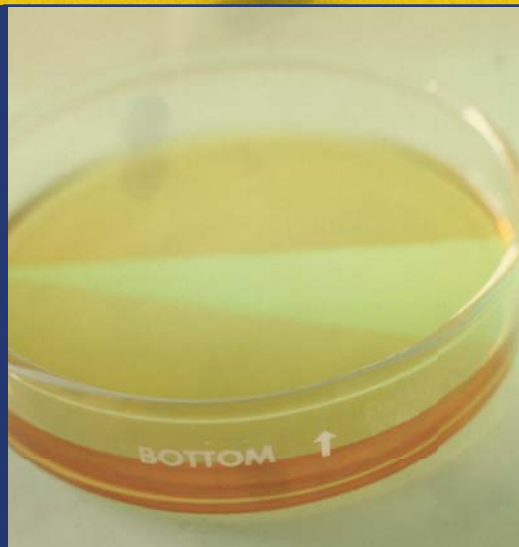


PUBLIC HEALTH –SEATTLE & KING COUNTY

*Annual  
Tuberculosis  
Report*  
**2007**



Public Health  
Seattle & King County



David Fleming MD, Director and Health Officer



## ACKNOWLEDGEMENTS

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

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### Acknowledgement

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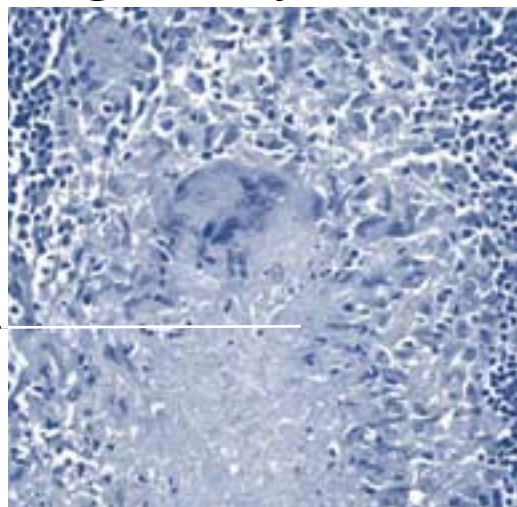
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*Public Health - Seattle & King County*  
*Annual*  
*Tuberculosis*  
*Report*

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**2007**



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

## EXECUTIVE SUMMARY

### *Summary*

As the number of reported cases of TB increases, King County faces on-going challenges. These challenges include a high proportion of people who have TB and live under the Poverty Threshold, patients from increasingly diverse backgrounds and the transient and migratory nature of many individuals at high risk for TB infection.

In 2007, King County reported 161 cases of active tuberculosis (TB) disease, representing an 11% increase from the 2006 count. King County had a TB rate of 8.6 cases per every 100,000 individuals; this rate remains higher than the national rate (4.4 per 100,000 in 2006).

The TB Program has been very successful in ensuring that TB cases complete treatment and in screening and evaluating contacts to these cases. To manage this disease with the tools currently available, the King County 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 and treatment of latent TB infection.

Due to the large pool of individuals with latent TB Infection – an estimated 100,000 people in King County, 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.

### *Age, race, ethnicity and nativity*

The median age of TB cases was 36 years. There were 13 pediatric cases (age 0-14 years), 11 of whom were identified and diagnosed through contact investigations (i.e., family

members had active TB disease) and two were diagnosed soon after emigrating from their countries of birth. In 2007, 122 cases (76% of all King County TB cases) were born outside the United States (US). The five most common countries of origin were Vietnam (21 cases), Somalia (17), Ethiopia (14), India (11), and Marshall Islands (8). In addition, racial and ethnic minorities continue to have disproportionately high rates of tuberculosis. As an example, blacks have a rate of 46.2 cases per 100,000 individuals. Blacks born outside the US made up 38 (75%) of the 51 black cases in King County in 2007.

### *TB-human immunodeficiency virus (HIV) co-infection*

HIV is the most significant risk factor for TB. Offering HIV testing is an important part of TB management. In 2007, over 90% of TB cases in King County were offered HIV testing. Nine of these people were also infected with HIV, representing 6% of all TB cases.

### *Drug resistant TB*

In 2007, 20 (16%) TB cases in King County were drug-resistant to at least one TB medication. Multi-drug resistant (MDR) TB is exceedingly costly and difficult to treat. King County reported two cases of MDR-TB in 2007. Additionally, two cases of MDR-TB were diagnosed in other jurisdictions in 2007 and transferred to continue treatment in King County. In 2007, no cases of extensively drug-resistant (XDR) TB were reported in King County.

### *TB treatment*

The proportion of TB patients initially placed on a standard four-drug regimen remains above 90 percent. The proportion of patients who were treated with directly observed therapy has increased from 61% in 2001 to 96% in 2006, the latest year with complete treatment outcome data.



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## THE TB CONTROL PROGRAM MISSION & 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 (TB) is an infectious disease which spreads by airborne transmission. TB has a highly variable latency period, the time between acquisition of TB infection and the development of active TB disease. If active TB disease is untreated, the 5-year survival rate is approximately 50%. With effective antibiotic treatment, however, 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 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.

### *Tuberculosis Control Program priorities*

Following national and international guidelines, the TB Control Program priorities are, in 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. Work closely 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.

In order to respond to 30-year historic high case counts (158 TB cases) in 2002, several TB control efforts were implemented between 2002 and 2005 and the following activities were established:

- A nurse case management model with five teams consisting of public health nurses and outreach workers, providing individualized, direct patient care;
- Enhanced partnerships with public health agencies and the private sector to increase the proportion of patients receiving directly observed therapy and case management; and
- A focused yet thorough approach to contact investigations. A team of two epidemiologists and two 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.

## *Core activities*

The TB Control Program is mandated by Washington law to perform public health functions related to surveillance, case finding, epidemiologic analysis, and contact tracing. State law requires local health departments to conduct the following core TB control functions:

### **Assure completion of appropriate treatment of active cases of TB**

The highest priority of our TB control program is to assure that people with active TB disease complete treatment. Treatment also stops transmission of the disease. Complete and appropriate treatment reduces the risk of disease relapse and prevents the development of drug resistant TB strains.

The TB Control Program takes an individualized case management approach to treatment. Medical providers are required, by law, to report every suspected case of TB to the health department of the patient's county of residence. Directly observed therapy (DOT) is considered for every person with TB in King County. The TB Control Program achieves a very high treatment completion rate (over 90%) by considering each patient's individual needs and utilizing a range of incentives and enablers. Voluntary compliance with treatment is very successful, but in rare instances, the TB Control Officer will issue directives to comply with evaluation and treatment. Violation of the directive is referred to the Prosecuting Attorney for consideration of court orders and/or detention, as necessary.

### **Investigate contacts**

Persons with untreated tuberculosis disease of the lungs can spread TB bacteria to others. Approximately one in three household contacts of a person with infectious TB can be expected to acquire latent TB infection. Since people are at the highest risk of developing active TB disease in the first two years after acquiring latent TB infection, finding newly infected contacts of persons with active TB disease is a very high priority. Infected persons can be given treatment

that greatly reduces their chances of developing active TB disease. Treatment of persons with latent TB infection reduces the likelihood of developing active disease by up to 92 percent.

In addition to the management of active TB cases and suspects, the TB Control Program evaluated an average of five close contacts per infectious TB case. Expanded contact investigations were conducted at 19 sites with 362 contacts identified and 269 tested. Clinical services were provided to 3,737 King County residents during 11,829 patient visits to the TB Clinic in 2007.

The TB Control Program takes a concentric circle approach to contact investigations. The closest contacts of a person with infectious TB are evaluated first, usually with symptom reviews and TB skin tests. If a high rate of infection is found in that group, the next closest circle is investigated. Since the skin test can turn positive eight to ten weeks after the last exposure, contacts are re-tested as late as ten weeks after exposure to determine whether infection has occurred. Persons with latent TB infection are usually treated, but highly vulnerable close contacts, such as infants and persons with HIV infection, may receive treatment regardless of the skin test result.

### **Screen and treat high risk populations**

The TB Control Program provides direct service to complete the TB evaluation for recent immigrants whose screening chest X-rays were abnormal and suggestive of possible TB ("Class B" immigrants). Although cleared upon emigration based on negative sputum examination (AFB smear), approximately two to five percent have smear-negative, culture-positive pulmonary TB. Even with inactive TB status, these immigrants pose a high risk of developing TB in the future. The TB Control Program works closely with the King County Refugee Screening Program to evaluate all refugees.





## Surveillance

The TB Control Program participates in a TB surveillance network that includes weekly reporting of active cases to the state and national control programs. The program tracks trends in local patterns of TB incidence, drug resistance, and other parameters. This report, detailing TB in Seattle-King County, is published annually. Further, the case counts are published in each edition of Epi-Log, a monthly epidemiological newsletter of Public Health - Seattle & King County.

The TB Control Program uses the Tuberculosis Information Management System (TIMS) database for program and case management. TIMS was developed by the Centers for Disease Control and Prevention (CDC) for standardized TB data collection and analysis. Case reports are transmitted through a secure modem to the state, then on to the federal program for accurate epidemiological assessments. In addition, the TB Control Program uses several local databases for case and contact tracking.

Below are the Washington State TB Objectives for 2009 and data showing how well Seattle & King County has been able to meet prescribed indicators.

## Medical consultation and training

Seattle & King County's TB Control Program serves as a resource for health care providers seeking:

- General information on TB screening, diagnosis, and treatment;

- Specialty consultation on diagnosis and management of challenging TB cases; and
- Lectures and in-services for physicians-in-training, and community-based health care providers.

Additionally, the TB Control Program collaborates with local graduate and post-graduate educational programs to work on projects related to TB program activities.

## Triaging people suspected to have TB

In Seattle & King County, people suspected to have TB are classified in two categories:

### a. High suspicion:

Based on clinical presentation, TB risk factors, radiographic findings and other clinical information, clinical specimens are collected, and isolation and/or empirical TB treatment are initiated. Over 90% of individuals with "high suspicion" are confirmed to have active TB. Approximately 180 high suspects were evaluated for high suspicion of TB disease in 2007.

### b. Low suspicion:

Based on clinical presentation, TB risk factors, radiographic findings and other clinical information, clinical specimens are collected, but isolation and/or empirical TB treatment are NOT initiated. Approximately 5% of individuals with "low suspicion" are confirmed to be active TB cases. The majority of Class B immigrants evaluated through the TB Program belong to this category as well. Approximately 200 patients were evaluated for low suspicion of TB disease in 2007.

