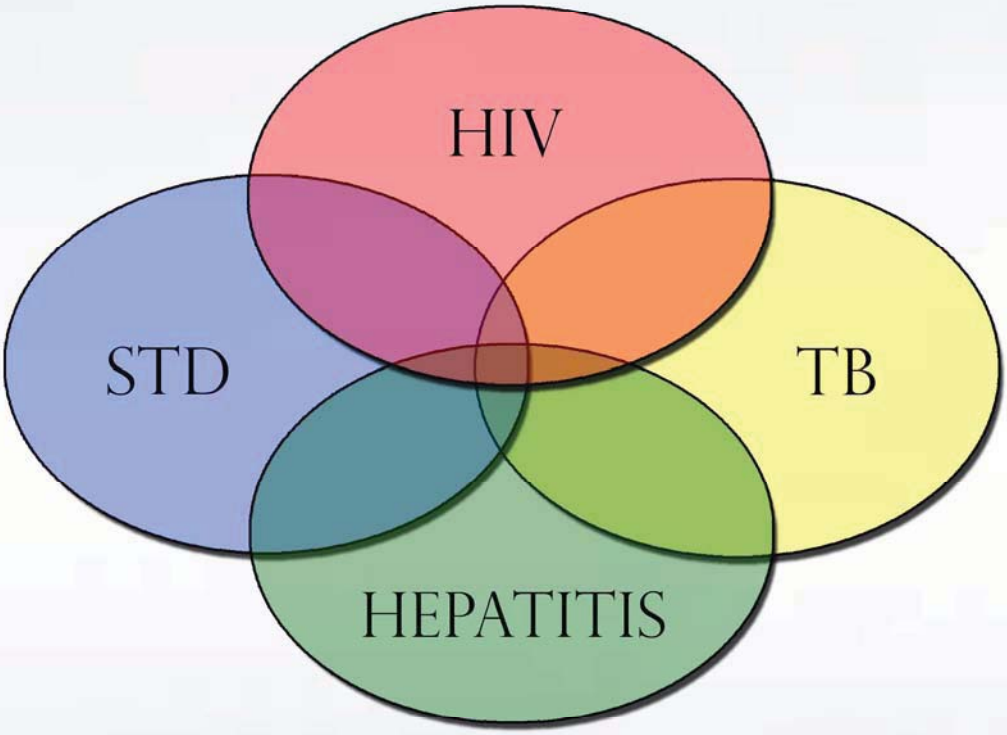
Intersecting Infections of Public Health Significance

The Epidemiology of HIV, Viral Hepatitis, Sexually Transmitted Diseases, and Tuberculosis in King County

2008



Public Health
Seattle & King County

David Fleming, MD, Director

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Executive Summary

This report examines the epidemiology of seven diseases: HIV/AIDS, hepatitis B, hepatitis C, chlamydia, gonorrhea, syphilis, and tuberculosis, as well as co-infections with some of these infections within individuals. These seven diseases have a large impact on public health, constituting 85% of all infectious disease reports in King County. The simultaneous epidemics of these infections has been described as "syndemic" because many of these infections may occur in the same populations, in response to the same social and demographic conditions, and as a result of similar behavioral or other risk factors. The Centers for Disease Control and Prevention's (CDC) National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention has identified integrated disease surveillance as a strategic imperative, recognizing that both national and local public health often fail to respond to the interconnectedness between these seven diseases. As of 2010, the HIV/AIDS and STD programs at Public Health were combined into a single program, which will facilitate future integrated surveillance and data analysis activities.

Using funding from CDC, Public Health staff from the HIV, STD, TB and Communicable Disease Epidemiology & Immunization programs collaborated to develop this report and to identify and describe concurrent co-infections. While surveillance data are generally population-based, data quality for these seven infections varies in accuracy and representativeness. In addition to case reporting data, we included information from other special surveillance and research projects to complement our findings. To facilitate comparison, we present data for each infection in a similar format, and include maps that show their geographic impact.

