

Seattle & King County Annual Tuberculosis Report



2005



Public Health
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City of Seattle



King County



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Dorothy F. Teeter, MHA, *Interim Director and Health Officer*

2 ACKNOWLEDGEMENTS

Prepared by:

Tuberculosis Control Program, Public Health
– Seattle & King County

Eyal Oren, MS — Lead TB Epidemiologist
Jennifer Harris, MPH — TB Epidemiologist
Masa Narita, MD — TB Disease Control Officer

Graphic Design:

Sue McCauley

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For comments or questions contact:

Tuberculosis Control Program

Public Health – Seattle & King County

Harborview Medical Center
325 Ninth Avenue
Box 359776
Seattle, WA 98104

206-731-4579 TTY: 711
www.metrokc.gov/health/tb

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EXECUTIVE SUMMARY



2005 Report Highlights

In 2005, King County reported 127 cases of active tuberculosis (TB) disease. This represents a 5 percent decrease from the 2004 count and marks a continued decline since 2002 when 158 TB cases, a 30-year historic high, were reported. Between 2002 and 2005, several new TB control efforts were initiated:

- a nurse case management model was introduced, with five teams consisting of public health nurses and outreach workers providing individualized and direct patient care;
- enhanced partnerships with public health agencies and the private sector resulted in the dramatic increase in the proportion of patients receiving directly observed therapy and case management;
- a focused yet thorough approach to contact investigations was recently initiated, with a team of two epidemiologists and two disease intervention specialists conducting screenings, and collecting, managing and analyzing data for over 1,000 contacts a year.

In King County, TB continues to disproportionately affect the foreign-born, who represented 95 cases reported in 2005. King County's TB rate (7.0 per 100,000 population) remains higher than the national rate (4.9 per 100,000 in 2004).

Age, Race, Ethnicity and Nativity

TB case rates vary by factors such as age, race, ethnicity and country of origin. The largest decline in case rates among age groups occurred among 15-24 year-olds, where

rates declined from 12.2/100,000 in 2004 to 7.0/100,000 in 2005. The TB case count among children 0-14 years was four. Blacks (37.0/100,000) and Asians (24.5/100,000) had disproportionately higher rates of TB. In 2005, 75 percent of reported cases occurred among foreign-born persons, similar to the 2004 proportion. The highest case numbers came from Vietnam, Ethiopia, the Philippines, Somalia and Mexico.

TB-HIV Co-infection

HIV is a significant risk factor for TB. There were seven TB cases among HIV infected persons in King County, representing 5.5 percent of all TB cases reported in 2005. This represents an increase from 2004, but is consistent with proportions from previous years (years 2001–2003). The proportion of cases offered HIV testing in King County has improved from 85 percent to 99 percent over the past five years.

Drug Resistant TB

In 2005, 15 percent of TB cases were resistant to at least one TB medication in King County. Ten percent of all TB cases exhibited primary resistance to isoniazid (INH) in 2005, compared to 8 percent the year before. Multi-drug resistant TB (MDR-TB: TB resistant to at least isoniazid and rifampin, the most effective TB medications) is exceedingly costly and difficult to treat. In 2005, two cases (2 percent of cases) of MDR-TB were reported.

TB Treatment

The proportion of TB patients initially placed on a standard four-drug regimen continues to remain above 90 percent. The proportion of patients who were treated with directly

observed therapy has increased from 61 percent in 2001 to 99 percent in 2004, the latest year with available outcome data.

Summary

The program continues to face many ongoing challenges, such as (1) the high proportion of TB patients who live in poverty and who have special needs in respect to language and acculturation, and (2) the transient and migratory nature of many individuals at high risk for TB.

Because of a large pool of individuals with latent TB infection (estimated 100,000 people in King County, and a third of the world's population), lack of convenient preventive medications, and lack of an effective TB vaccine, it is unlikely that TB will be eliminated anytime soon. To manage this disease with the tools currently available, the TB Control Program focuses on (1) case management of patients with active TB disease in order to ensure the cure of all TB cases, stop further transmission of TB and prevent development of multi-drug resistant TB; (2) timely and thorough contact investigations around active TB cases to identify, evaluate and treat those who were exposed and recently infected and (3) efforts to enhance targeted TB testing and treatment of latent TB infection.



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1. TB IN KING COUNTY



Tuberculosis Morbidity 2005

The incidence rate (the ratio of new cases to the average size of the population) of active TB disease in Seattle & King County was 7.0 per 100,000 in 2005, a decrease from the case rate of 7.4 per 100,000 in 2004. The number of TB cases decreased from 133 reported in 2004 to 127 reported in 2005 (Figure 1).

In Washington State, the case rate also continues to decline, with an incidence of 4.0/100,000 in 2005 (Table 1).

14,517 cases of TB were reported in the United States in 2004, with the five highest metropolitan statistical area rates in 2004 in McAllen, TX (12.5), San Francisco, CA (12.1), San Jose, CA (12.0), New York City (11.9) and Miami, FL (11.4).

TB incidence rates in Seattle & King County remain higher than rates in the rest of the state and the national average. It is estimated that there are over 100,000 people with latent TB infection in King County.

FIGURE 1: TUBERCULOSIS CASES, KING COUNTY, 1969-2005

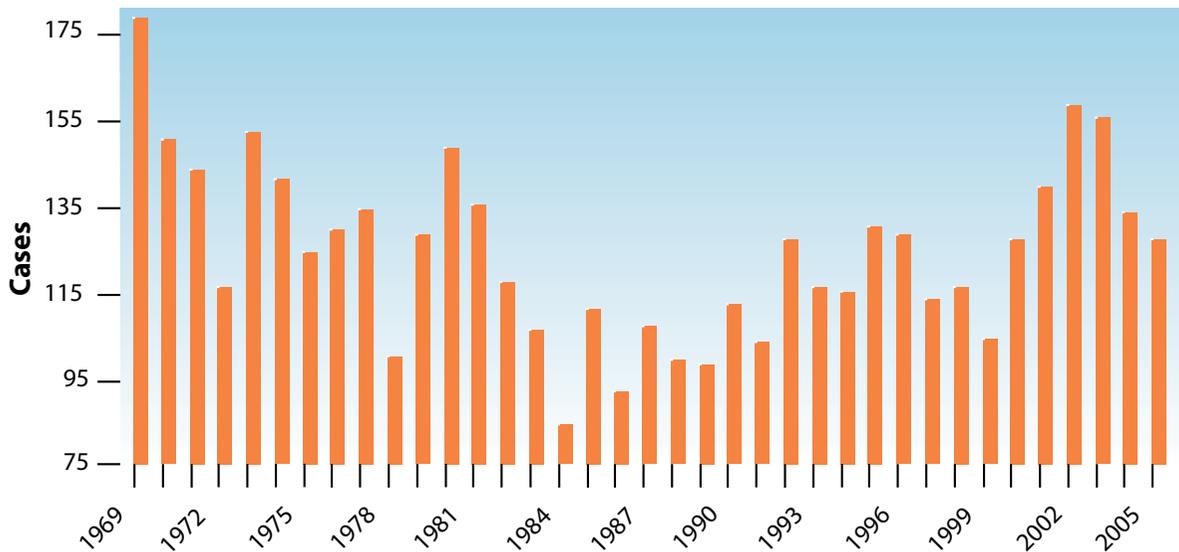


TABLE 1: TUBERCULOSIS CASE RATES 2001-2005 FOR US, WASHINGTON AND SEATTLE & KING COUNTY

		2001	2002	2003	2004	2005
U.S.A.	Count	15,945	15,057	14,852	14,517	14,093
	rate/100,000	5.6	5.2	5.1	4.9	4.8
Washington State	Count	261	252	250	245	256
	rate/100,000	4.3	4.1	4.0	3.9	4.0
Seattle & King County	Count	139	158	155	133	127
	rate/100,000	7.9	8.9	8.7	7.4	7.0

8 2. WHO GETS TB?