## Washington TB objectives and status in Seattle &amp; King County:

Indicator (2006 status, unless indicated)	Current status in Seattle & King County
All newly diagnosed cases of TB reported to CDC using TIMS; >95% completeness for key RVCT* variables	100%
85% of cases completing TB treatment within 12 months (2004)	88%
100% of cases completing treatment on directly observed therapy	100%
HIV status reported for 95% of cases	90%
Drug susceptibility results reported for >95% of culture-positive TB cases	99%
TB incidence rate of 18.8/100,000 among American Indian/Native Alaskans	22.9/100,000
Contacts identified to 84% of smear positive cases	90%
59% of contacts to smear positive cases evaluated for infection (WA definition)	70%
53% of contacts who started on LTBI** treatment completed regimen (WA definition)	45%
% of Class B's appropriately evaluated within 60 days of arrival	90%

\* RVCT = Report of Verified Case of Tuberculosis

\*\* LTBI = latent TB infection



# 1. TUBERCULOSIS IN KING COUNTY

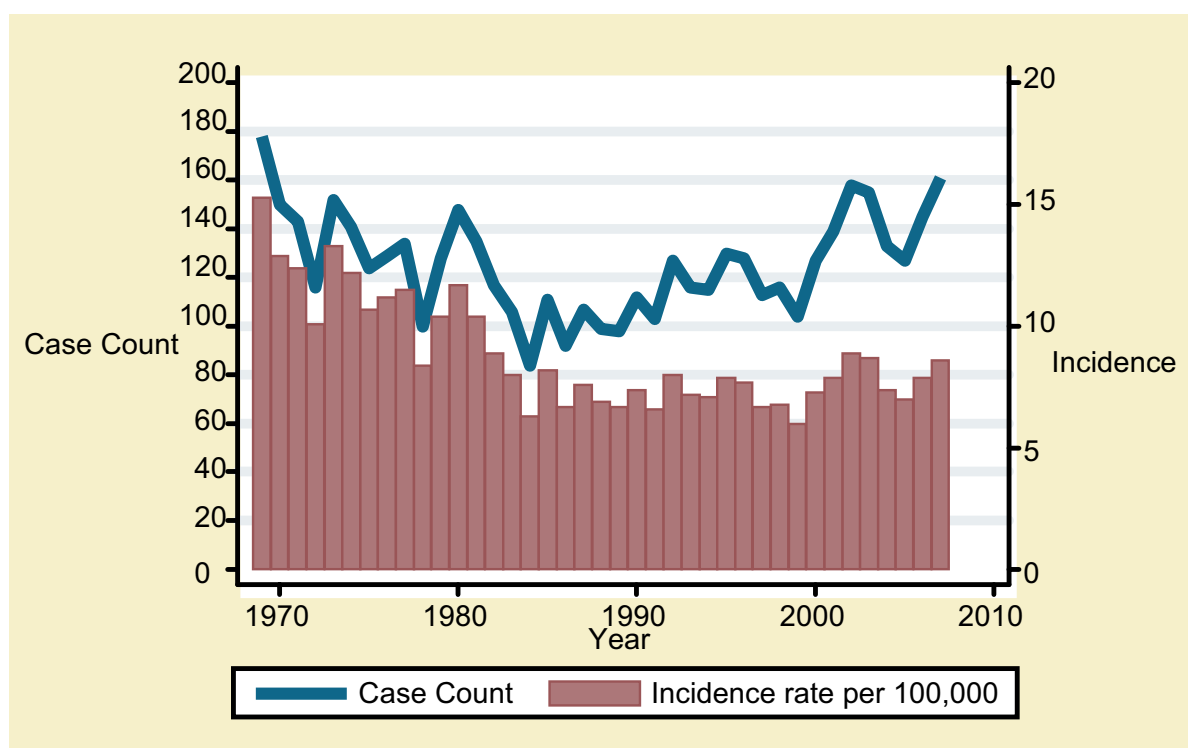
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## *Tuberculosis morbidity in 2007*

The incidence rate of active tuberculosis (TB) disease in Seattle & King County was 8.6 TB cases per 100,000 people in 2007, compared to the case rate of 7.9 per 100,000 in 2006. The number of TB cases increased from 145 reported in 2006 to 161 reported in 2007 (Figure 1).

This increase is due in part to fluctuating immigration patterns from countries where the TB infection rate is over 30 percent. In 2006, fifteen percent of King County residents were reported to be foreign-born. In addition, an outbreak of TB among Marshall Islanders in 2007 resulted in an increase in case count.

FIGURE 1: TUBERCULOSIS INCIDENCES PER 100,00 AND CASES, KING COUNTY, 1969-2007



### *Incidence in King County and the US*

The incidence rate of TB in King County continues to be higher than the overall incidence rate in Washington and the United States. In Washington, the incidence rate increased from 4.1 per 100,000 in 2006, to 4.4 per 100,000 in 2007 (Table 1). This rate is comparable to the national TB rate (4.4 per 100,000) in 2007.

In 2007, 13,293 cases of TB were reported in the United States. The five highest metropolitan statistical areas for TB incidence in 2006 (latest data available) were San Jose, CA (12.8 per 100,000), Stockton, CA (11.6 per 100,000), San Diego (10.7 per 100,000), Honolulu, HI (10.4 per 100,000) and El Paso, TX (9.8 per 100,000).

**TABLE 1. TB CASE RATES 2003-2007 FOR US, WASHINGTON AND SEATTLE & KING COUNTY**

		2003	2004	2005	2006	2007
<b>US</b>	Count	14,852	14,517	14,093	13,767	13,293
	rate/100,000	5.1	4.9	4.8	4.6	4.4
<b>Washington</b>	Count	250	245	256	262	291
	rate/100,000	4.0	3.9	4.0	4.1	4.4
<b>Seattle &amp; King County</b>	Count	155	134*	125*	145	161
	rate/100,000	8.7	7.4	6.9	7.9	8.6

*\*Due to delayed modifications of classification, there have been slight changes since the 2005 report in counts and incidence rates for 2004 and 2005 King County cases*



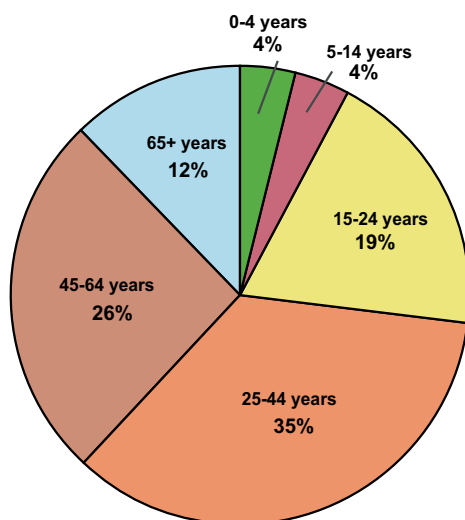
## 2. AGE AND GENDER

### Age groups

In 2007, the mean age of TB cases was 39 years (median 36 years), with a range from 1 to 95 years of age. The greatest proportion of TB cases in King County was among individuals 25-44 years of age (Figure 2).

Although the 25-44 year old age group represents the greatest proportion (35%) of cases in King County, the incidence of cases is highest in those 15 to 24 years of age (11.9 per 100,000) (Table 2). Those in the 25-44 years of age group had the second highest incidence rate among the defined age groups (9.7 per 100,000). The number and proportion of cases in each age group continues to fluctuate over time (Figure 3).

FIGURE 2. TUBERCULOSIS CASES BY AGE GROUP, 2007

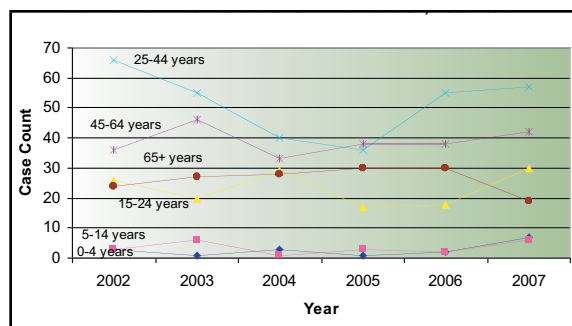


Statewide, in 2006, the greatest proportion (32%) of cases was seen among 45-64 year olds with cases aged 25-44 years old comprising 28% of total cases and 15-24 year olds comprising 14% of cases. Children aged 0-14 represented 4% of cases and adults aged 65 and over made up 21% of cases. Nationally, in 2006, the greatest proportions of cases was seen among 25-44 year olds (34%), followed by 45-64 year old adults (29%) and older adults (65 years of age and older, 19%). However, the highest rate of TB is seen in older adults, 7.2 cases per 100,000 individuals 65 years of age and older. Individuals 25-44 years of age had the second highest rate, 5.6 cases per 100,000 individuals.

TABLE 2. INCIDENCE BY AGE GROUP

	2003	2004	2005	2006	2007
<b>Rate/100,000</b>					
<b>Age Group (years)</b>					
0-4	1.0	2.8	0.9	1.9	6.4
5-14	2.8	0.5	1.4	0.9	2.8
15-24	8.4	12.1	7.0	7.2	11.9
25-44	9.4	6.9	6.2	9.4	9.7
45-64	10.3	7.2	8.1	7.8	8.4
65+	14.4	14.8	15.6	15.3	9.5

FIGURE 3. TUBERCULOSIS CASES BY AGE GROUP, 2003-2007



## Children

In 2007, there were 13 pediatric cases (0 to 14 years) of TB in King County, 11 of which were diagnosed through contact investigations (i.e., family members had active TB). All individuals were caught in early stages of TB disease; two were diagnosed soon after emigrating from their countries of birth.

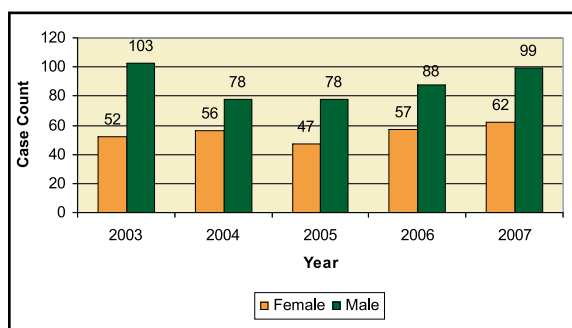
Pediatric cases made up eight percent of all King County TB cases in 2007. Nationally, this proportion was six percent in 2006.

## Gender

Males represented 61% of all King County TB cases in 2006, similar to proportions seen in recent years (Figure 4). The incidence rate among males was 10.7 per 100,000; among females 6.6 per 100,000.