Groups known to be disproportionately affected by selected infectious diseases, King County

Group	HIV	HBV	HCV	Chlamydia	Syphilis	Gonorrhea	TB
MSM	✓	‡	◇	✓	✓	✓	
IDU	✓	‡	✓				
Hispanic	✓			✓		✓	
Asian/PI		✓					✓
Native Am				✓		✓	✓
Black	✓	✓	✓	✓	✓	✓	✓
Central & South Seattle	✓	✓	✓	✓	✓	✓	✓
S. King Co.	✓	✓	✓	✓		✓	✓

‡ No King County surveillance data available, but known to be at increased risk.
◇ Among HIV-infected MSM.

The intent of this report is to focus attention on the affected populations and geographic areas in addition to the individual infections. Although differences exist in the epidemiology of these seven infections, there are similarities in the groups affected, as seen in the table below.

Geographic areas: Although there were some variations in the geographic distribution of cases, the highest concentration of the seven infections occurred in the areas of central and south Seattle and south King County.

Age groups: Younger age groups were disproportionately affected by HIV, gonorrhea, chlamydia, syphilis, hepatitis B (HBV), and tuberculosis (TB).

Racial and ethnic groups: People of color were disproportionately affected: Blacks by all seven infections, Hispanics by HIV and chlamydia, and Asian/Pacific Islanders by HBV and TB.

Persons born abroad: Foreign-born persons were disproportionately affected by HIV and TB.

Men who have sex with men: Men who have sex with men (MSM) were disproportionately affected by HIV, gonorrhea, syphilis, chlamydia and by co-infections with HIV and gonorrhea and HIV and syphilis.

Injection drug users: Injection drug users (IDU) were disproportionately affected by HIV, hepatitis C (HCV) and by co-infection with HIV and HCV.

It is important to consider the combined impact of these infections on the affected communities when planning and delivering services. In King County we are fortunate to have Public Health facilities, including the TB and STD clinics, the Needle Exchange Program, and Community Health Centers that provide integrated prevention and health services to populations disproportionately impacted by these seven infections. The STD clinic, for example, not only provides screening and treatment for STDs, but also HIV, HBV and HCV testing, and hepatitis A and B vaccinations. Unfortunately, the Public Health clinics and the Needle Exchange Program are facing severe budget cuts at a time of growing need for low-cost services to those most in need. This is an example of the need for a dedicated, stable revenue source to sustain essential public health functions.

Chapter I. Introduction

This report describes the epidemiology of HIV/AIDS, gonorrhea, syphilis, chlamydia, hepatitis B (HBV), hepatitis C (HCV), and tuberculosis (TB), as well as co-infections with some of these infections in individuals, in King County, Washington. These infectious diseases have a significant impact on public health in King County. While the number of reported cases varied widely (from 161 TB cases to 5,682 chlamydia cases), together they represented 85% of all infectious disease cases reported in King County in 2007 (**Table 1**).

Co-infection with some of these infections occurs because they affect similar populations, share transmission routes and social and/or sexual networks, and in some instances, infection with one enhances transmission of a second infection. Infection with a sexually transmitted disease (STD), for example, facilitates transmission and acquisition of HIV. Co-infection with HIV and HCV causes more rapid progression to HCV-related liver disease and increased risk of cirrhosis. The immune suppression caused by HIV in TB-infected persons increases the risk of development of clinical, systemic, and infectious TB.

The seven infections covered in this report are part of more than 60 infectious diseases that are reportable to local public health surveillance programs and to the Washington State Department of Health. The overall purpose of surveillance is to:

- Identify unusual cases and clusters of illness requiring public health investigation or action
- Ensure appropriate diagnosis, testing and treatment for cases with public health significance
- Ensure that persons exposed to infectious diseases (contacts) receive appropriate counseling and preventive treatment
- Implement and facilitate disease control measures to prevent the spread of infection in communities, schools, workplaces, and healthcare facilities
- Coordinate public health surveillance and disease control measures with local healthcare professionals and facilities
- Provide information for longer-term planning of prevention, healthcare, and social services.