Age Groups

From 2001 to 2004, the greatest proportion of TB cases in King County was among individuals aged 25-44 years (Figure 2). However, the past two years have shown an increase in the proportion of cases aged 45-64 years and aged 65 and over. In 2005, the greatest percentage of cases shifted to the 45-64 year old age group (31 percent) and the proportion of cases in the 15-24 years age group declined to a level similar to that seen in 2000-2003 after a rise in 2004. Though 45-64 year olds comprise the greatest proportion of cases, the highest incidence (defined as number of new cases divided by the total population at risk) is in the 65+ years of age group (Table 2).

FIGURE 2: TUBERCULOSIS CASES BY AGE GROUP, 2005

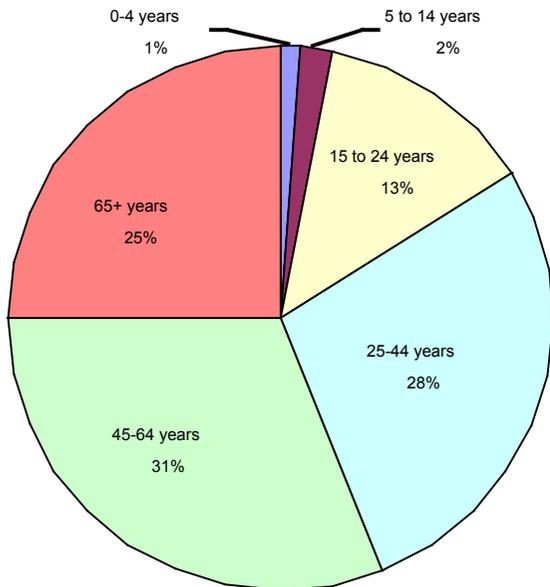
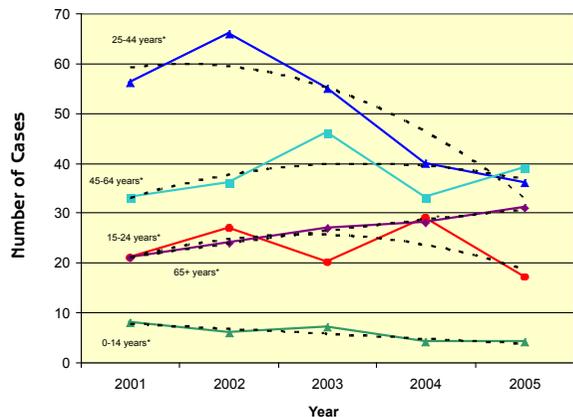


TABLE 2: INCIDENCE BY AGE GROUP

0-4 years of age	0.9/100,000
5-14 years of age	1.4/100,000
15-24 years of age	7.0/100,000
25-44 years of age	6.2/100,000
45-64 years of age	8.3/100,000
65+ years of age	16.1/100,000

Absolute numbers of cases decreased in all age groups except among cases aged 45-64 and 5-14. The number of cases aged 45-64 increased from 33 cases in 2004 to 39 cases in 2005. While the number of cases aged 5-14 also increased from one in 2004 to three in 2005, the overall number of pediatric cases (cases aged 0-14 years) remained steady, with four cases in 2004 and 2005 (Figure 3).

FIGURE 3: TUBERCULOSIS CASES BY AGE GROUP, 2001-2005



*Dashed lines show quadratic trend line generated by the ordinary least squares method

Statewide, the greatest proportion of cases was also seen among 45-64 year olds (32 percent), with cases aged 25-44 years old comprising 28 percent of total cases as in King County. Children aged 0-4 and youth aged 5-14 each represented 2 percent of cases and adults aged

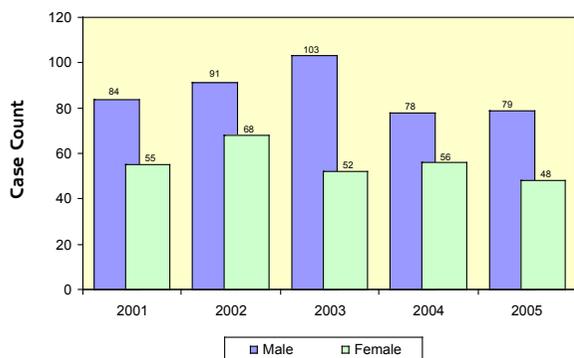
65 and over made up 21 percent of cases.

Nationally, there were greater proportions of cases in the 25-44 range (34 percent) and among children aged 0-14 (7 percent). A smaller percentage of cases were among individuals aged 65 or older (19 percent). While national trends change slowly, numbers have gradually increased among 45-64 year-olds, as well as among 15-24 year-olds, while decreasing among the 25-44 and 65+ age groups over the last 10 years.

Gender

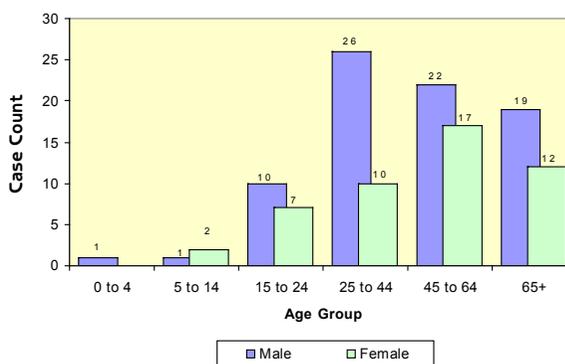
Males represented 62 percent of all King County TB cases which is similar to the proportions seen in recent years (Figure 4). The incidence rate among males was 8.8/100,000; among females 5.3/100,000.

FIGURE 4: TUBERCULOSIS BY GENDER, 2001-2005



In Washington as a whole, males represented 59 percent of all cases in 2005 and nationally, males constitute approximately 61 percent of all TB cases (2004 data).

FIGURE 5: TUBERCULOSIS BY AGE AND GENDER, 2005



Age and Gender

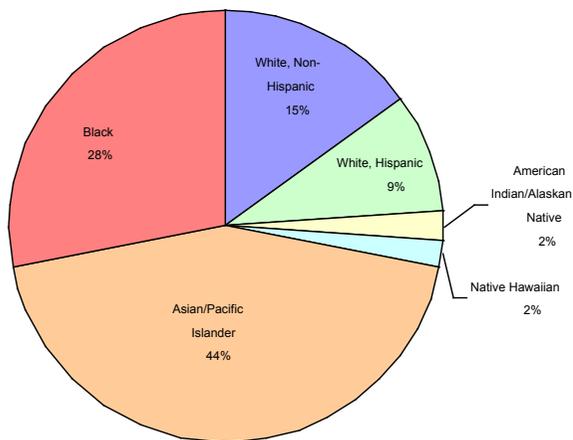
The greater proportion of cases among males is consistent across all age groups except 5-14 year olds. However, the difference is greatest among individuals aged 25-44 where there were 2.5 times as many cases among males as among females. In 2005, the greatest male:female ratio was also seen in the 25-44 age group. It is also interesting to note that the number of male cases peaks with the 25 to 44 year old age group, while the number of female cases peaked among 45 to 64 year olds (Figure 5).