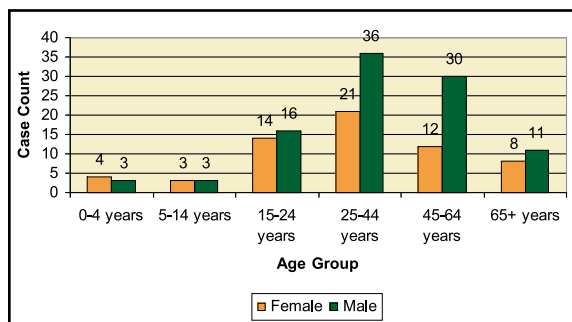
In Washington, males represented 59% of all TB cases in the State during 2006. Nationally, males represented 62% of all TB cases in the United States in 2006.

**FIGURE 4. TUBERCULOSIS BY GENDER, 2003-2007**



The greater proportion of cases among males was consistent across all age groups with the exception of pediatric cases (0 -14 years of age). The greatest difference in proportion of males to females was seen among individuals 45-64 years of age where there were more than two times as many cases among males as among females; this is consistent with the pattern seen in 2006. The number of cases for both male and females was highest in the 25-44 year old age group (36 and 21 cases, respectively) (Figure 5).

**FIGURE 5. TUBERCULOSIS BY GENDER AND AGE GROUP, 2007**



### 3. TB AMONG FOREIGN-BORN

#### Country of origin

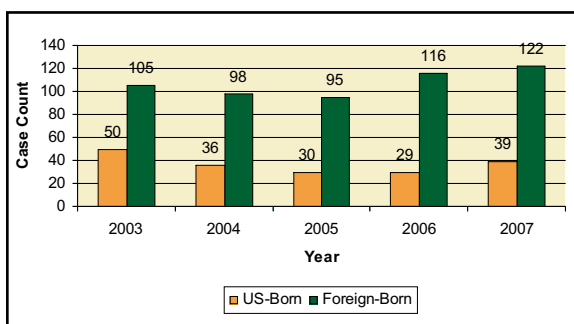
In 2007, 122 cases (76% of all King County cases) were born outside the US, from 32 different countries (Figure 6). Of these, 70 (57%) came from five countries: Vietnam, Somalia, Ethiopia, India, and Marshall Islands. From 2003 through 2007, 536 (74% of all King County cases) foreign-born TB patients came from 65 different countries total (range of 26 to 32 countries per year) in King County.

In 2007, the highest case numbers came from the Vietnam, Somalia, Ethiopia, India and Marshall Islands. Twenty-three percent of King County TB cases came from South East Asia (e.g., Vietnam and Laos), 15% from East Africa (e.g., Ethiopia and Somalia), and 8% from Central America (e.g., Mexico) (Figure 7).

King County continues to experience a higher proportion of foreign-born cases than the United States (57% foreign-born in 2006). However, the national proportion of foreign-born cases has been steadily increasing over the last decade, from 36% in 1996 to 57% in 2006.

Over the last five years, the five most common countries of origin among King County's foreign-born cases were Vietnam, Ethiopia, the Philippines, India and Mexico (Table 3). Nationwide, in 2006, 57% of cases were among foreign-born persons; the top five countries of origin for foreign-born cases in the US were Mexico, the Philippines, Vietnam, India and China.

FIGURE 6. TUBERCULOSIS BY US vs FOREIGN-BORN, 2003-2007



#### Region of birth

As per the recent article by Cain et al (JAMA 2008; 300(4): 405-412), the relative yield of finding and treating latent TB infection has been shown to be particularly high among individuals from most countries of sub-Saharan Africa and South-East Asia. Hence we decided to include a section focusing on these regions.

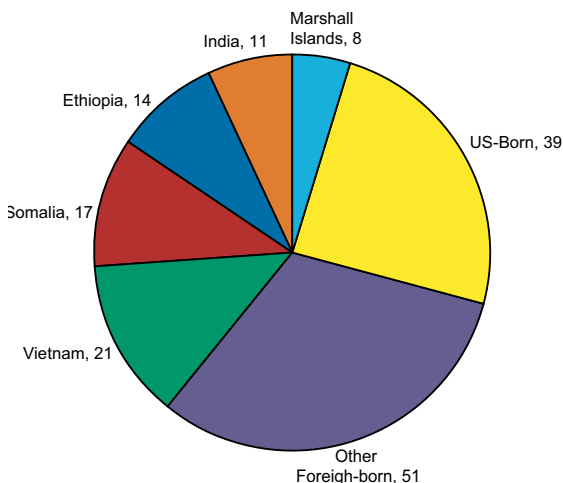
#### South East Asia

From 2003 through 2007, there were 167 cases from South East Asia, representing 31% of the foreign born cases and 23% of all TB cases, for this time period in King County. Highest burden countries within this region include Vietnam (75), Philippines (59), Cambodia (16), and Laos (9). Cases originating from South East Asia during this five year period were, on average, 50 years of age (mean of 47 years of age in 2007). Fifty-nine percent of cases (2003-2007) were male. Two percent (3 cases) were co-infected with HIV. Of note, the incidence of TB in these countries ranges from 103 cases per 100,000 (Malaysia) to 500 cases per 100,000 (Cambodia), with a median of 172 cases per 100,000 individuals.

Duration of time in the US prior to diagnosis:

Seventy three percent (73%) of cases from South East Asia resided in the US five or more years prior to their diagnosis. The proportion in the US prior to diagnosis for less than one year and one to four years during this five year time period is

FIGURE 7. TB CASES BY COUNTRY OF BIRTH, 2007



13% and 14%, respectively. In 2007, the proportion in the US prior to diagnosis for less than one year, one to four years, and over 5 years is 19%, 9% and 72% respectively.

### East Africa

From 2003 through 2007 there were 110 cases from East Africa, representing 21% of the foreign born cases and 15% of all TB cases, for this time period in King County. Highest burden countries within this region include Ethiopia (59) and Somalia (43). Cases originating from East Africa during this five year period were, on average, 34 years of age (mean of 34 years of age in 2007). Fifty-five percent of cases were male. Five percent (6 cases) were co-infected with HIV.

Duration of time in the US prior to diagnosis:

From 2003 through 2007, the proportion of cases with duration of time prior to diagnosis is 30%, 36%, and 34% for those in the US less than one year, one to four years, and five or more years, respectively.

### Other regions

From 2003 through 2007 there were 259 cases from

outside the US other than South East Asia and East Africa, representing 48% of the foreign born cases and 36% of all TB cases, for this time period in King County. Highest burden countries within this region include India (46), Mexico (45), China (33), and Republic of Korea (20). Cases originating from these other countries during this five year period were, on average, 45 years of age (mean of 41 years of age in 2007). Sixty-three percent (63%) of cases were male. Six percent (15 cases) were co-infected with HIV.

Duration of time in the US prior to diagnosis:

The proportion of cases with duration of time prior to diagnosis for foreign born other than those originating from South East Asia or East Africa is greatest among those that have been in the US for five or more years, 65 percent. Twenty four percent of cases from 2003 through 2007 were in the US for one to four years prior to diagnosis and 11% were in the US less than one year. The relative proportions remained the same when looking exclusively at 2007 cases in King County. Sixty-four percent were in the US five or more years prior to diagnosis, 20% for one to four years, and 16% were in the US for less than one year prior to diagnosis.

**TABLE 3. TRENDS IN COUNTRY OF ORIGIN AMONG FOREIGN-BORN TB CASES 2003 – 2007**

	2003	2004	2005	2006	2007	TOTAL of 2003-07
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	
<b>Country<sup>1</sup></b>						
Vietnam	12 (11)	15 (15)	12 (13)	15 (13)	21 (17)	<b>75</b>
Ethiopia	11 (11)	13 (13)	9 (10)	12 (10)	14 (11)	<b>59</b>
Philippines	12 (11)	11 (11)	13 (14)	20 (17)	3 (2)	<b>59</b>
India	10 (10)	4 (4)	8 (8)	12 (10)	11 (9)	<b>45</b>
Mexico	12 (11)	5 (5)	9 (10)	12 (10)	7 (6)	<b>45</b>
Somalia	2 (2)	8 (8)	8 (8)	8 (7)	17 (14)	<b>43</b>
China	10 (10)	4 (4)	6 (6)	9 (8)	4 (3)	<b>33</b>
Korea, Republic of	8 (8)	5 (5)	4 (4)	1 (1)	2 (2)	<b>20</b>
Cambodia	5 (5)	3 (3)	3 (3)	2 (2)	3 (2)	<b>16</b>
Honduras	1 (1)	1 (1)	0 (0)	5 (4)	1 (1)	<b>8</b>
Marshall Islands	0 (0)	0 (0)	0 (0)	0 (0)	8 (7)	<b>8</b>
Sudan	0 (0)	6 (6)	1 (1)	1 (1)	0 (0)	<b>8</b>
<b>TOTAL</b>	<b>106</b>	<b>97</b>	<b>95</b>	<b>116</b>	<b>122</b>	

<sup>1</sup> Inclusion criteria: any country with five or more cases in one year since 2003



### Age and gender in foreign-born cases

The greatest number of foreign-born cases were 25-44 years of age (48 cases, 39% of all foreign-born cases) (Figure 8). The largest proportion of US-born cases could be found among those individuals 45-64 year of age (38% of US born cases). Over 80% of males and 80% of females in the 25-44 year old age group were foreign-born.

### Duration of stay in US prior to diagnosis

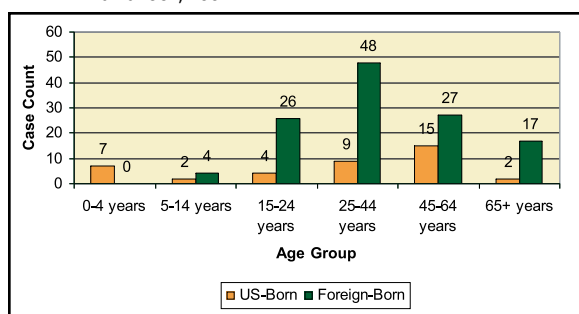
The length of time since arrival in the US was available for 98% of TB cases born outside of the US in King County. Of this group, 20% of cases had been in the US less than one year; 24% of the cases had been in the US between one and four years; and 56% of cases had been in the US for five or more years at the time of diagnosis. In 2006, 9% of cases had been in the US less than one year; 33% between one and four years; and 57% for five or more years at the time of diagnosis. Nationally, in 2006, 18% of foreign-born

cases had been in the US less than one year, 21% had been here one to four years, and 50% had been in the US for five or more years; the additional 10% of foreign born cases did not have a known duration in the US prior to diagnosis.