There are both advantages and disadvantages to using surveillance data for these integrated analyses. To the extent that county-level data are increasingly maintained in computer databases, case-matching across programs becomes more feasible. Surveillance data are usually population-based, which makes it possible to compare rates of disease, but data quality varies between programs, as some diseases, especially those with CDC-sponsored surveillance programs, such as HIV and syphilis, are more intensively investigated. Additionally, when screening recommendations exist for asymptomatic cases, such as for chlamydia in

Table 1. Notifiable infectious disease case reports, King County 2007

Notifiable infection	Number of reported cases	Percent of all reported cases
HIV/AIDS	404	3.3%
Chlamydia	5,682	45.9%
Gonorrhea	1,409	11.4%
Syphilis	194	1.6%
Hepatitis B (acute and chronic)	862	7.0%
Hepatitis C (acute and chronic)	1,766	14.3%
Tuberculosis	161	1.3%
Sub-total	**10,478**	**84.7%**
Other notifiable infections	1,890	15.3%
Total	**12,368**	**100%**

young women, such diseases are reported much more completely for some groups than others. Also, special studies here in King County have revealed that reporting compliance varies by disease.

Although there are some differences in the epidemiology of these seven infections, racial minorities, younger people, immigrants, sexual minorities, and marginalized and stigmatized populations are all disproportionately affected by one or more of them (**Table 2**). For example, the majority of syphilis and HIV cases and a high percentage of gonorrhea cases occurred in men who have sex with men (MSM), and most of the reported HCV cases were among injection drug users (IDU). With regard to race/ethnicity, Blacks comprise about six percent of the King County population (**Table 4, Chapter II**) but, with the exception of syphilis (with 11%), between 21% and 33% of all infections were among Blacks. Asian/Pacific Islanders are about 13% of the population, but 54% of HBV cases and 49% of TB cases were among Asian/Pacific Islanders.

Some of these infectious diseases also contribute to premature deaths in King County. Data from death certificates were used to identify deaths related to HIV, HBV, or HCV, including deaths attributed to one of these infections or deaths where one of these infections was listed as a contributing cause of death. Between 2003 and 2007, HIV-, HBV-, and HCV-related deaths comprised 1.6% of all deaths in King County. However, among the deaths related to these infections, a much higher percent occurred at an age younger than 65 compared to deaths overall (**Table 3**).

Table 2. Total reported cases of HIV, chlamydia, gonorrhea, syphilis, hepatitis B and C, and tuberculosis, by demographic and exposure characteristics, King County 2005-2007

	HIV[a]	Chlamydia	Gonorrhea	Syphilis	HBV[b]	HCV[b]	TB
No. of reported cases	1,064	17,987	6,128	598	2,451	5,292	391
Reported cases per 100,000/yr	19	327	111	11	45	96	7
% Seattle residents	78%	55%	70%	87%	53%	65%	65%
% Foreign-born	22%	NA	NA	NA	NA	NA	79%
% 18-34 years old	32%	76%	63%	33%	37%	13%	35%
% Male	88%	34%	62%	98%	53%	63%	62%
% Female	12%	66%	38%	2%	47%	37%	38%
% White	58%	37%	37%	79%	18%	63%	23%
% Black	21%	23%	33%	11%	23%	23%	26%
% Hispanic	13%	5%	3%	6%	2%	6%	3%
% Asian/Pacific Islander	6%	8%	4%	3%	54%	5%	49%
% MSM	69%	6%	26%	95%	NA	NA	NA
% IDU	5%	NA	NA	NA	NA	89%	NA

[a] HIV cases diagnosed 2005-2007 and reported by 6/30/2008.

[b] Information on race/ethnicity and suspected route of exposure was missing from a large proportion of HBV and HCV cases. The percentages are based on cases reported with this information.

NA=Not available or not applicable.

Table 3. King County deaths 2003-2007

Age at death	All deaths		HIV-related deaths[a]		HBV-related deaths[a]		HCV-related deaths[a]	
	N	%	N	%	N	%	N	%
<65 years	14,687	26%	334	94%	48	69%	383	78%
≥65 years	42,684	74%	21	6%	22	31%	106	22%
Total	**57,371**	**100%**	**355**	**100%**	**70**	**100%**	**489**	**100%**

[a] These infections were listed on death certificates as cause of death or contributing to cause of death.