3. RACIAL DISPARITIES AND TB

Race and Ethnicity

Asians and Blacks continue to disproportionately represent more than two-thirds of TB cases in Seattle & King County (Figure 6). Fewer American Indian cases were seen in 2005, resulting in a much lower incidence rate than in the previous few years for this population. In 2005, 9 percent of TB cases were Hispanic, (11 of 127 cases reported in 2005), an increase from 7 percent the year before (9 of 133 cases reported in 2004).

FIGURE 6: TUBERCULOSIS BY RACE, 2005



Incidence in King County by race was as follows:

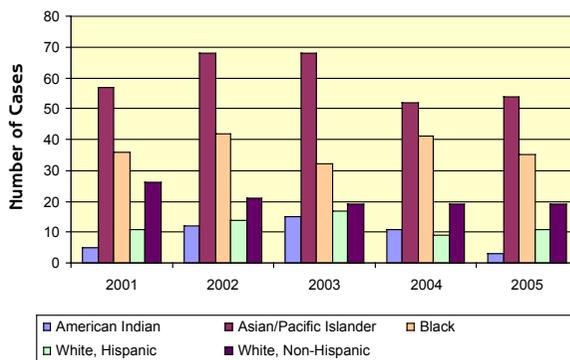
American Indian	20.4/100,000
Asian	24.5/100,000
Black	37.0/100,000
Native Hawaiian	37.7/100,000
White, Hispanic	20.4/100,000
White, Non-Hispanic	2.4/100,000

High rates among Native Hawaiian can be misleading; due to the small Native Hawaiian population in King County (approximately 10,000 inhabitants), a few cases can result in a very high incidence. Statewide, compared to Seattle & King county, smaller proportions

of cases occur among Asians (39 percent) and Blacks (17 percent). Fourteen percent of cases statewide were Hispanic.

Nationally, the highest case rates are seen among Asian, Black and Hispanic populations, (27, 11, and 10 per 100,000 respectively). King County case rates are higher than national case rates for Blacks and Hispanics; this is likely due to greater proportions of foreign-born individuals in King County's Black and Hispanic populations than in other parts of the United States. This is supported by the fact that 66 percent of Black cases in King County are foreign-born while 27 percent of Black cases nationally are foreign-born. Among Hispanics, 91 percent of cases in King County are foreign-born while 73 percent of cases nationwide are foreign-born.

Figure 7: TUBERCULOSIS BY RACE, 2001-2005



The distribution of cases across racial groups has remained relatively stable over the past five years (Figure 7). The largest percent change has been among American Indians whose case numbers increased 200 percent from five cases in 2001 to 15 cases in 2003 and then dropped down to three cases in 2005. This was due to an outbreak in the homeless population which disproportionately affected American Indians.



4. CHILDREN AND TB

In 2005, the TB case count among children 0-14 years was four in King County. This comprised 3 percent of King County TB cases in 2005. Nationally, this proportion is 7 percent.

Pediatric TB represents a failure of TB control, because children with TB have been recently infected by an adult case. Thus, unrecognized

active TB cases and ineffective contact investigations can result in a child with active TB disease. The TB Control Program initiates timely and thorough contact investigations for all infectious TB cases in order to prevent this from happening and conducts investigations to identify sources of pediatric cases.

12 **5. TB-HIV CO-INFECTION**

In 2005, 99 percent of cases were offered HIV tests. Of those TB cases for whom HIV test results are available (76 percent of all cases), 7 percent were co-infected with HIV (see Table 3). However, at the state and national level, the percentage of TB cases co-infected with HIV is calculated as the percentage of HIV positive cases among all reported TB cases (including cases that did not have an HIV test). Thus, for comparison purposes, we report HIV co-infection as the percentage of people who have a positive test result among all reported. This percentage is 6 percent for both King County and the state of Washington. Nationally, the most recent published data are from 2003 when 54 percent of all cases were given an HIV test, and the percentage of HIV positive cases was 9 percent.

TABLE 3: HIV TEST RESULTS AMONG TB CASES, 2005

HIV Status	Number	Percent
Negative	91	70.9
Positive	7	5.5
Refused	17	13.4
Not offered	1	0.8
Unknown*	11	9.4
Total	127	100.0

*Four of the cases with "unknown" HIV status were deceased at the time of diagnosis

TABLE 4: TREND OF HIV INFECTION AMONG TB CASES, 2001-2005

Year	N (%) with HIV Infection
2001	9 (6.5)
2002	11 (9.0)
2003	9 (7.4)
2004	3 (2.3)
2005	7 (5.5)

Determining the HIV status of every TB case is an important clinical measure to ensure appropriate medical management of both diseases. 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 transmission in this group so that appropriate disease control measures can be taken to avert or interrupt outbreaks (see Table 4).



6. DRUG-RESISTANT TB

Multi-Drug Resistant TB

Two individuals were observed with Multi-Drug Resistant TB (MDR-TB—defined as resistance to at least isoniazid and rifampin) in 2005. In 2004, King County also had two cases of MDR-TB. As a state, Washington had one additional case of MDR-TB in 2005 for a total of three cases. When a TB strain is resistant to both isoniazid and rifampin, treatment lasts for 18-24 months or longer, as compared to a usual course of six-nine months.

Nationally, 101 cases (or 1 percent of all cases with drug-susceptibility results reported) were diagnosed with MDR-TB in 2004. This proportion of MDR cases has been relatively stable for the last few years.

Primary Drug Resistance

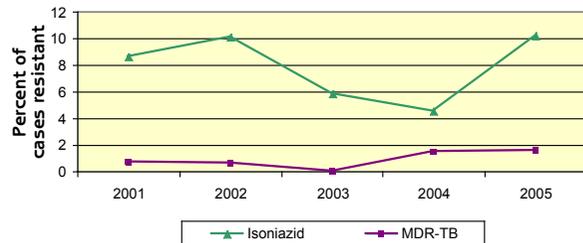
Primary drug resistance is drug resistance based on initial isolates from persons with no prior history of TB. Table 5 shows the percentage of King County cases whose TB strain was resistant to each of the five most common drugs used to treat TB. Figure 8 shows the trends in INH resistance and MDR-TB among King County cases from 2001 through 2005. Nationally, approximately 8 percent of cases showed resistance to isoniazid in 2004.

TABLE 5: PRIMARY DRUG RESISTANCE, 2005*

Drug	N (%)
Isoniazid	13 (10.2%)
Rifampin	2 (1.6%)
Pyrazinamide	3 (2.4%)
Ethambutol	4 (3.1%)
Streptomycin	14 (11.0%)
Any	19 (15.0%)

*Includes both mono-resistance and resistance to more than one drug. Percentages are of total cases for 2005.

FIGURE 8: PRIMARY ISONIAZID RESISTANCE AND MDR-TB IN KING COUNTY, 2001-2005



7. EAST AFRICAN OUTBREAK

We had an outbreak of TB among mostly young men of East African origin in 2004. Eleven cases were genotypically linked with a matching strain type, and one clinical case was epidemiologically linked to the outbreak.

Disease progression was rapid in this population, and an unusually high number of patients had cavitary pulmonary tuberculosis. The group was generally involved in

“hotboxing,” the practice of smoking marijuana with others in a vehicle with the windows closed.¹ Intense efforts aimed at case finding, case management, and identification and treatment of latently infected close contacts appear to have been successful in halting the outbreak. No further cases with this strain were diagnosed in 2005.