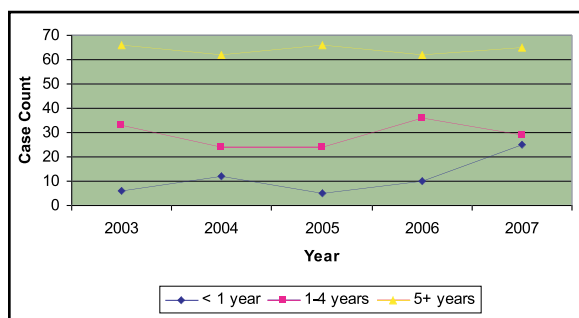
The increase in cases among those with less than one year in the US prior to diagnosis can be seen in Figure 9. The figure also shows the number of cases in the one to four year group decreased and those in the US for five or more years prior to diagnosis experienced the least change from 2006 to 2007.

Figure 10 shows the duration of stay in the US at the time of diagnosis by country of origin for 2003 through 2007. 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. On average, individuals from East African countries arrived in the US with less time prior to diagnosis than those from other high burden countries. Figure 11 details the number of cases diagnosed by time since arrival as stratified by site of disease.

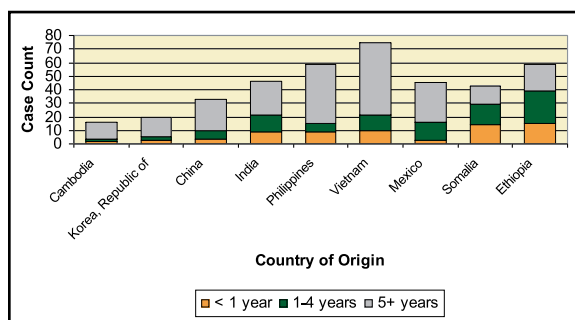
**FIGURE 8. TUBERCULOSIS CASES BY US- OR FOREIGN- BORN AND AGE GROUP, 2007**



**FIGURE 9. TIME SINCE US ARRIVAL, 2003-2007**

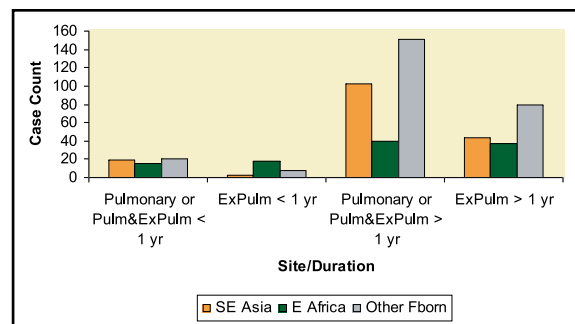


**FIGURE 10.<sup>2</sup> DISTRIBUTION OF TIME SINCE ARRIVAL IN THE US, 2003-2007**



<sup>2</sup>Among cases with date of arrival time available

**FIGURE 11. PULMONARY VS. EXTRAPULMONARY DISEASE BY TIME SINCE ARRIVAL**



## 4. RACIAL DISPARITIES AND TB

### *Race and ethnicity*

In 2007, nationally, the highest case rates were seen among Asian and Black individuals, (26 and 9 per 100,000 respectively). King County 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. Asians continue to represent the greatest proportion of all TB cases in 2007 (46%) and the second highest incidence (30.2 per 100,000) in King County (Figure 12). Blacks (including African-born) had a case rate of 46.2 cases per 100,000. Hispanics represent 12% of all TB cases in 2007 compared to 13% in 2006 and 9% in 2005, with an incidence rate of 17.0 per 100,000. The trend in cases across racial groups

FIGURE 12. TUBERCULOSIS BY RACE, 2007

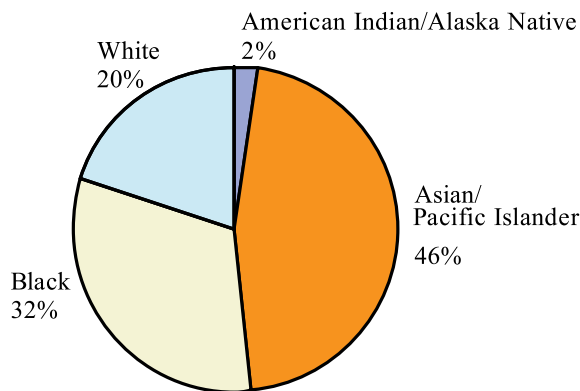


TABLE 4. RACE/ETHNICITY RATES, 2005-2007

	2003	2004	2005	2006	2007
<b>Rate/100,000</b>					
<b>Race</b>					
Am Indian or AK Native	89.3	63.1	17.2	17.2	22.9
Asian/PI	33.5	24.2	25.6	30.6	30.2
Black or African American	31.2	39.4	32.7	26.3	46.2
White	2.6	2.1	2.2	2.7	2.3
<b>Ethnicity-Hispanic</b>					
	15.9	8.2	10.0	16.1	17.0

has remained relatively stable with the exception of Native Americans (significant decrease since 2003 and 2004) and blacks (significant increase due to African-born blacks in 2007) (Table 4).

Further breakdowns by race and US-born or foreign-born origin follow below (Figures 13-15).

FIGURE 13. TUBERCULOSIS BY RACE AND NATIVITY, 2007

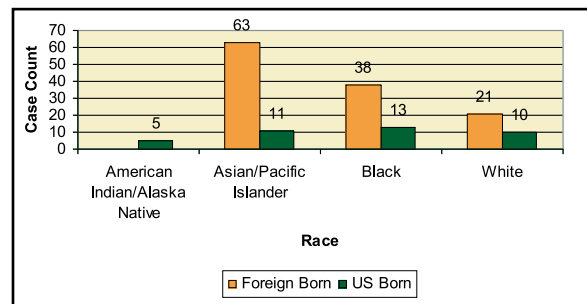


FIGURE 14. TUBERCULOSIS BY RACE AMONG US-BORN INDIVIDUALS, 2003-2007

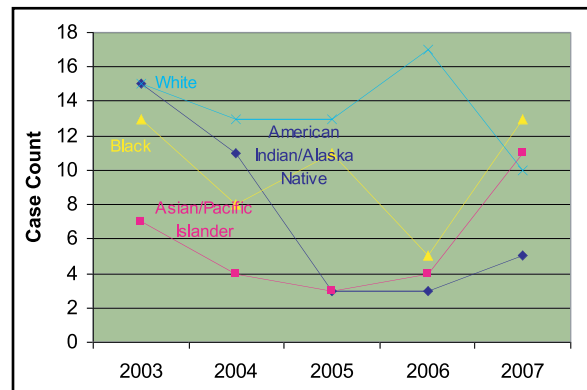
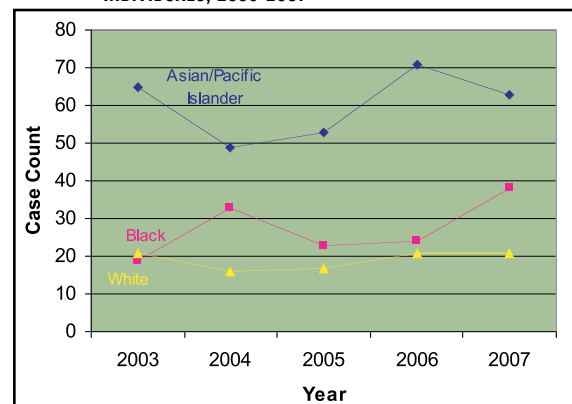


FIGURE 15. TB CASE COUNTS BY RACE AMONG FOREIGN-BORN INDIVIDUALS, 2003-2007



## 5. TB AND THE HUMAN IMMUNODEFICIENCY VIRUS CO-INFECTION

In 2007, Human Immunodeficiency Virus (HIV) test results were obtained for 93% of cases. Among this group, nine TB cases were co-infected with HIV, representing 6% of all TB cases (Tables 5 and 6). The Centers for Disease Control and Prevention (CDC) reported over one third of US TB cases did not have an available HIV status in 2007. Of those with available HIV status, 11% of TB cases in the US were co-infected with HIV. In King County, HIV co-infection was reported at 5% (6 of 122 cases) among foreign-born cases and 8% among US-born cases (3 of 39 cases) in 2006.

**TABLE 5. HIV TEST RESULTS AMONG TB CASES, 2007**

HIV Status	Number	Percent
Negative	140	87%
Positive	9	6%
Refused	2	1%
Not offered	5	3%
Unknown	5	3%

It is important to know the HIV status of every TB case to minimize morbidity and mortality and to provide the necessary complex medical care. Case management of TB-HIV co-infected patients typically requires more intense and frequent coordination of care between the Seattle & King County TB Control Program and HIV care providers. Furthermore, tracking HIV status of TB cases, in general, facilitates early detection of HIV transmission so appropriate disease control measures can be taken to avert or interrupt outbreaks.

**TABLE 6<sup>3</sup>. TB IN PERSONS WITH HIV CO-INFECTION BY AGE GROUP, 2003-2007**

	25-44 Years of Age	All Ages
	HIV Positive	HIV Positive
Year	No. (%)	No. (%)
2003	7 (16)	9 (7)
2004	2 (6)	3 (3)
2005	4 (13)	7 (7)
2006	5 (10)	10 (8)
2007	5 (10)	9 (6)

<sup>3</sup> Percentages are based on cases with HIV testing results

## 6. DRUG RESISTANT TB

### Multi-drug resistant TB

Two individuals were diagnosed as having multi-drug resistant (MDR) TB in 2007. In addition, two individuals with MDR TB moved in to King County while they were receiving TB treatment. MDR TB is defined as resistance to at least isoniazid (INH) and rifampin, the two most effective first-line TB medications. There were no extensively drug resistant (XDR) TB cases reported in King County (XDR TB is defined as resistance to INH, rifampin, and the two most effective second-line medications: fluoroquinolones and at least one of three injectable drugs [i.e., amikacin, kanamycin, or capreomycin]). In comparison, three cases of MDR-TB were diagnosed in King County, with one transfer-in case in 2006. In 2006, Washington had two additional cases of MDR TB outside of King County for a total of five cases statewide. For individuals with MDR TB, treatment lasts from 18 to 24 months or longer, as compared to a usual course of six-to-nine months, at a reported cost of \$250,000 or more to cure.