Figure 1 shows mortality trends related to infections with HIV, HBV, and HCV from 1999 to 2007. While deaths among persons with HIV have declined dramatically since the introduction of highly active antiretroviral therapy (HAART) in 1996 and have remained fairly stable since then (with the exception of a brief increase in 2003), deaths related to HCV increased over this period. Deaths related to HBV remained flat during this time period.

The co-occurrence of these seven infections in groups with similar demographic, geographic, social and/or sexual networks, and behavioral characteristics also offers opportunities for coordinated prevention and treatment approaches. Comparing the epidemiology of these infectious diseases and conducting analyses of combined data may provide information to help target prevention, control and treatment efforts.

Data for this report were collected by the Public Health HIV/AIDS, STD, TB, and Communicable Disease Epidemiology & Immunization Programs. Many of the tables and figures in this report are included in reports published by these programs. For more information, please see the following Public Health resources:

HIV:
2008 HIV/AIDS Epidemiology Profile for Community Planning at:
www.kingcounty.gov/healthservices/health/communicable/hiv/epi/profile.aspx

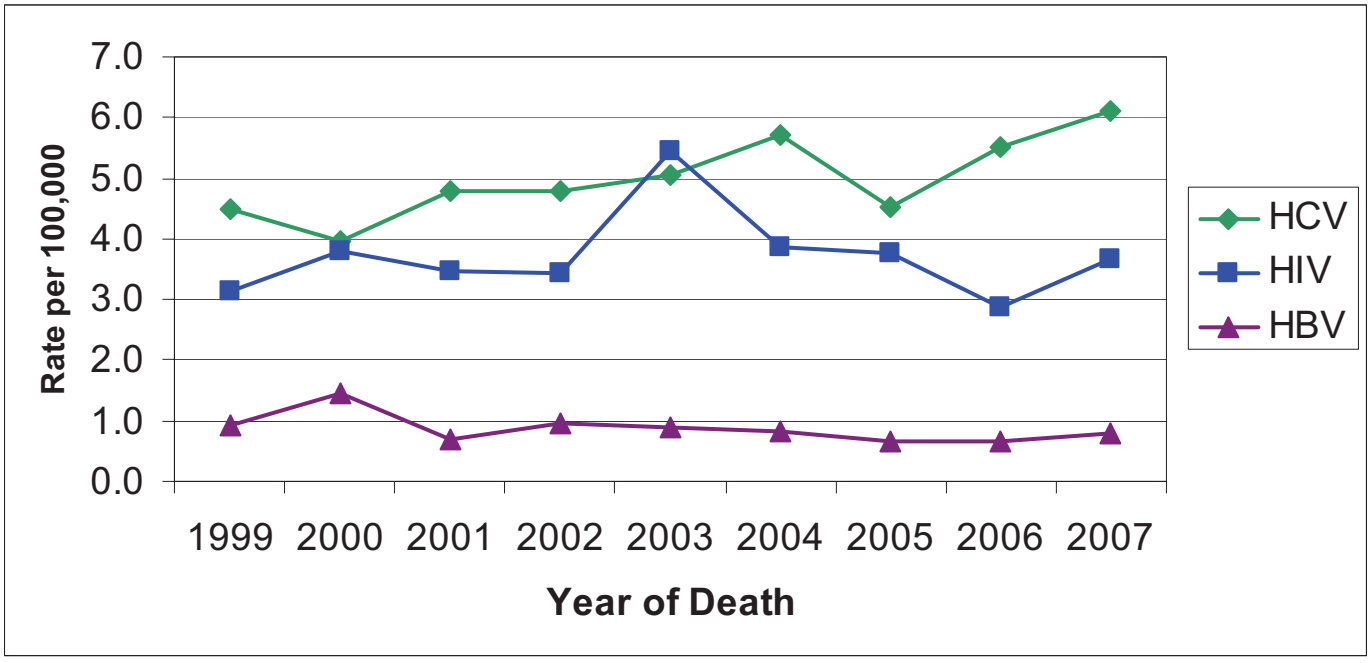
HIV/AIDS Epidemiology Semi-annual Reports at:
www.kingcounty.gov/healthservices/health/communicable/hiv/epi/reports.aspx