¹ Emerg Infect Dis 2006; 12(7):1156-1159.



8. TB AMONG THE HOMELESS

There were 23 homeless cases diagnosed with TB in 2005, comprising 18 percent of all TB cases in King County, which is comparable to the year before. 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 23 homeless cases, 13 were born in the U.S. (57 percent). U.S.-born homeless cases represented 14 percent of all U.S.-born cases in 2005. Six Hispanic homeless cases were seen in 2005, which is an increase from the

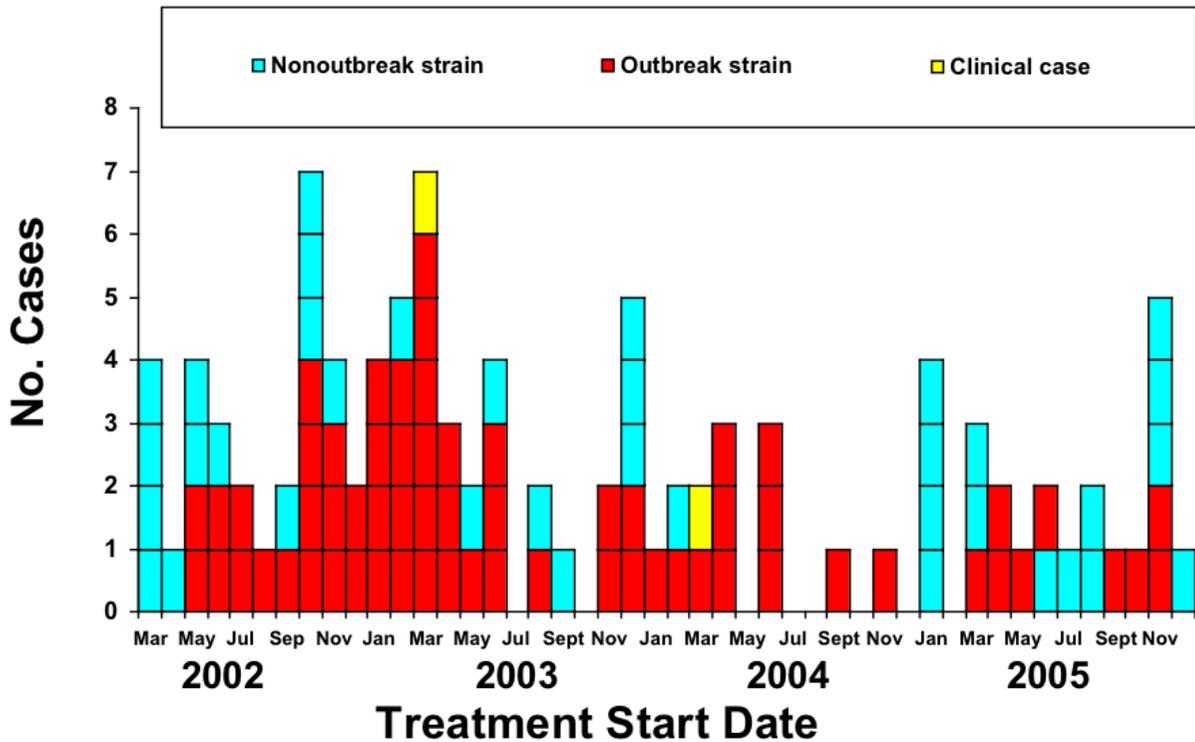
past several years (range from 1-3 between 2002 and 2004). In contrast, the number of American Indian cases, the predominant case group during the 2002-2003 outbreak, continued to decrease (17 in 2003 to 2 in 2005) (Table 6).

Fifteen percent of TB cases in Washington State are homeless. Nationwide, homeless cases currently represent 6 percent of all TB cases, although rates fluctuate widely by state.

In 2002, a TB outbreak among the homeless was detected (see Figure 9). One strain (the outbreak strain) caused 17 (57 percent) of 30

FIGURE 9: HOMELESS TB CASES IN KING COUNTY

Homeless TB Outbreak in King County by Treatment Start Date



cases among the homeless in 2002 (Figure 9). In 2003, the outbreak strain was responsible for 26 cases (74 percent of all homeless cases in 2003).¹ Over the past two years, due to intensive effort to control this outbreak, the number of TB cases matching the outbreak strain dropped considerably (11 cases [48 percent of homeless] in 2004 and nine cases [39 percent] in 2005).

however, it is clear that reactivation of TB disease caused by the outbreak strain is still taking place, as indicated by genotyping results. This illustrates long-term consequences of disseminated transmission among homeless individuals who were exposed to infectious TB patients in 2002 and 2003. It is also difficult to ensure a high latent TB infection treatment completion rate in this population.

We consider the ongoing transmission of the outbreak strain to be currently contained;

¹ Int J Tuberc Lung Dis. 2006;10(6):683-9.

TABLE 6: WHO ARE THE HOMELESS TB CASES?

	2002 (n=30) N(%)	2003 (n=35) N(%)	2004 (n=15) N(%)	2004** (n=23) N(%)	2005 (n=23) N(%)
Gender					
Male	26 (87)	27 (77)	12 (80)	20 (87)	21 (91)
Female	4 (13)	8 (23)	3 (20)	3 (13)	2 (9)
Age Group					
15-30	1 (3)	1 (3)	0 (0)	8 (35)	1 (4)
31-40	8 (27)	2 (6)	2 (13)	2 (9)	3 (13)
41-50	10 (33)	16 (46)	4 (26)	4 (17)	10 (43)
51-60	9 (30)	13 (37)	5 (33)	5 (22)	6 (26)
61-70	2 (7)	1 (3)	3 (20)	3 (13)	2 (9)
71-80	0 (0)	2 (6)	1 (7)	1 (4)	1 (4)
Race/Ethnicity					
White, non-Hispanic	3 (10)	7 (20)	3 (20)	3 (13)	5 (22)
Black, non-Hispanic	12 (40)	8 (23)	3 (20)	11 (48)	7 (30)
Hispanic	3 (10)	3 (9)	1 (7)	1 (4)	6 (26)
Asian/Pacific Islander	1 (3)	0 (0)	0 (0)	0 (0)	3 (13)
American Indian/Alaska Native	11 (37)	17 (49)	8 (53)	8 (35)	2 (9)
US-born					
Yes	25 (83)	33 (94)	13 (87)	13 (57)	13 (57)
No	5 (17)	2 (6)	2 (13)	10 (43)	10 (43)
HIV Result					
Positive	9 (30)	1 (3)	0 (0)	0 (0)	1 (4)
Unknown	1 (3)	0 (0)	2 (13)*	3 (13)	4 (17)
Genotyping					
Strain Match	17 (57)	26 (74)	11 (73)	11 (48)	9 (39)
American Indian strain match	9	15	7	7	2
Other race strain match	8	10	4	4	7
Non-outbreak strain	13 (43)	8 (23)	2 (13)	10 (43)	14 (61)
Pending	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Clinical Case	0 (0)	1 (3)	2 (13)	2 (9)	0 (0)
No strain done	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Excess Alcohol use	15 (50)	25 (71)	9 (60)	12 (52)	12 (52)
Injecting Drug Users	3 (10)	3 (9)	4 (27)	4 (17)	4 (17)
Unemployed	22 (73)	24 (69)	10 (67)	12 (52)	9 (39)

*Some patients refused HIV test

**Includes East African Outbreak patients who were homeless



9. TB AMONG THE FOREIGN-BORN

In 2005, there were 95 foreign-born TB cases, representing 75 percent of all cases in King County (Figure 10). While 41 percent of U.S.-born cases were homeless, only 11 percent of foreign-born cases were homeless. HIV co-infection prevalence was 5 percent among foreign-born cases and 6 percent among U.S.-born cases. The percentage of foreign-born cases among all cases has remained relatively stable over the past five years, ranging from 68-77 percent.