Nationally, 116 cases (1.1% of all cases with drug-susceptibility results reported) were diagnosed with MDR TB in 2006. This proportion of MDR cases has been stable since 1997.

### Primary drug resistance

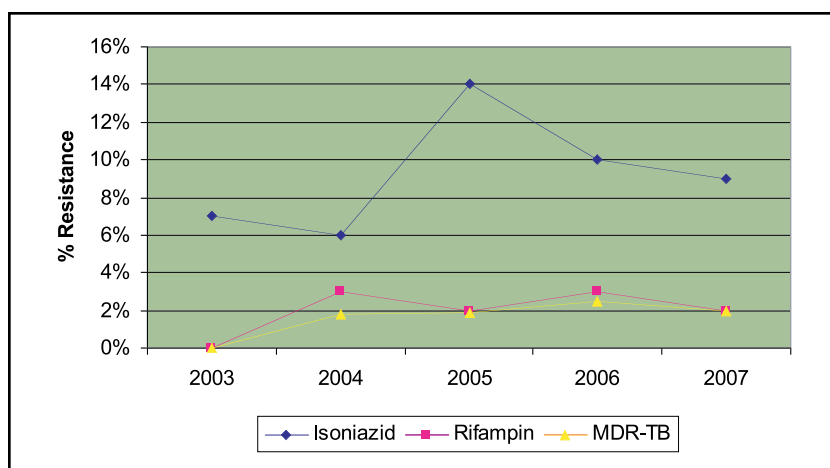
Primary drug resistance is drug resistance based on initial isolates from persons with no prior history of TB treatment. Table 7 shows King County cases whose TB strain was resistant to each of the five most common drugs used to treat tuberculosis. Figure 16 shows the trends in isoniazid resistance, rifampin resistance and MDR-TB among King County cases from 2003 through 2007. Nationally, approximately 7% of cases showed resistance to isoniazid in 2005.

TABLE 7. PRIMARY DRUG RESISTANCE, 2007\*

	Total Cases (n=130)	US-born (n=27)	Foreign-born (n=103)
Drug	No. (%)	No. (%)	No. (%)
Isoniazid	11 (8.5)	2 (7.4)	9 (8.7)
Rifampin	2 (1.5)	1 (3.7)	1 (1.0)
Pyrazinamide	2 (1.5)	1 (3.7)	1 (1.0)
Ethambutol	5 (3.9)	2 (7.4)	3 (2.9)
Streptomycin	8 (6.2)	2 (7.4)	6 (5.8)
Any	19 (14.6)	4 (14.8)	15 (14.6)

\*Includes both mono-resistance and resistance to more than one drug. Percentages are based on those with susceptibilities available for 2007.

FIGURE 16. PRIMARY ISONIAZID AND RIFAMPIN RESISTANCE AND MDR-TB IN KING COUNTY, 2003-2007



\*Includes both mono-resistance and resistance to more than one drug.



## 7. TB AMONG THE HOMELESS

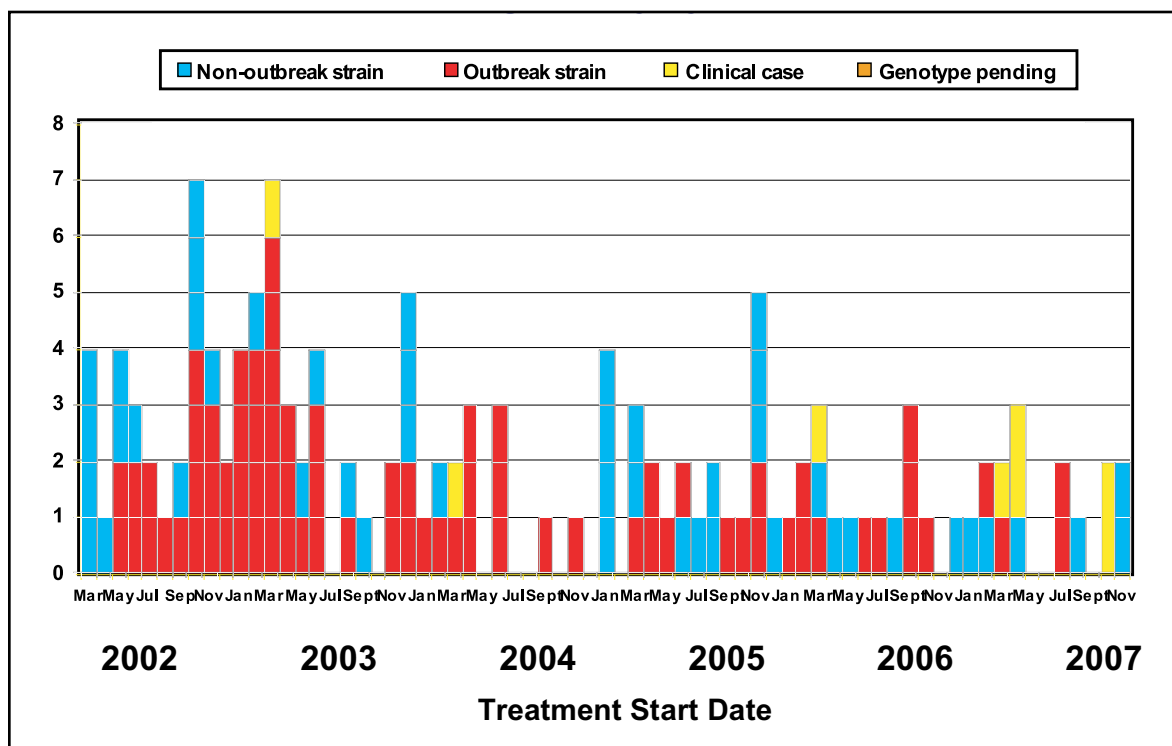
Fifteen homeless persons were diagnosed with active TB in 2007, comprising 9% of all TB cases in King County. Homelessness was defined as people who lacked a fixed, regular, and adequate night-time residence or whose primary night-time residence was a supervised shelter designed to provide temporary living accommodations.

Of the 15 homeless cases, 12 (80%) were born in the US (Table 8). The 12 US-born homeless cases represented 31% of all US-born cases in 2007; 11 cases, (38%) in 2006. Two Hispanic people who were homeless were diagnosed. The

number of American Indian homeless cases, the predominant racial group during the 2002-2003 TB outbreak among the homeless, remained low (from 17 cases in 2003 to two cases in each of 2005 through 2007).

In 2007, eight percent of TB cases in Washington were homeless. Nationwide, homeless cases represented six percent of all TB cases in 2006, although rates fluctuate widely by state.

FIGURE 17. CASES OF TB AMONG HOMELESS PEOPLE IN KING COUNTY BY TREATMENT START DATE.



### *Note on TB outbreak among the homeless*

In late 2002, a TB outbreak was detected among the homeless. A single strain was responsible for 17 (57%) of 30 cases among the homeless (Figure 17). In 2003, this outbreak strain was responsible for 26 (74%) of 35 cases (Figure 18). Since 2003, the TB Control Program, community healthcare providers and various agencies which serve this population have made intensive efforts to control this outbreak. The number of homeless TB cases matching the outbreak strain dropped considerably (9-11 cases yearly between 2004 and 2006 and 4

cases in 2007). However, in 2007, 5 non-homeless individuals presented with the same outbreak strain. Two had a history of homelessness, two were linked to each other and were migrant laborers and the fifth had no documented transient or homeless lifestyle.

Reactivation of TB disease caused by the outbreak strain is still taking place, as indicated by genotyping results (7% of culture-positive cases in 2007). It is uncertain whether further recent transmission is playing a role in the persistence of the outbreak strain among this population.

**FIGURE 18. HOMELESS OUTBREAK STRAIN CASES, 2002-2007**

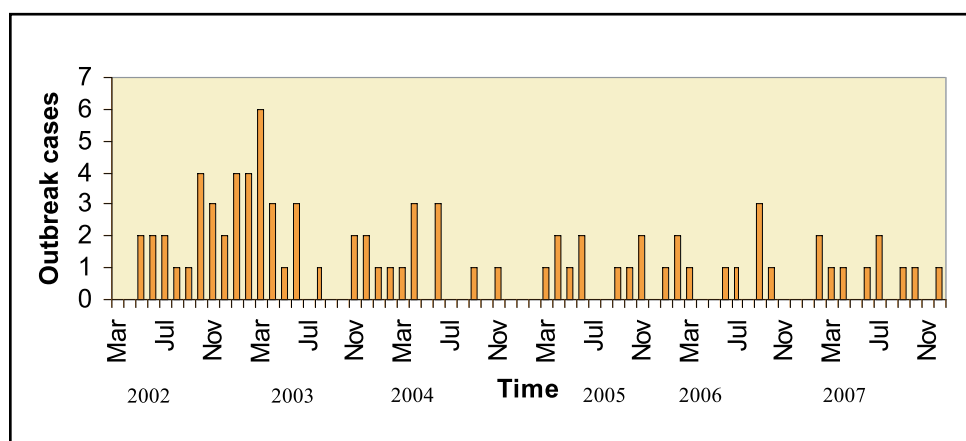


TABLE 8. HOMELESS PEOPLE DIAGNOSED WITH TB

	2002 (n=30) N(%)	2003 (n=35) N(%)	2004 (n=23) N(%)	2005 (n=23) N(%)	2006 (n=16) N(%)	2007 (n=15) N(%)
<b>Gender</b>						
Male	26 (87)	27 (77)	20 (87)	21 (91)	15 (94)	11 (73)
Female	4 (13)	8 (23)	3 (13)	2 (9)	1 (6)	4 (27)
<b>Age Group</b>						
0-30	1 (3)	1 (3)	8 (35)	1 (4)	2 (13)	1 (7)
31-40	8 (27)	2 (6)	2 (9)	3 (13)	0 (0)	2 (13)
41-50	10 (33)	16 (46)	4 (17)	10 (43)	9 (56)	4 (27)
51-60	9 (30)	13 (37)	5 (22)	6 (26)	5 (31)	6 (40)
61-70	2 (7)	1 (3)	3 (13)	2 (9)	0 (0)	2 (13)
71-80	0 (0)	2 (6)	1 (4)	1 (4)	0 (0)	0 (0)
<b>Race/Ethnicity</b>						
White, non-Hispanic	3 (10)	7 (20)	3 (13)	5 (22)	7 (44)	3 (20)
Black, non-Hispanic	12 (40)	8 (23)	11 (48)	7 (30)	3 (19)	7 (47)
Hispanic	3 (10)	3 (9)	1 (4)	6 (26)	4 (25)	2 (13)
Asian/Pacific Islander	1 (3)	0 (0)	0 (0)	3 (13)	0 (0)	1 (7)
American Indian/Alaska Native	11 (37)	17 (49)	8 (35)	2 (9)	2 (13)	2 (13)
<b>US-born?</b>						
Yes	25 (83)	33 (94)	13 (57)	13 (57)	11 (69)	12 (80)
No	5 (17)	2 (6)	10 (43)	10 (43)	5 (31)	3 (20)
<b>HIV Result*</b>						
Positive	9 (30)	1 (3)	0 (0)	1 (4)	3 (19)	2 (13)
Unknown	1 (3)	0 (0)	3 (13)	4 (17)	1 (6)	0 (0)
<b>Genotyping</b>						
Outbreak Match	17 (57)	26 (74)	11 (48)	9 (39)	10 (63)	4 (27)
American Indian Outbreak match	9	15	7	2	2	0
Other race outbreak match	8	10	4	7	7	4
Non-outbreak genotype	13 (43)	8 (23)	10 (43)	14 (61)	5 (31)	6 (40)
Pending	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Clinical Case	0 (0)	1 (3)	2 (9)	0 (0)	1 (6)	5 (33)
No RFLP done	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