STDs:
2007 and 2008 Sexually Transmitted Diseases Epidemiology Reports at:
www.kingcounty.gov/healthservices/health/communicable/std/statistics.aspx

HBV and HCV:
2007 and 2008 Communicable Disease Summaries at:
www.kingcounty.gov/healthservices/health/data/communicable.aspx

TB:
2007 and 2008 Annual Tuberculosis Reports at:
www.kingcounty.gov/healthservices/health/communicable/TB/facts.aspx

Figure 1. Rates of death related to HIV, hepatitis B, and hepatitis C[a], King County 1999-2007



[a] These infections were listed on death certificates as cause of death or contributing to cause of death.

Chapter II. Description of King County

Located on Puget Sound in Western Washington, King County (estimated 2007 population 1,861,300) is home to 29% of Washington's population and ranks as the 13th most populous county in the country. It spans an area of 2,134 square miles. Thirty-one percent of King County residents reside in Seattle and 49% reside in the 38 incorporated suburban cities (**Figure 2**).

The ports of Seattle and Tacoma make Puget Sound the second largest combined loading center in the U.S. The Seattle-Tacoma International Airport is the largest airport in the Pacific Northwest. Interstate 5 runs from Tijuana, Mexico along the west coast of the U.S. and through King County to Canada. Interstate 90 runs from Boston to Seattle, crossing Washington state from east to west.

King County's population is 6% Hispanic, 74% White, 13% Asian/Pacific Islander, 6% Black, and 1% Native American or Alaska Native (**Table 4**). Between the 1990 and 2000 census, the population grew about 18% while the foreign-born population nearly doubled to comprise 15% of the population in 2000. An estimated 18% of King County residents speak a language other than English at home (2000 census). King County has an aging population, with the median age near 36 and people under age 18 constituting only 21% of the county's population. People living in King County are highly educated; 90% of persons 25 years of age or older have a high school education, and 40% have at least a bachelor's degree (2000 census). The median King County household income is $66,969 and 10% of the population lives in households with incomes below the poverty level (2007 estimates).

We include maps depicting disease case rates by zip code in this report. For that purpose we use a map that shows the western part of King County, where the majority of the population resides (**Figure 3**).

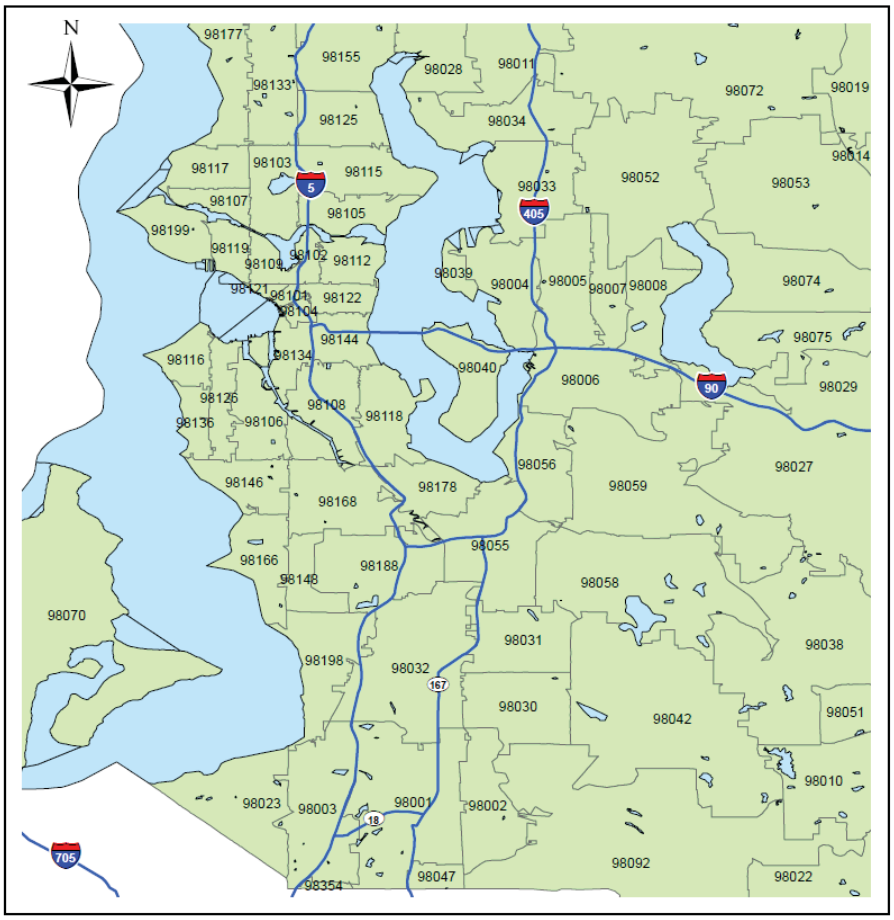
Table 4. Population estimates by sex, race, and age group, King County 2007[a]

