993).

The online supplement contains data specific to various regions of birth.

Figure 3 shows the country of origin among foreign-born cases from 2004 to 2008 including the eight countries with the highest number of cases in 2008.

Figure 4. Distribution of time between arrival in U.S. and TB diagnosis, foreign-born TB cases, 2008, King County, Washington



#### Age and gender in foreign-born cases

The greatest number of people diagnosed with TB, but born abroad in 2008 were 25 to 44 years of age (39% of foreign-born cases). The age proportion is similar to U.S. born cases (32%).

Males made up a similar proportion of cases in foreign-born (50% of foreign-born cases) and U.S.-born (55%) people.

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

In 2008 in King County, the length of time since arrival in the U.S. was available for 98% of TB cases born outside the United States. Of this group, 13% lived in the U.S. less than one year when they were diagnosed with TB, 31% lived in

the U.S. one to four years, and 54% resided in the U.S. five years or more when diagnosed. Nationally, in 2007, 19% of foreign-born cases lived in the U.S. less than one year, 21% one to four years, and 50% five years or more at TB diagnosis.

Figure 4 shows the 2008 distribution of time between immigration and TB diagnosis for people born outside the U.S. for whom an arrival date is known and who are from select high TB burden countries. Overall, individuals from Asian countries and Mexico lived the U.S. longer than individuals from other areas before they received a diagnosis of TB.

## *Racial disparities and TB*

### **Race and ethnicity**

In 2008, nationally, the highest case rates of TB were among individuals identifying as Asian (25.1 cases per 100,000) and Black (8.7 cases per 100,000). Though King County saw an overall decrease in cases that mirrored the national decline, King County's case rates continue to be higher than national rates for all race categories.

All non-white race and ethnicities in King County continue to have disproportionately high rates of TB. In 2008, Blacks represented the greatest proportion of all TB cases (36%) and the highest incidence (34.2 cases per 100,000) in King County. For the past 10 years, the greatest proportion of TB cases in King County is in people who identify as Asian. While 2008 represented a change, the proportion of Asian cases was still high in 2008 (32%) as was incidence (15.9 per 100,000). Table 3 shows TB incidence in King County by race and ethnicity for 2004-2008.

People who identify as 'Hispanic' represented 17% of TB cases in 2008, a slight increase over the 12% seen in 2007, 13% in 2006, and 9% in 2005. Hispanics had an incidence of 15.7 per 100,000 in 2008 compared to 17.0 per 100,000 in 2007.

The overall decrease in TB incidence in 2008 was also seen in every racial category. The largest decrease from 2007 to 2008 was seen in the American Indian/Alaska Native group (27.6/100,000 in 2007 to 11.1/100,000 in 2008).

**Table 3.** TB incidence per 100,000 population by race and ethnicity, 2004-2008, King County, Washington

Race/Year	2004	2005	2006	2007	2008
Am Indian or AK Native	63.2	17.1	16.8	27.6	11.1
Asian/PI	24.9	25.8	33.6	29.5	15.9
Black	35.9	29.6	24.8	43.2	34.2
White	2.0	2.1	2.6	2.1	1.6
Hispanic	8.2	10.0	17	18.6	15.7

### *TB and Human Immunodeficiency Virus (HIV) co-infection*

In order to provide concomitant medical care and minimize morbidity and mortality, it is important to know the HIV status of every person who has active TB. In 2008, HIV test results were obtained for 88% of people with active TB, of whom eight people were co-infected (7%) (Table 4). In King County, 11% of U.S.-born and 7% of foreign-born cases with HIV test results available were TB-HIV co-infected. In 2008, all the HIV-positive people with TB knew their HIV sero-status prior to their TB diagnostic evaluation.

The U.S. Centers for Disease Control and Prevention (CDC) reported that over one-third of 2008 U.S. TB cases did not have the results of a recent (within three months of TB report) HIV test available. Nationally, of those with HIV status available, almost 11% are co-infected with TB and HIV.