\*Some patients refused HIV test

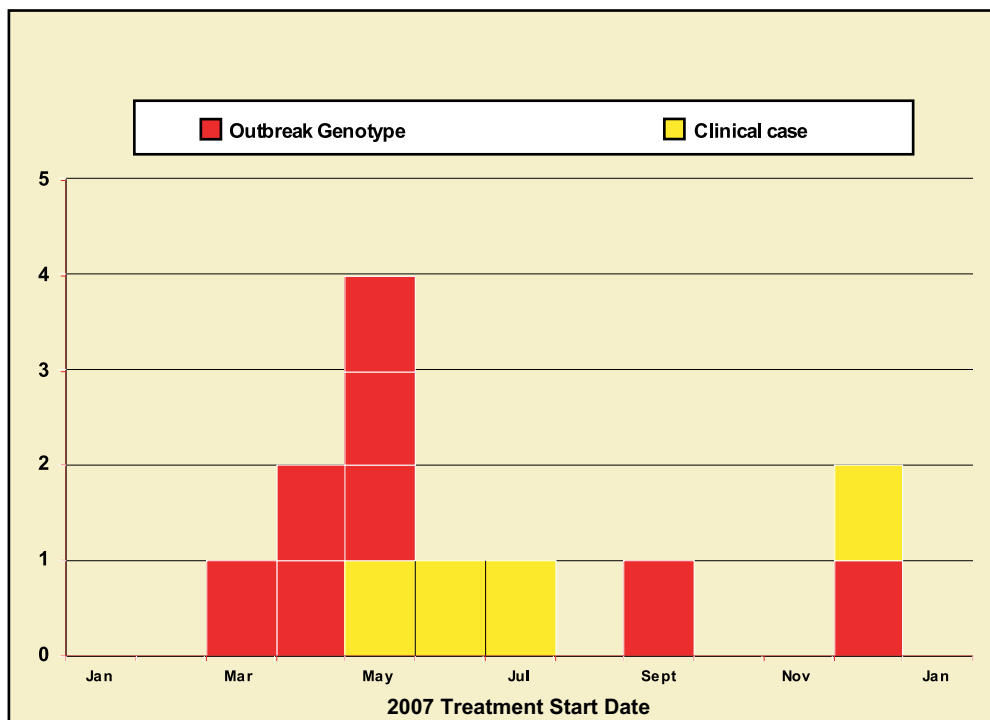
## 8. OUTBREAK AMONG MARSHALL ISLANDERS

From February through December 2007, 14 cases of tuberculosis were diagnosed in Marshall Islanders in Washington; 12 of these in King County (Figure 19). In the 15 years prior, no case of TB was reported among Marshallese in the State of Washington. Public Health - Seattle & King County, in collaboration with Washington and other county TB Control Programs, began an investigation to identify and manage active TB cases and their close contacts with latent tuberculosis in the Marshallese community of Washington.

The King County index case was a 21 year old man who immigrated to the US in July 2006. Thereafter, five other Marshallese persons were diagnosed with active TB, ages 10 months to 68 years, in King County. It was later discovered that the index patient had potential contact with all five of these cases.

Contact investigation in King County identified 161 contacts, of whom 143 were screened with a tuberculin skin test, and 84 (59%) were positive. Sixty-one of these individuals began treatment for latent infection. From the contact investigation, seven additional cases of active TB were identified, all with direct contact to the King County index case.

FIGURE 19. MARSHALLESE TB CASES BY TREATMENT START DATE, 2007





## 9. TREATMENT OF TB CASES

Of the cases alive at the time of diagnosis, greater than 95% received an initial regimen consisting of four-drug therapy. Four-drug therapy is the standard recommended by the CDC, the American Thoracic Society and the Infectious Diseases Society of America. Treating TB with a combination of drugs prevents the occurrence of drug resistance and facilitates the cure in a timely manner.

### *Proportion of cases completing therapy*

Overall treatment completion rates have remained at 95% or greater over the past five years (2007 data incomplete, as some people require more than 12 months of treatment). The most common reasons 'not completed' were moving out of King County (five percent of cases from 2003-2006, in which case efforts were made to ensure treatment continuation and completion in the jurisdiction the case moved to) or died (five percent of cases from 2002-2006). The percentage of cases ever completing treatment has remained steady over the past few years, and the percent completing within one year has fluctuated between 84-89% (Figure 20). Factors contributing to case non-completion within one year include drug intolerance, non-adherence with TB treatment regimen, and TB affecting bone/joint and central nervous system that requires prolonged TB treatment

(see Section 10. Disease Characteristics). Furthermore, TB treatment guidelines (published by CDC/American Thoracic Society/Infectious Disease Society of America in 2003) recommend prolongation of TB treatment for those with pulmonary cavities and delayed microbiological response.

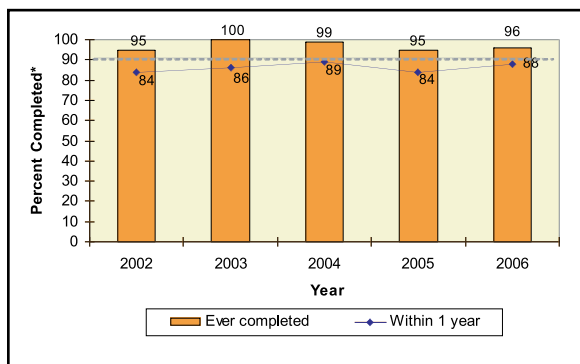
The most recent national data is from cases who initiated treatment in 2004; 82% of these cases completed treatment within one year and 91% completed therapy in total.

### *Mode of TB treatment*

Among the cases from 2006 who have already completed treatment (138 cases), 91% were treated with directly observed therapy (DOT) only or a combination of DOT and self-administered therapy (73% DOT only, 18% combination). The proportion of cases treated with DOT has decreased slightly as compared to 2006 (Figure 21). Nationally, 85% of cases are on DOT or a combination of DOT and self-administered therapy (2004 data).

For the 2006 cases with data available (125 at time of this report), TB patients in King County received 32 weeks of DOT on average (median of 29 weeks).

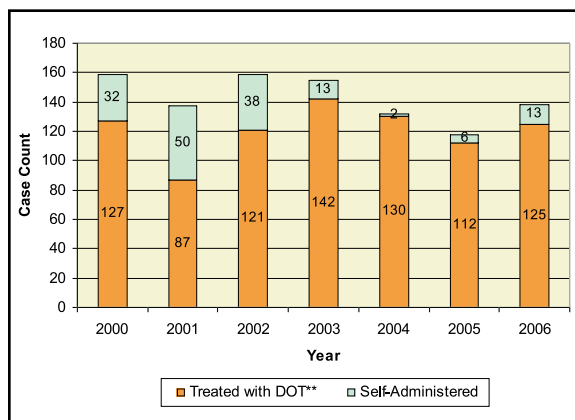
FIGURE 20. COMPLETION OF TB TREATMENT, 2002-2006



\*Per CDC guidelines for summarizing completion of therapy, includes persons alive at diagnosis, with initial drug regimen of one or more drugs prescribed, who did not die during therapy. Excludes persons with initial isolate resistant to rifampin and pediatric (aged <15) cases with meningeal, bone or joint, or miliary disease.

\*\*Healthy People 2010 Goal of 90% completion within 1 year or less

FIGURE 21. TB CASES TREATED WITH DOT, 2000-2006



\*2006 data incomplete

\*\* Includes both DOT only treatment and treatment with a combination of DOT and self-administered medications

## 10. DISEASE CHARACTERISTICS

### *Disease site*

In 2007, 45% of the King County cases were exclusively pulmonary, 33% were exclusively extrapulmonary, and 22% were both pulmonary and extrapulmonary. Nationally, 70% of cases were pulmonary in 2006, 21% of cases were extrapulmonary, and nine percent of cases were both pulmonary and extrapulmonary. Reasons for the differences between local and national data may include better ascertainment of extrapulmonary cases (both improved diagnosis and reporting), more complete and specific coding of all involved disease sites and a higher proportion of cases among groups known to have increased rates of extrapulmonary TB (e.g., East African and South East Asian cases).

Figure 22 shows the five year trends in disease sites among King County cases. Compared to national statistics during this time period, King County consistently maintained a greater percentage of extrapulmonary cases.

**FIGURE 22. PULMONARY VS. EXTRAPULMONARY SITE OF DISEASE, 2003-2007**

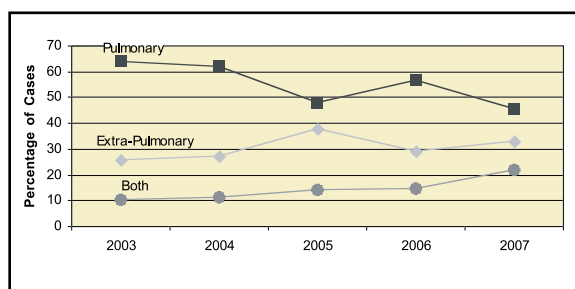


Table 9 presents data for sites of disease for TB cases from 2003-2007.