FIGURE 10: TUBERCULOSIS BY U.S. VS FOREIGN-BORN, 2001-2005

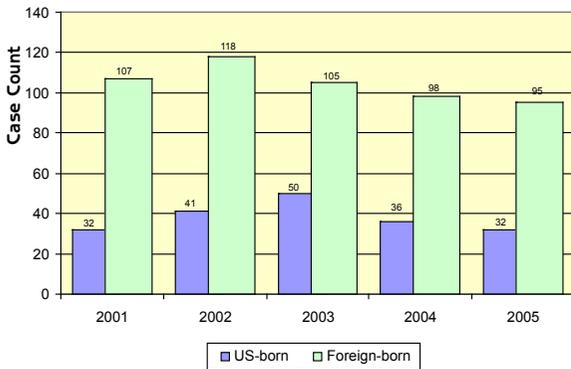
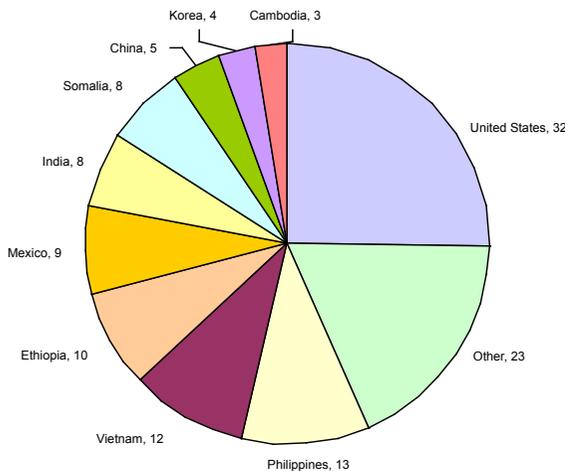


FIGURE 11: TB CASES BY COUNTRY OF BIRTH, 2005



Country of Origin

Sixty percent of foreign-born cases came from 10 countries in South Asia, Southeast Asia or East Africa (Figure 11). Over the last five years, the most common countries of origin among King County's foreign-born cases have been Vietnam, Ethiopia, the Philippines, Somalia and Mexico (Table 7). Nationwide, in 2004, 54 percent of cases were among foreign-born persons; the top 5 countries of origin for foreign-born cases in the U.S. (unchanged from 2003) were Mexico, the Philippines, Vietnam, India and China.

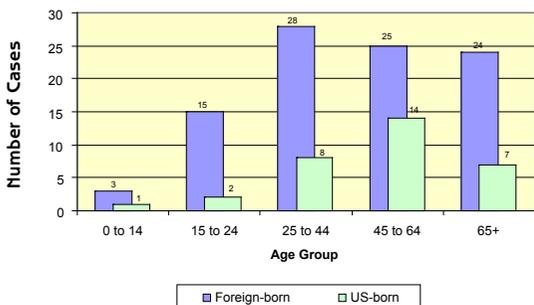
TABLE 7: TRENDS IN COUNTRY OF ORIGIN AMONG FOREIGN-BORN TB CASES 2001-2005

	2001	2002	2003	2004	2005
Somalia	12 11%	15 13%	2 2%	8 8%	8 8%
Ethiopia	12 1%	8 7%	11 10%	13 13%	10 11%
Philippines	16 16%	18 18%	12 12%	15 15%	13 10%
Vietnam	17 17%	17 17%	12 12%	12 12%	12 9%
Sudan	0 0%	1 1%	0 0%	6 6%	1 1%
Mexico	8 7%	8 7%	12 11%	5 5%	9 7%
Korea	3 3%	1 1%	8 8%	5 5%	4 3%
China	4 4%	5 5%	10 10%	4 4%	5 4%
India	9 9%	11 11%	10 10%	4 4%	8 6%
Cambodia	3 3%	5 5%	5 5%	3 3%	5 4%
TOTALS	107	116	106	97	95

Age of Foreign-born TB cases

Foreign-born cases were younger, on average, than U.S.-born cases (Figure 12). The greatest numbers of foreign-born cases were 25-44 years old, while the greatest numbers of U.S.-born cases were between the ages of 45 and 64 years.

FIGURE 12: TUBERCULOSIS CASES BY U.S.-OR FOREIGN-BORN AND AGE GROUP, 2001-2005



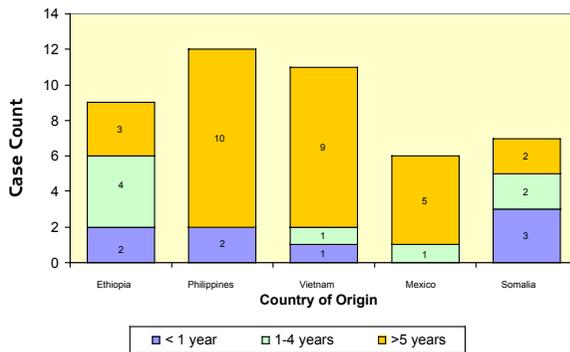
Duration of Stay in U.S. Prior to Diagnosis

The length of time since arrival in the United States was available for 83 percent of King County’s foreign-born cases in 2005. Of this group, 12 percent of cases had been in the United States under one year, 23 percent had been here for 1-4 years, and 65 percent had been here for more than 5 years. Nationally in 2004, 24 percent of foreign-born cases had been in the United States less than one year, 26 percent had been here 1-4 years, and 50 percent had been here for five or more years.

Figure 13 shows the duration of stay in the U.S. for cases from Ethiopia, Somalia, Mexico, Vietnam and the Philippines. A greater proportion of the cases from Ethiopia and Somalia, as compared to cases from the other three countries, were recent immigrants (defined as living in the United States less than one year). The cases from Ethiopia and Somalia were also younger on average, with

50 percent of them under 25 years old. The majority of cases from the Philippines, Vietnam and Mexico were older, with 12 percent of them under age 25.

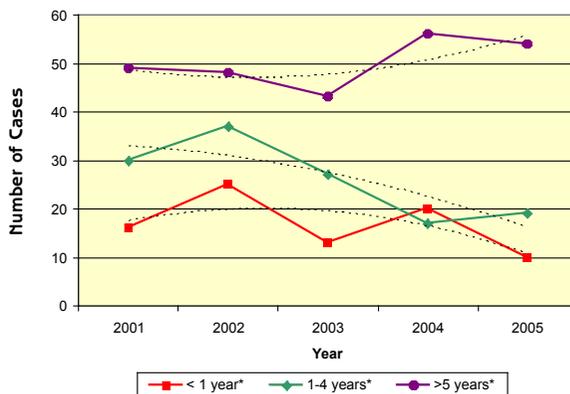
FIGURE 13: DISTRIBUTION OF TIME SINCE ARRIVAL IN THE U.S. FROM SELECTED COUNTRIES (AMONG CASES WITH LENGTH OF STAY



DATA AVAILABLE), 2005

Figure 14 shows the 5-year trend in duration of stay in the U.S. There appears to be an increasing trend in the number of cases among people who have been here for more than five years, while the number of cases among people who have been here fewer than five years has decreased since 2002.