**Table 4.** HIV status among TB cases, 2008, King County, Washington

HIV Status	2004 N (%)	2005 N (%)	2006 N (%)	2007 N (%)	2008 N (%)
Negative	99 (74)	90 (72)	113 (78)	141 (88)	98 (81)
Positive	3 (2)	7 (6)	10 (7)	9 (6)	8 (7)
Refused	20 (15)	17 (14)	6 (4)	3 (2)	4 (3)
Not offered	11 (8)	1 (<1%)	8 (6)	5 (3)	8 (7)
Unknown	1 (<1%)	9 (7)	7 (5)	3 (2)	3 (2)

### *TB Drug resistance*

Multi-drug resistant TB (MDR TB) is defined as TB that is resistant to at least isoniazid (INH) and rifampin, the two most effective first-line TB antibiotics. While treatment for a fully-susceptible (i.e. non-drug resistant) case of TB typically lasts from six to nine months, treatment for individuals with

MDR TB typically lasts from 18 to 24 months, or longer. Cost estimates for a typical case of MDR TB are \$250,000 or more to cure.

Three individuals were diagnosed as having MDR TB in King County in 2008, representing 3% of all culture-positive cases. In addition, one individual with MDR TB moved

to King County during treatment for active TB disease. 2008 numbers approximate numbers seen in a typical year. For comparison, nationally, 125 cases of MDR TB were reported in 2007 (1.2% of cases with drug susceptibility results available), the most recent year for which data are available. The proportion of MDR TB cases in the U.S. has been stable since 1997. In 2007, MDR TB continued to disproportionately affect people not born in the United States, accounting for 81.6% of MDR TB cases in 2007. Nationally, approximately 7.7 % of TB cases were resistant to isoniazid and 1.2% were reported as MDR TB in 2007 (latest year data is available).

Extensively drug-resistant TB (XDR TB) is defined as resistance to INH and rifampin, as well as any of the fluoroquinolones, and at least one of the three second-line injectable TB medications (amikacin, kanamycin, or capreomycin). No XDR TB cases were reported in King County in 2008. Two cases of XDR TB were reported nationally in 2007, and provisional data indicate that four XDR TB cases were reported in 2008.

Table 5 shows King County cases whose TB strain was resistant to some of the most commonly used to treat TB.

**Table 5.** Drug resistance, TB cases, 2008, King County, Washington\*

Drug	Foreign-born (n=78)	US-born (n=16)	Total cases (n=94)
Isoniazid	3	1	4
Streptomycin	4	0	4
MDR (isoniazid +rifampin)	2	1	3
Extreme drug resistance (XDR)	0	0	0
Any drug resistance	7	1	8

### *TB in people who are homeless*

Thirteen homeless persons were diagnosed with active TB in 2008, comprising 11% of all TB cases in Seattle & King County. Fifteen homeless people with TB were reported in King County in 2007, representing 9% of all cases last year.

Homelessness is defined as lacking a fixed, regular, and adequate night-time residence or occupying a primary night-time residence that is a supervised shelter designed to provide temporary living accommodations. Cases reported as homeless must be homeless within the 12 months prior to the initiation of their TB diagnostic evaluation. Compared with homeless people who got TB in previous years, in 2008 a larger percentage were younger, and, strikingly, one-third of patients were co-infected with HIV.

In 2007, 12 of the 15 (80%) homeless cases were born in the United States. In 2008, however, of the 13 people who were

homeless and diagnosed with active TB, five were born in the U.S. (38% of homeless cases), a decrease in the proportion of U.S.-born homeless cases from the previous year.

Seven of the 13 homeless cases identified as Hispanic (54%), representing an increase over the two Hispanic homeless cases (13% of homeless cases) reported last year.

Two of the 13 homeless cases identified as American Indian or Alaska Native (15%) compared to two cases in 2007 (13%). The number and proportion of American Indian cases has remained low since the 2002-2003 TB outbreak among the homeless subsided.

Nationwide in 2007, 5.7% of TB cases were reported as homeless, although case count and incidence varies widely between states.