**TABLE 9. SITE OF DISEASE, 2003-2007**

	2003 N (%)	2004 N (%)	2005 N (%)	2006 N (%)	2007 N (%)
<b>Disease Site</b>					
Pulmonary	113 (73%)	96 (72%)	83 (66%)	100 (69%)	126 (78%)
Pleural	12 (8%)	9 (7%)	10 (8%)	13 (9%)	11 (7%)
Lymphatic: Cervical	18 (12%)	15 (11%)	15 (12%)	19 (13%)	23 (14%)
Lymphatic: Intrathoracic	6 (4%)	7 (5%)	8 (6%)	10 (7%)	17 (11%)
Lymphatic: Other/Unk	5 (3%)	6 (4%)	8 (6%)	3 (2%)	4 (2%)
Bone/Joint	5 (3%)	3 (2%)	5 (4%)	8 (6%)	10 (6%)
Genitourinary	3 (2%)	1 (1%)	2 (2%)	2 (2%)	3 (2%)
Miliary	3 (2%)	2 (1%)	1 (1%)	3 (2%)	0 (0%)
Meningeal	1 (1%)	2 (1%)	2 (2%)	1 (1%)	3 (2%)
Peritoneal	5 (3%)	4 (3%)	2 (2%)	5 (4%)	2 (1%)
Other	4 (3%)	5 (4%)	9 (7%)	4 (3%)	4 (2%)

Categories not mutually exclusive; one case may have multiple sites of disease.

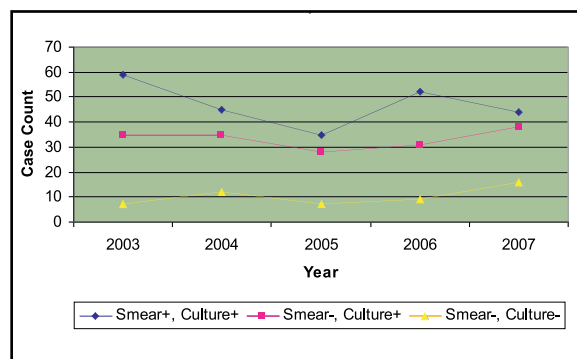
### *Smear and culture results*

Of all 161 cases reported in 2007, 130 (81%) were confirmed by the results of positive culture for *M. tuberculosis*. Nationally, 78% of all cases were diagnosed through a positive TB culture in 2006.

There were 108 cases whose major site of disease was reported to be pulmonary TB. Of those, 42% were sputum acid-fast bacilli (AFB) smear-positive, and 76% had positive AFB cultures. Nationwide, in 2006, 47% of pulmonary cases were smear-positive and 70% were culture-positive.

Figure 23 illustrates the five year trends of AFB smear and culture results of all pulmonary cases in King County. Of note, 10 individuals had results that were either unknown, not done, or otherwise classified.

**FIGURE 23. SMEAR AND CULTURE STATUS OF PULMONARY CASES AT DIAGNOSIS, 2003-2007**



## 11. GENOTYPING AND CLUSTERING

Genotyping of specimens has taken place at the CDC or a CDC-affiliated laboratory since 2000. However, until the start of Universal Genotyping (UG) in 2004, only a partial sample of culture-positive specimens were submitted for genotyping. Since UG was implemented in 2004, all culture-positive specimens have been submitted to the CDC-affiliated laboratory in Berkeley, California for genotyping. Table 10 summarizes the results of all specimens tested from King County.

The clustering trends from this table should be interpreted with caution as the majority of samples sent in 2000-2003 were sent specifically due to linked epidemiological information and a heightened alert for outbreaks (hence specimens were, by definition, more likely to cluster).

Large clusters were identified and investigated further. Meetings were held to discuss each of the clustered cases, with additional social networking information used to supplement demographic and medical information obtained from the patient chart and from the Tuberculosis Information Management System database. We continue to monitor the trend of incidence of strains, as an increasing trend of a particular strain may represent undiscovered ongoing transmission.

**TABLE 10. GENOTYPE SUMMARY**

Year	No. of isolates	No. clustered	Proportion clustering	No. of unique clusters	Mean isolates/cluster
2003	73	63	86%	26	2.4
2004	118	58	49%	23	2.5
2005	99	50	51%	23	2.2
2006	123	62	50%	30	2.1
2007*	118	64	54%	29	2.2

*\*results available on >90% of samples at the time of writing*

## 12. TB CONTACT INVESTIGATIONS

Primary contact investigations are performed in household settings for all infectious TB cases. 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” that include close friends/relatives who have spent many hours in a confined space. An estimated 400 household contacts were identified in King County in 2007. Of these, 378 (94%) individuals received evaluation. Evaluation consists of history, symptom check and a TB skin test, if indicated. Of the 378 screened contacts, 151 were skin test positive, and 228 were skin test negative, for a rate of 40% positive (TB infection rate). The number screened does not include contacts whose names were obtained but who were never located. When the TB infection rate was above expected, the contact investigation was expanded.

Routine contact investigations (primary and expanded) uncovered 26 additional secondary cases. Twenty-six out of 970 (3%) contacts evaluated thus were diagnosed as active cases. Of all 161 cases in 2007, 16% were discovered as a result of contact investigation.

When an index case is a highly infectious case, or a household contact investigation suggests TB transmission, contact investigations are expanded to congregate settings where the index case is involved. These locations typically include schools, colleges, shelters, worksites, and nursing homes.

The TB Control Program uses a concentric circle approach to conduct contact investigations; contacts are prioritized based on their duration/intensity of exposure and personal medical characteristics, those at highest risk are tested first. Depending on the results from this closest circle of contacts, the investigation may be expanded to the ‘second tier’ contacts, and so on. Additional factors which determine the scope of contact investigations include: characteristics of the case (i.e., relative infectiousness and duration of “infectious period”), vulnerability and immunocompetence of the population exposed, and the environmental features of the setting where exposure occurred (ventilation, room size, etc.). The TB Control Program evaluates all contacts with a symptom review, a medical-risk assessment, and a skin test. If necessary, contacts are encouraged to obtain a chest x-ray and treatment if they are found to have latent TB infection or TB disease. In addition, contacts with latent TB infection are eligible to be enrolled in the TB Trials Consortium clinical research study (see section 14).

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

In 2007, the TB Control Program conducted contact investigations at 19 congregate setting sites (excluding homeless shelters); 17 worksites and other places of business, one school and one medical/nursing facility. In 2007, 362 individuals were identified as close contacts to infectious TB cases at these settings. Eighty-three percent (300) of these contacts were located and screened for both active and latent TB. Table 11 summarizes the congregate setting contact-investigation activities for 2007.

**TABLE 11. CONGREGATE SETTING INVESTIGATION SUMMARY, 2007**

Investigation	Contacts Identified	Prior Positive Skin Tests	Received a Skin Test	Skin Test Positive (% positive)±
Nursing/Medical facilities*	11	0	11	0 (0%)
Schools/Universities	56	2	26	1 (4%)
Worksite/Other Institution#	295	29	232	43 (19%)
Total	362	31	269	44 (16%)

±Excluding prior positive skin tests

\*Excluding hospitals

# Excluding homeless shelters and services

### *TB cases in homeless shelters*

Six contact investigations were conducted in homeless shelters during 2007. There were over 300 individuals identified at these shelters, of whom 207 were considered close contacts. At-risk individuals were screened for both active and latent TB in collaboration with the TB satellite clinic. Table 12 summarizes the homeless shelter contact-investigation activities for 2007.

**TABLE 12. 2007 HOMELESS SHELTER INVESTIGATIONS SUMMARY**

Homeless Shelter Contact Investigations	
Contacts Identified	207
Contacts Evaluated	127
Prior Positive Skin Tests	9
Received a Skin Test	118
Skin Test Positive (% positive)	7 (6%)

The need for a TB satellite clinic in close proximity to the homeless community was identified through focus group research. The satellite clinic began follow-up of close contacts in December 2006 with four core functions:

- Treating homeless contacts of persons with infectious TB;
- Screening homeless contacts of persons with infectious TB;
- Collaborating with public health and community partners to enhance targeted TB testing and treatment of latent TB infection in the homeless population; and
- Assisting in the treatment of homeless individuals with active TB disease who are not infectious.

In 2007, the satellite site screened over 40 close contacts, skin tested over 30 of these, and offered treatment for latent TB infection to 5 individuals.





## 13. OUTBREAK PREVENTION SECTION

The Public Health - Seattle & King County Tuberculosis Control Program recently implemented an outbreak prevention section that is responsible for congregate setting investigations, outbreak response, and surveillance. Congregate setting investigations take place at workplaces, schools, vocational settings, as well as nursing homes, religious organizations and homeless shelters (see Section 12 above).

Following a large outbreak among the homeless in King County in 2002-2003, a section was formed consisting of an outbreak coordinator, epidemiologists and disease intervention specialists was formed. The goals of the outbreak prevention section are to conduct contact evaluations in congregate settings and provide assessment of the contact investigation process. The assessment is used to determine how investigations can be improved and whether to expand to the next concentric circle of contacts.

The coordinator and epidemiologists organize screenings, process and analyze exposure data, and produce summary reports; the disease intervention specialists interview index cases, locate contacts, and conduct skin tests for congregate setting TB screenings. Additionally, the team conducts environmental assessments to analyze possible transmission.

Prioritization of activities depends on case characteristics, cumulative exposure, exposure risk based on environmental characteristics, and available resources. This specialized section assists heavily-burdened nurse case managers who generally carry a case load of 15-25 people at any given time. The section coordinates the development of procedures to ensure treatment for latent TB infection is successfully initiated and completed by infected contacts.

## 14. THE TB CONTROL PROGRAM SPECIAL PROJECTS

### *Community partnerships*

Community partners provide important collaborations for the TB Control Program. As an example, a community TB coalition created during the homeless TB outbreak meets on a quarterly basis. Issues discussed at the coalition meetings include re-evaluation of environmental factors that influence the transmission of TB in homeless shelters. Partnership with Healthcare for the Homeless Network (HCHN), the REACH project, King County Jail Health, Harborview Medical Center, homeless service sites, and others have been enormously helpful and successful in our searches for homeless TB cases and contacts. These partnerships offer additional information and insight on behaviors and patterns that have resulted in refining the approach to control TB among the homeless.

The King County HCHN contracts with the TB Control Program to provide TB services to homeless persons in our area. These services include TB screening in shelters and directly observed therapy for homeless persons who are found to have latent TB infection and active TB disease. The HCHN provides funding for a number of incentives and enablers, such as housing and food, which help homeless persons with TB complete their course of treatment while preventing transmission of TB to others.

Another area of partnership has been with the TB laboratories of the CDC, Washington Department of Health, Harborview Medical Center, Public Health – Seattle & King County, and Seattle Biomedical Research Institute (SBRI). This collaboration, utilizing advanced genotyping, has enhanced our ability to monitor the transmission of TB within King County and beyond.