FIGURE 14: TIME SINCE U.S. ARRIVAL, 2001-2005



10. TREATMENT OF TB CASES

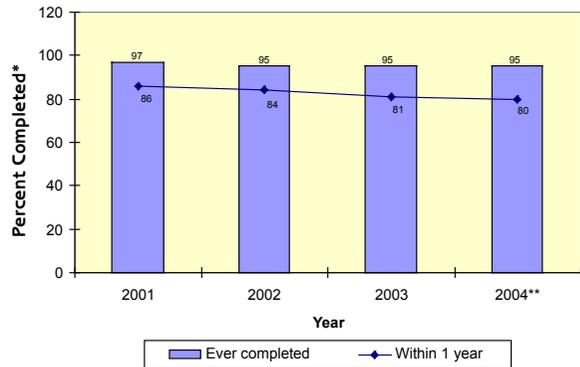
Of the cases alive at the time of diagnosis, 97 percent received an initial regimen consisting of four-drug therapy, which is recommended by the CDC, the American Thoracic Society and the Infectious Diseases Society of America. Treating individuals with a combination of drugs prevents the further emergence of drug resistance.

Proportion of Cases Completing Therapy

Overall treatment completion rates have remained at 95 percent or greater over the past five years (Figure 15). The most common reasons for classification as 'not completed' were that cases moved out of King County (2 percent of cases from 2001-2005, in which case efforts were made to ensure treatment continuation), or died (3 percent of cases from 2001-2005). While the percentage of cases ever completing has remained steady (95 percent) over the past few years, the percent completing within one year has decreased from 86 percent in 2001 to 80 percent in 2004 (Figure 15). 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 (see section 11: Disease Characteristics), TB treatment guidelines (published in 2003) recommend prolongation of TB treatment for those with pulmonary cavities and delayed response to therapy.

The most recent national data are from cases who initiated treatment in 2002; 81 percent of these cases completed treatment within one year.

FIGURE 15: COMPLETION OF TB TREATMENT, 2001-2005



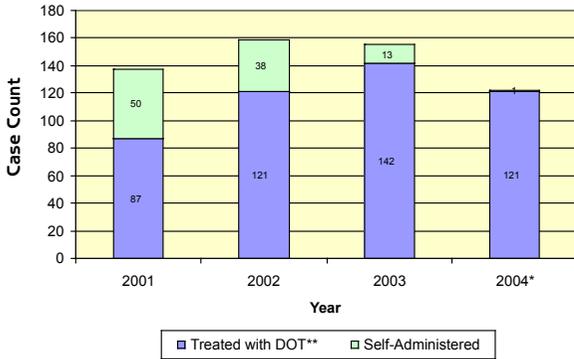
*Per CDC guidelines for summarizing completion of therapy, includes persons alive at diagnosis, with initial drug regimen of 1 or more drugs prescribed, who did not die during therapy. Excludes persons with initial isolate resistant to rifampin and pediatric (aged <15) cases with meningeal, bone or joint, or military disease

**2004 data based on the 117 cases for whom we have treatment completion data at time of the report

Mode of Delivery

Among the cases from 2005 who have already completed treatment (n=45), 86 percent were treated with directly observed therapy (DOT) and only 12% with a combination of DOT and self-administered therapy (Figure 16). The proportion of cases treated with DOT has increased substantially over the past four years (Figure 16). Nationally, 83 percent of cases are on DOT or a combination of DOT and self-administered therapy.

FIGURE 16: TB CASES TREATED WITH DOT, 2001-2004



*2004 data incomplete

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

For the 2005 cases with data available (n=37 at time of this report), TB patients in King County received 29 weeks of DOT on average (median of 26 weeks).

11. Disease Characteristics



In King County in 2005, 48 percent of cases were exclusively pulmonary, 38 percent were exclusively extra-pulmonary, and 14 percent were both pulmonary and extra-pulmonary. Nationally, 71 percent of cases were pulmonary in 2004, 21 percent of cases were extra-pulmonary, and 8 percent of cases were “both.” Reasons for the differences between local and national data may include better ascertainment of extrapulmonary cases (both 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 Africans).

Figure 17 shows the five-year trends in disease sites among King County cases. Compared to national statistics during this time period, King County has consistently had a greater percentage of extra-pulmonary cases.

FIGURE 17: PULMONARY VS. EXTRAPULMONARY SITE OF DISEASE, 2001-2005

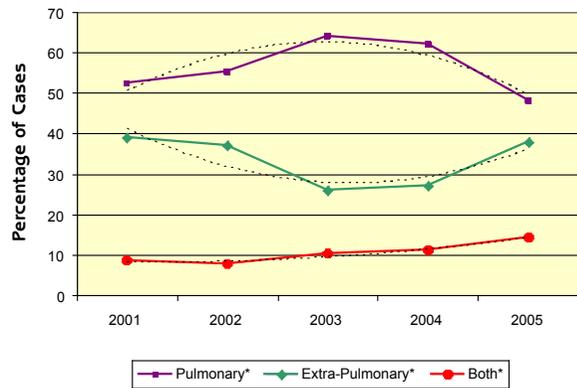


TABLE 8: SITE OF DISEASE, 2001-2005

	2001	2002	2003	2004	2005
Pulmonary	81 (58%)	96 (61%)	108 (70%)	95 (71%)	79 (62%)
Pleural	7 (5%)	15 (9%)	7 (5%)	5 (4%)	9 (7%)
Lymphatic: Cervical	25 (18%)	25 (16%)	17 (11%)	14 (11%)	10 (8%)
Lymphatic: Intrathoracic	1 (1%)	2 (1%)	4 (3%)	4 (3%)	7 (6%)
Lymphatic: Other	3 (2%)	8 (5%)	4 (3%)	3 (2%)	7 (6%)
Lymphatic: Unknown	0 (0%)	0 (0%)	0 (0%)	1 (1%)	0 (0%)
Bone/Joint	7 (5%)	4 (3%)	4 (3%)	2 (2%)	4 (3%)
Genitourinary	3 (2%)	2 (1%)	2 (1%)	0 (0%)	0 (0%)
Miliary	3 (2%)	2 (1%)	2 (1%)	2 (2%)	0 (0%)
Meningeal	0 (0%)	0 (0%)	1 (1%)	2 (2%)	2 (2%)
Peritoneal	5 (4%)	2 (1%)	4 (3%)	3 (2%)	2 (2%)
Other*	4 (3%)	3 (2%)	2 (1%)	3 (2%)	7 (6%)

*Includes Central Nervous System

Table 8 presents more detailed major sites of disease for TB cases from 2001-2005.

Smear and Culture Results

Of the 79 cases with pulmonary TB as their major site of disease, 46 percent were smear positive, and 81 percent had positive cultures. Table 9 shows a more detailed breakdown of these cases. Nationwide, 45 percent of pulmonary cases were smear positive and 69 percent were culture positive. However, 14 percent of cases nationwide had test results that were “not done or unknown” and this may contribute to the lower percentage of culture positive cases nationwide than in King County.