### *TB contact investigations*

Contact investigations are conducted in household settings for all people infectious with TB. Nurse case managers are responsible for identifying and evaluating all household contacts and “very close social contacts”. In general, household contacts are family members of an infectious TB case and “very close social contacts” include close friends, relatives, and coworkers who spend many hours together in a confined space.

An estimated 721 close contacts were identified in King County in 2008. Of these, 618 (86%) individuals received an evaluation for TB. Evaluation consisted of history, symptom check and a test for latent TB infection (TB skin test or Quantiferon Gold In-Tube (QFT)), if indicated. Of the screened contacts, 459 had a skin test or QFT administered and read. 126 were skin test positive (25 QFT positive), and 289 were skin test negative (19 QFT negative), for a rate of 26% positive (TB infection rate) among close contacts. The number screened did not include contacts whose names were obtained but who were never located. When an index case was highly infectious, or a household contact investigation suggested TB transmission (i.e., TB infection rate higher than expected), the contact investigation was expanded to the second tier of people who were less intensely exposed to the index case (“expanded contact investigations”).

In 2008, contact investigations (primary and expanded combined) uncovered eleven additional secondary TB cases. Eleven of 618 (2%) contacts were thus diagnosed as active cases. Of all 121 cases in 2008, 9% were discovered as a result of contact investigation. When necessary, if the index case spends a lot of time in congregate settings, contact investigations are expanded to include them. Congregate settings typically include schools, colleges, shelters, worksites, and nursing homes.

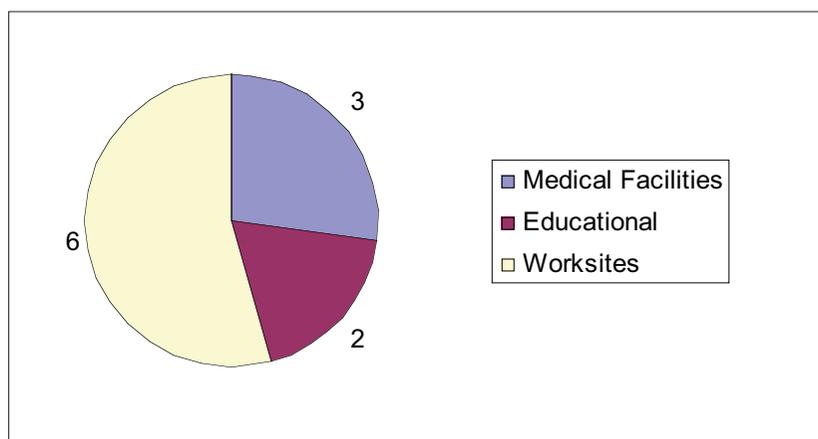
### **TB cases in schools or other congregate settings**

The Public Health - Seattle & King County TB Control Program outbreak prevention section is responsible for investigating outbreaks in congregate settings, outbreak response, and surveillance. Congregate setting investigations take place at workplaces, schools, vocational settings, and congregate care settings such as nursing homes, religious organizations and homeless shelters.

In 2008, the TB Control Program conducted contact investigations at 11 congregate setting sites, as outline in Figure 5 below (excluding homeless shelters).

Additionally, a ship docked at the port of Seattle was investigated for the presence of individuals with active tuberculosis.

**Figure 5.** Non-homeless Congregate Setting Investigation Sites, 2008



## ACKNOWLEDGEMENTS

---

We acknowledge the staff of Public Health - Seattle & King County TB Control Program for their dedication to providing high-quality patient service in order to prevent transmission of TB in King County. We also express gratitude to our community-based medical colleagues for their diagnosis, reporting, and collaboration in the management of TB cases, as well as to the various institutions and agencies which support our case management and contact investigation efforts.

For more detailed epidemiological and programmatic data please see our online supplement: [www.kingcounty.gov/healthservices/health/communicable/TB](http://www.kingcounty.gov/healthservices/health/communicable/TB)

For additional copies of this report contact:

**TB Control Program**  
**Public Health – Seattle & King County**  
325 Ninth Ave, Box 359776  
Seattle, WA 98104  
206-744-4579