	Male N=927,057		Female N=934,243		Total N=1,861,300	
Race and ethnicity	**N**	**%**	**N**	**%**	**N**	**%**
White non-Hispanic	686,807	74%	697,442	75%	1,384,249	74%
Black non-Hispanic	57,734	6%	55,020	6%	112,754	6%
Hispanic	61,263	7%	51,636	6%	112,899	6%
Native American/Alaska Native	8,167	1%	8,267	1%	16,434	1%
Asian/Pacific Islander	113,086	12%	121,878	13%	234,965	13%
Age						
Age 0 - 17 years	201,309	22%	191,899	21%	393,209	21%
Age 18 - 24 years	92,642	10%	91,209	10%	183,851	10%
Age 25 - 34 years	152,808	17%	142,900	15%	295,709	16%
Age 35 - 44 years	148,649	16%	140,932	15%	289,581	16%
Age 45 - 54 years	145,846	16%	147,708	16%	293,554	16%
Age 55 - 64 years	100,966	11%	103,616	11%	204,582	11%
Age 65 and over	84,836	9%	115,978	12%	200,814	11%

[a] 1990-25507 Population Estimates: PopulatioPublic Health Assessment, Washington State Department of Health, December 2007.

Figure 2. Map of King County

Figure 3. Map of zip codes in west King County



Chapter III. Human Immunodeficiency Virus (HIV)

Background

According to estimates by the World Health Organization and the Joint United Nations Program on HIV/AIDS, 33 million people worldwide were living with HIV/AIDS at the end of 2007. That same year, some 2.7 million people became newly infected, and 2 million died of AIDS, including 270,000 children. Two-thirds of all HIV-infected people live in sub-Saharan Africa.

The Centers for Disease Control and Prevention (CDC) estimates that 1.1 million people in the U.S. are currently infected with HIV.[1] The majority (65%) are people of color, more than half are men who have sex with men (MSM) (53%) or MSM who inject drugs (MSM-IDU) (4%), and 12% are heterosexual IDU. Approximately 56,300 new HIV cases occurred in 2006.[2] The estimated number of AIDS cases diagnosed in 2006 was 36,828 (12 cases per 100,000).

As of 2007, approximately 7,500 King County residents were living with HIV or AIDS. Approximately 22% of MSM/IDU were infected, compared with 14% of MSM who do not inject, and 3% of heterosexual IDU. Overall, fewer than 0.1% of heterosexuals who do not inject drugs were infected, although rates were as high as 1.6% among foreign-born Blacks, whose risk is largely heterosexual. The number of King County residents diagnosed with HIV has recently declined to approximately 330 each year.