FIGURE 18: SMEAR STATUS OF PULMONARY CASES AT DX, 2001-2004

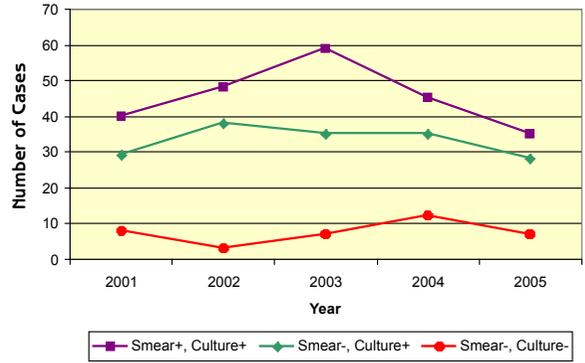


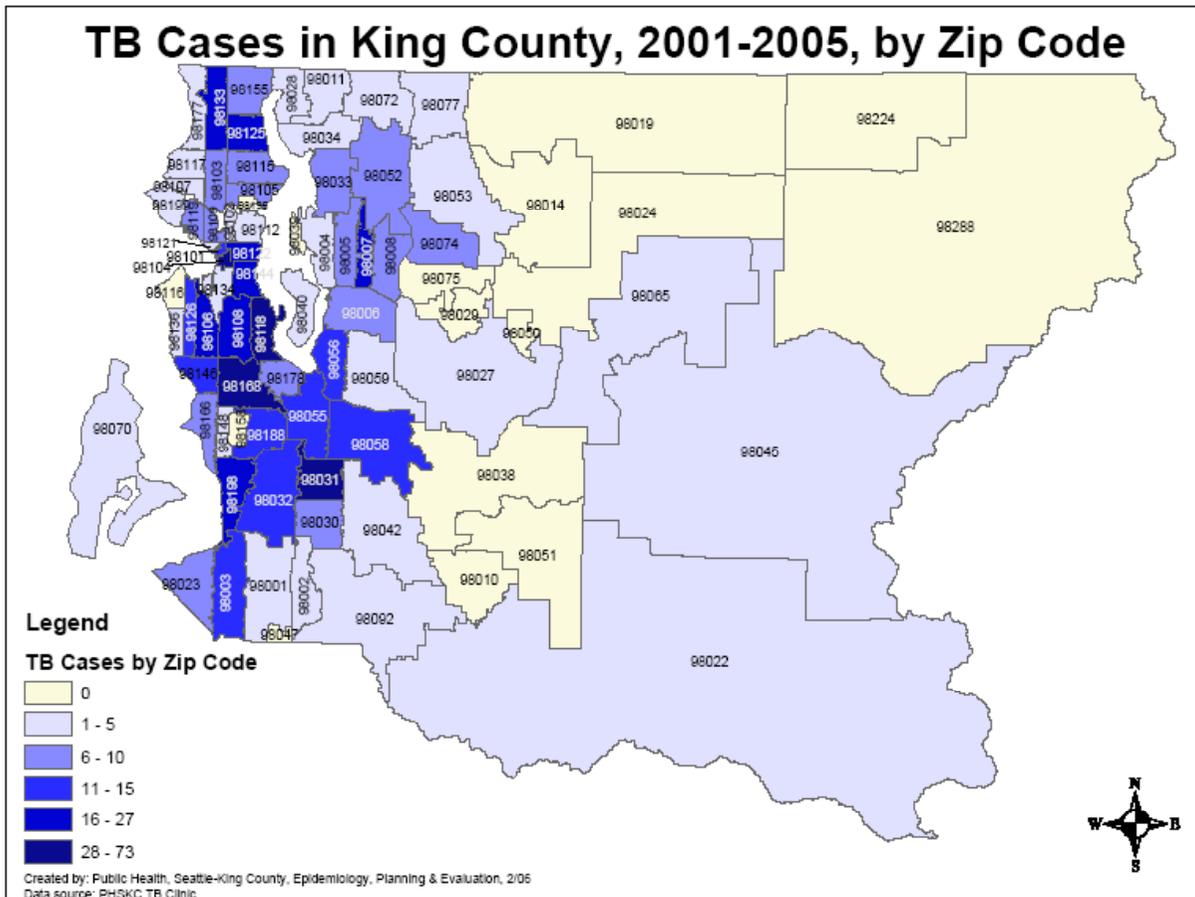
TABLE 9: 2005 SMEAR AND CULTURE RESULTS ON PULMONARY CASES

Smear+, Culture+	Smear-, Culture+	Smear-, Culture-	Not done or unknown	Total
36 (46%)	28 (35%)	8 (10%)	7 (9%)	79 (100%)

Looking at 5-year trends in King County, we see a peak of smear positive, culture positive cases in 2003; this coincides with the time of our homeless outbreak which consisted of primarily smear positive, culture positive cases with matching genotypes (Figure 18).



12. GEOGRAPHIC DISTRIBUTION OF LOCAL TB CASES



As seen above, there is a concentration of cases over the West side of King County,

especially in the areas of Kent and Rainier Valley.

13. TB CASES IN SCHOOLS OR OTHER INSTITUTIONS

Contact investigations are conducted in all congregate settings and institutions where people were exposed to infectious TB cases. These locations typically include schools, colleges, worksites, and nursing homes.

In 2005, the TB Control Program conducted contact investigations at six institutional sites (excluding homeless shelters); four worksites and two schools. Two hundred seventy-four contacts were identified at these institutions and 60 percent of these contacts were located and screened for both active and latent TB. Table 10 summarizes the institutional contact-investigation activities for 2005.

The TB Control Program uses a concentric circle approach to contact investigations; contacts are prioritized based on their duration/intensity of exposure and personal medical characteristics, with those at highest risk tested first. Depending on the results from this closest circle of contacts, the investigation might be expanded to the 'second tier' contacts, and so on. Additional factors which determine the scope of contact investigations include: characteristics (i.e., relative infectiousness) of the case, vulnerability and immunocompetence of the population exposed, and the environmental features of the setting where exposure occurred. The TB Control Program offers medical evaluation for all contacts and treatment if contacts are found to have latent TB infection or TB disease.

TABLE 10: 2005 INSTITUTIONAL INVESTIGATION SUMMARY

	Workplace	School	Total
# Contacts Identified	44	230	274
# Self-identified prior TST* positives	5	8	13
# people with at least 1 TST placed & read	29	126	155
# TST positive (% positive) excluding prior TST positives	13 (45%)	27 (21%)	40 (26%)

*TST: tuberculin skin test

14. THE TB CONTROL PROGRAM MISSION & FUNCTION



Tuberculosis Control Program Mission Statement

Our mission is to prevent the transmission of tuberculosis (TB) within Seattle-King County.

Pulmonary Tuberculosis (TB) is an infectious disease with a highly variable latency period, which spreads by airborne transmission. In the pre-antibiotic era it was fatal for approximately 50 percent of cases, but with the development of effective antibiotic treatment it is preventable and curable. Given that one third of the world's population has latent TB infection and two million people per year die of TB, the disease remains a serious public health threat worldwide. The Seattle-King County TB Control Program views TB control as a public-private partnership, collaborating with other local, state, and national organizations, in a way that provides the residents, workers and students of King County with the best available prevention and treatment services.

The TB Control Program is mandated by Washington State law to perform public health functions related to surveillance, case finding, epidemiologic analysis, and contact tracing.

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

1. Ensure that persons with active TB are found, isolated and fully treated until cured.
2. Ensure that contacts of persons with infectious TB are screened and offered appropriate preventive therapy.
3. Collaborate with a number of public health and community partners, particularly to enhance targeted TB testing and treatment of latent TB infection.
4. Monitor TB trends in Seattle and King County.