## *Tuberculosis Trials Consortium*

The TB Control Program at PHSKC is one of 28 health departments and academic centers worldwide which comprise the TB Trials Consortium (TBTC). The CDC sponsors the TBTC to conduct large scale, multi-center trials of new diagnostic tools and regimens for the treatment of TB infection and disease. Ongoing studies include: comparison of a 3-month, once-weekly regimen of two drugs to standard 9-month therapy with isoniazid for treatment of latent TB infection and a randomized, double-blind clinical trial assessing the impact on 2-month sputum conversion rate of substituting moxifloxacin for isoniazid in the standard intensive phase TB treatment regimen. Further details regarding the TBTC can be found at: [www.cdc.gov/nchstp/tb/tbtc/default.htm](http://www.cdc.gov/nchstp/tb/tbtc/default.htm)

## *Tuberculosis Epidemiologic Studies Consortium*

The Tuberculosis Epidemiologic Studies Consortium (TBESC) consists of 21 sites across the US and Canada. These sites collaborate on multiple special studies, thereby providing access to diverse populations at highest risk for TB and assuring that findings are generalized across the US and Canada. Currently, the Seattle TBESC site participates in four projects/Task Orders (TOs):

- TO 5 (Prevalence of latent TB among the Homeless)
- TO 8 (Multi-drug resistant TB to better determine how MDR TB is acquired)
- TO 9 (TB among the foreign-born to determine how to better prevent TB disease among foreign-born persons living in the US)
- TO 12 (Providers who care for foreign-born persons)

Additional details regarding the TBESC can be found on <http://www.cdc.gov/nchstp/tb/TBESC/TOC.htm>

## *TB educational course for healthcare professionals*

In 2007, Seattle & King County's TB Control Program worked closely with the American Lung Association of Washington, the Washington Thoracic Society, the University of Washington/Harborview Medical Center, the Washington TB Advisory Council, the Firland Foundation, the Washington Department of Health, and the Seattle STD/HIV Prevention Training Center to hold the 5th annual, two-day TB educational course for healthcare professionals who provide health care services to high-risk TB clients. This successful collaboration led to further expansion of this project and partnering with the Francis J. Curry National TB Center in San Francisco.

## *EPI-LOG*

Working closely with the Communicable Disease Control, Epidemiology & Immunization Section of Public Health – Seattle & King County, sections of “TB update” were published in Epi-Log (November and December issues), a monthly publication distributed to health care providers in King County. These updates discussed recent TB epidemiology, TB Control Program activities, and the role that healthcare providers play in the control of TB in King County.



## APPENDIX 1: GLOSSARY

**Acid-Fast Bacilli (AFB) smears:** Smears performed on sputum or other non-respiratory specimens to detect the presence of *Mycobacterium*.

**Bacille Calmette-Guerin (BCG):** A vaccine for TB named after the French scientists Calmette and Guérin. BCG is not widely used in the United States, but it is often given to infants and small children in other countries where TB is common.

**Cavity:** A hole in the lung resulting from destruction of pulmonary tissue. TB patients with cavities on chest X-rays are generally more infectious because of high bacterial load.

**Clinical Case:** In the absence of laboratory confirmation of *M. tuberculosis* after a diagnostic process has been completed, persons must have all of the following criteria for clinical TB case:

- Evidence of TB infection bases on a positive TB skin test AND
- One of the following:
  - (1) signs and symptoms compatible with current TB disease, such as an abnormal, unstable (worsening or improving) chest radiograph, or
  - (2) clinical evidence of current disease (such as fever, night sweats, cough, weight loss, hemoptysis). AND
- Current treatment with two-or more anti-TB medications.

**Contact:** An individual who has had some exposure to a source case. Contacts are often differentiated into 'close contacts,' that is, individuals who have shared the same air space with a person who has infectious TB disease for a prolonged time, or 'casual contacts,' those who did not have prolonged exposure.

**Culture:** Growth of bacteria in the laboratory, on either a liquid or solid medium, so that organisms can be identified based on species.

**Directly Observed Therapy (DOT):** A health care worker or other designated person who watches the TB patient swallow each dose of the prescribed drug.

**DNA Genotyping:** A laboratory approach that provides a description of the genetic makeup of a TB isolate.

**Drug Susceptibility Testing:** Tests done to determine which drugs will kill the bacteria that are causing the disease. Those bacteria killed by a particular drug are said to be susceptible to that drug, while those that grow in a drug's presence are said to be resistant to it.

**Epidemiological (Epi) link:** A known epi-link is defined as either: a) one of the patients naming the other as a contact during one of the patient's infectious period or b) the two patients being at the same place at the same time during one of the patient's infectious period.

**Ethambutol (EMB):** One of the four first-line oral drugs used for TB treatment.

**Extrapulmonary TB:** TB disease in any part of the body other than the lungs (for example, the kidney or lymph nodes).

**Fingerprinting:** Refers to TB genotyping using a specific type of RFLP analysis.

**Foreign-born:** Anyone born outside the United States; regardless of the location of their family's birth.

**Genotyping:** A laboratory approach used to determine if TB isolates are genetically identical.

**Immunosuppression:** Medical conditions that reduce the body's immune response and thus predispose a person to TB disease. Examples include HIV infection, diabetes, malnutrition and immunosuppressive therapy (such as steroids).

**Incidence:** The number of new cases of TB identified

during a specified period of time; often expressed as a rate (per 100,000 individuals).

**Index case:** The first case identified.

**Infectious:** The stage of disease in which an individual transmits TB bacteria into the air.

**Isoniazid (INH):** One of the four first-line drugs used to treat TB, this drug is used either alone or in combination with other drugs as therapy for either TB disease or infection.

**Latent TB Infection:** Condition in which living TB bacteria are present in an individual, but do not produce clinically active disease. While the infected person usually has a positive tuberculin skin test, he/she does not have symptoms related to the infection, has a normal chest x-ray, and is not infectious. However, this individual remains at risk for developing TB disease.

**Multi-Drug Resistant TB (MDR-TB):** Drug resistance to both isoniazid (INH) and rifampin (RIF).

**Mycobacterial interspersed repetitive unit (MIRU):**

A PCR-based genotyping assay performed on every isolate submitted for analysis.

**Mycobacterium tuberculosis (M. tb, M. tuberculosis):**

The mycobacterium organism that causes TB.

**Polymerase Chain Reaction (PCR):** A technique that allows for identification of TB strain types. Two PCR-based techniques are currently in use, spoligotyping and MIRU analysis.

**Pulmonary TB:** TB that occurs in the lungs.

**Purified Protein Derivative (PPD):** A type of purified tuberculin preparation derived in the 1930's. The standard (Mantoux) skin test uses five tuberculin units of this preparation. The test is thus also known as a 'PPD,' or 'TST,' which stands for Tuberculin Skin Test.

**Pyrazinamide (PZA):** One of the four first-line oral drugs used for TB treatment.

**Regimen:** The treatment plan specifying which drugs, dosages, schedule and length of therapy to use for TB.

**Resistance:** The ability of some strains of bacteria to grow even in the presence of certain drugs which normally kill them.

**Restriction Fragment Length Polymorphism (RFLP):** A lab technique used to "fingerprint" strains of TB to track patterns of transmission. The technique is based on measuring the number and length of specific DNA fragments that are cut using specific enzymes.

**Rifampin (RIF):** One of the four first-line oral drugs used for TB treatment.

**Screening:** Evaluation for TB including skin testing of individuals or groups.

**Spoligotyping:** A genotyping technique based on spacer sequences found in a specified region of the TB bacteria's chromosome.

**Source case:** An infectious individual who has transmitted TB to other people.

**Susceptible:** Bacteria which can be killed by drugs used against them

**Tuberculin Skin Test (TST):** The test to see if someone has latent TB infection.

**Purified protein derivative (PPD)** is injected under the skin on the lower part of your arm during a TB skin test. If you have latent TB infection, you will probably have a positive reaction to the tuberculin. [see Purified Protein Derivative].

**Tuberculosis Disease (TB):** The disease that is caused by the mycobacterium *M. tuberculosis*. Diseased persons have met one of the case definition criteria, be it either a laboratory or clinical case definition (or both).

## APPENDIX 2: TB EPIDEMIOLOGY RESOURCES

**Public Health - Seattle & King County:** [www.kingcounty.gov/health](http://www.kingcounty.gov/health)

**Public Health - Seattle & King County TB Control Program:** [www.kingcounty.gov/health/tb/](http://www.kingcounty.gov/health/tb/)

**Washington State Department of Health TB Services:** [www.doh.wa.gov/cfh/tb/](http://www.doh.wa.gov/cfh/tb/)

**CDC Division of TB Elimination:** [www.cdc.gov/nchstp/tb/](http://www.cdc.gov/nchstp/tb/)

**TB Education and Training Resources:** [www.findtbresources.org/scripts/index.cfm](http://www.findtbresources.org/scripts/index.cfm)

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

**WHO Stop TB Partnership:** [www.stoptb.org/](http://www.stoptb.org/) and [www.who.int/tb/en/](http://www.who.int/tb/en/)

## SOURCES AND NOTES FOR THIS REPORT

Since TB is a reportable disease, all 2007 cases are assumed to have been included in this report. However, where unavailable, summaries from previous years have been presented.

All case data came from the Tuberculosis Information Management System database (TIMS). This database was designed to allow counties and states to report TB surveillance data to the Centers for Disease Control and Prevention. TIMS uses data from the Report of Verified Case of Tuberculosis (RVCT) case report form, submitted by all reporting areas.

Epi-Log support provided by Communicable Disease Epidemiology & Immunization Section, Public Health - Seattle & King County.

All charts and tables are from TB Control Program, Public Health - Seattle & King County.

Denominator estimates are courtesy of the Washington Office of Financial Management at: <http://www.ofm.wa.gov/pop/default.asp>.

Washington data for 2006 and 2007 are courtesy of the Washington Department of Health Infectious Disease and Reproductive Health Assessment Unit.

National data are from the surveillance reports at CDC's Division of TB Elimination website Reported Tuberculosis in the United States, 2006 (<http://www.cdc.gov/tb/surv/default.htm>) and from Trends in Tuberculosis-United States, 2007 (<http://www.cdc.gov/tb/>)

Some percentages may not sum to 100 percent due to rounding.

Figure trends were generated in Microsoft Excel using ordinary least squares regression.

For more information about tuberculosis in King County, please visit the TB Control Program's website at: <http://www.kingcounty.gov/health/tb/>