Core Activities

Washington State Law requires local health departments to conduct the following core TB control functions:

Assuring completion of treatment of active cases of TB

The highest priority of any TB control program is assuring the complete and appropriate treatment of persons with active tuberculosis. Treatment helps those who are suffering from the disease and stops transmission of TB. Complete and appropriate treatment reduces the chance 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, within 24 hours, 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. The TB Control Program achieves a very high completion rate by considering each patient's individual needs and utilizing a range of incentives and enablers. Rarely, a recalcitrant patient is given a health officer's directive to comply with evaluation and treatment. Violation of these directives are referred to the Prosecuting Attorney for consideration of court orders and/or detention, as necessary.

Contact Investigations

Persons with untreated tuberculosis disease of the lungs can spread TB bacteria to others, although TB is not nearly as infectious as many other airborne diseases, such as varicella, measles, or influenza. Approximately one in three household contacts of a person with infectious TB can be expected to acquire latent TB infection. Since the highest risk of developing active TB disease is in the first two years after acquiring latent TB infection, finding newly infected contacts of persons with active TB disease has a very high priority. Infected persons can be given treatment that 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 60-90 percent.

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 up to 8-10 weeks after an exposure, contacts are re-tested as late as 8-10 weeks after the exposure to determine whether infection has occurred. Only persons with TB infection are usually treated. Highly vulnerable close contacts, such as young children and persons with HIV infection, may be treated regardless of the skin test result when they have been deemed to have had a significant exposure.

Screening and Treatment for Immigrants with Abnormal Chest Radiographs

TB Control Program provides timely evaluation for immigrants with abnormal chest radiographs and assures TB treatment is given appropriately.

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 performs epidemiological analysis to track trends in local patterns of Tuberculosis incidence, drug resistance, and other parameters. Early each spring an annual report on TB in Seattle-King County is published, and case counts are published in each edition of Epi-Log, the monthly epidemiology newsletter of Public Health-Seattle & King County.

The TB Control Program uses TIMS database for program and case management. TIMS is the Tuberculosis Information Management System, developed by the Centers for Disease Control and Prevention for standardized TB data collection and analysis. Case reports are forwarded to the State, then on to the federal program for accurate epidemiological assessments. In addition, the program uses several Access databases for case and contact tracking.

Medical Consultation and Training

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

- General information on screening, diagnosis, and treatment
- Specialty consultation on diagnosis and management of difficult cases
- Collaboration with local graduate medical education programs for orientation to TB case management
- Lectures and in-services for residents, fellows, and community based providers.

Special Projects

Community Partnerships

Community partners provide important collaborations with the TB Control Program. A community TB coalition created during the homeless TB outbreak meets on a quarterly basis. Partnership with the Health Care for the Homeless Network (HCHN), the REACH project, Jail Health, Harborview Medical Center, homeless service sites, and others have been enormously helpful in our searches for homeless TB cases and contacts and in offering additional information and insight on behaviors and patterns that help us refine our approach. Regular meetings of this coalition and a partnership between the TB Control Program and HCHN have also resulted in evaluation of environmental factors that affect the spread of TB in homeless shelters. The county's HCHN contracts with the TB Control Program to collaborate in providing 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 TB infection and disease. The HCHN provides funding for a number of incentives and enablers, such as housing and food, which are used primarily to help persons with TB disease complete their course of treatment while preventing TB transmission to others.

Another area of partnership has been with TB laboratories contracted through the CDC, Washington State Department of Health, Harborview Medical Center, Public Health – Seattle & King County, and Seattle Biomedical Research Institute (SBRI) who use advanced technology to identify TB strains. This collaboration has greatly enhanced our ability to monitor the spread of TB within King County.

Tuberculosis Trials Consortium (TBTC)

The TB Control Program is one of 28 health departments and academic centers worldwide that comprise the TB Trials Consortium. The federal Centers for Disease Control and Prevention (CDC) sponsors the TBTC to conduct large scale, multicenter trials of new diagnostic tools and of new regimens for the treatment of TB infection and disease. Ongoing studies include: comparison of a three-month once-weekly regimen of two drugs to standard nine-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

Tuberculosis Epidemiologic Studies Consortium (TBESC)

The TBESC consists of 21 sites across the U.S. and Canada. These sites collaborate on multiple special studies, thereby providing access to diverse populations at highest risk for tuberculosis and assuring that findings are generalizable across the U.S. and Canada. Currently, the Seattle TBESC site participates in four projects, called 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 U.S.)

TO 12 (Providers Who Care for Foreign-Born Persons)

Additional details on the TBESC can be found on www.cdc.gov/nchstp/tb/TBESC/TOC.htm

TB Educational Course for Healthcare Professionals

In 2005, 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 State TB Advisory Council, the Firland Foundation, the Washington Department of Health, and the Seattle STD/HIV Prevention Training Center to hold the second annual two-day TB educational course for healthcare professionals who provide medical services to high-risk TB clients. This successful collaboration led to further expansion of this course and partnering with the Francis J. Curry National TB Center in San Francisco in 2006.

World TB Day Event

This year, in conjunction with Washington Department of Health TB Control Office, the American Lung Association of Washington, RESULTS, International Community Health Services, the Firland Foundation, Snohomish County and the University of Washington, Public Health – Seattle & King County, sent out key messages and a call to action for World TB Day, March 24th, 2006. The Washington State Governor, the King County Executive and the Seattle City Mayor signed proclamations for World TB Day on March 24.



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 specie.

Directly Observed Therapy (DOT): A health care worker or other designated person watched 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.

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

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

Index case: The first case identified in a family or other defined group.

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 INH and Rifampin.

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 the arm during a TB skin test. In latent TB infection, there will probably be 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.metrokc.gov/health

Public Health - Seattle & King County TB Control Program: www.metrokc.gov/health/tb/

Washington State Department of Health: www.doh.wa.gov/cfh/tb/

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

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

Francis J. Curry National Tuberculosis Center: www.nationaltbcenter.edu

WHO Stop TB Partnership: stoptb.org/

www.who.int/tb/en/

SOURCES AND NOTES FOR THIS REPORT

This report primarily presents data for verified 2005 TB cases. 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 that is submitted by all reporting areas.

All Charts and Tables are from TB Control Program, Public Health – Seattle & King County.

2005 TB morbidity maps are provided courtesy of the Epidemiology, Planning and Evaluation unit (EPE), Public Health – Seattle & King County.

Denominator estimates are courtesy of the HIV/AIDS Epidemiology Unit, Public Health – Seattle & King County, and VISTAPHw software, courtesy of the EPE unit. 2000 Census Data Summary Files used in preparing these population estimates can be found at: www.census.gov/main/www/cen2000.html and quickfacts.census.gov/qfd/states/53/530331k.html

Estimates for overall population, age group and race were also taken from the State of Washington Office of Financial Management at: www.ofm.wa.gov/pop/april1/finalapril12005popofcities.pdf

Washington State data for 2005 are courtesy of the Washington State 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 www.cdc.gov/nchstp/tb/surv/Surv.htm, (Reported Tuberculosis in the United States, 2004) and from www.cdc.gov/mmwr/PDF/wk/mm5410.pdf

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

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

Since TB is a reportable disease, all 2005 cases are assumed to have been included in this report.

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

This report was prepared by:
Eyal Oren and Jennifer Harris
TB Control Program
325 Ninth Ave., Box 359776
Seattle WA 98104