Surveillance systems and reporting requirements

In Washington state healthcare providers and laboratories are required to report HIV infections, AIDS cases, CD4 lymphocyte counts, and HIV viral load tests to the local health jurisdiction. HIV/AIDS surveillance is important not only for assessing the level of disease in the population, but can also provide useful information to planners of prevention and control programs. The clinical and demographic information about people who have HIV and AIDS reported to Public Health is probably representative of all infected persons. The difference between the number of actual reports and the estimated number of HIV cases in King County is primarily due to undiagnosed cases.

Clinical aspects of HIV

Infection with HIV generally causes progressive HIV disease. HIV infection causes AIDS, and everyone with AIDS has HIV infection. Acute HIV infection is characterized about half of the time by one or more of the following non-specific symptoms: decreased appetite, fatigue, fever, headache, malaise, swollen lymph nodes, muscle stiffness or aching, rash, sore throat, and ulcers of the mouth and esophagus. These generic symptoms can last from a few days to four weeks, and then subside.

After acute infection, the initial mild, symptom-free phase of HIV disease can last for several years, but clinical symptoms appear after HIV has destroyed most of the cellular immune system. When a type of immune cell called the CD4 lymphocyte drops below 200 cells/μL (or 14%), or any of 26 opportunistic illnesses are diagnosed, the advanced disease is called acquired immune deficiency syndrome or AIDS.

In the pre-antiretroviral era and before development of potent highly active antiretroviral treatment (HAART) regimens, opportunistic illnesses were the primary cause of serious morbidity and death in HIV-infected people. The primary goals of treatment are to maximally suppress HIV viral load, reduce HIV-associated morbidity and prolong survival, restore and preserve immunologic function, and decrease HIV transmission. HIV suppression with HAART may also decrease inflammation and immune activation thought to contribute to higher rates of cardiovascular and other co-morbidities reported in HIV-infected cohorts. Achieving maximal viral suppression in initial therapy requires the use of genotypic testing-guided therapy including at least two, and preferably three, active drugs from multiple antiretroviral drug classes. HIV infection cannot be eradicated with current antiretroviral regimens, and most persons living with HIV eventually require lifelong treatment.

[1]CDC MMWR. 2008 / 57(39);1073-1076
[2]Hall HI et al. Estimation of HIV incidence in the United States. JAMA 2008;300:520-9.

Transmission

HIV infections are acquired primarily through sexual contact, exposure to blood through use of contaminated injection drug use equipment, from HIV-infected mothers to their infants, and before screening of the blood supply, through transfusion. Transmission also rarely occurs from exposure in the healthcare setting in developed countries. Persons with recently-acquired HIV are at highest risk of transmitting HIV due, in part, to high viral loads in early infection.

Prevention

An estimated 10-20% of persons with HIV in King County are unaware of their HIV-positive status compared to an estimated 20-21% nationwide. Early diagnosis of HIV infection is important in order to link newly-diagnosed persons to clinical and prevention services so they can access healthcare and take steps to prevent infecting others. In 2006 the CDC updated HIV testing recommendations to include universal one-time HIV screening in all healthcare settings for all persons aged 13 to 64 years. The CDC also recommends HIV screening for pregnant women, for children of infected mothers, and for tuberculosis (TB) and sexually transmitted disease (STD) patients, as well as more frequent screening for persons at higher risk for HIV, including MSM and IDU, because of their increased risk of infection as documented in this report. Public Health recommends repeat HIV and STD testing every three months for anyone diagnosed with gonorrhea, chlamydia or early syphilis in the past year, and for MSM with a history of unprotected anal intercourse with a partner of unknown or HIV-positive status and for MSM who report methamphetamine use in the last year.

Currently, no vaccine is available to protect people from becoming infected with HIV. Prevention relies on HIV screening of blood products, adherence to standard precautions in medical settings, HIV counseling and testing, antiretroviral treatment, behavioral interventions, and structural interventions, such as needle exchange programs and legalized pharmacy syringe sales.

Increasing emphasis is being placed on initiating antiretroviral treatment at earlier stages of infection as a way to lower viral load and further reduce the risk of sexual transmission. Post-exposure prophylaxis (PEP) is effective if started shortly (within 72 but ideally within four hours) after occupational or non-occupational substantial exposures. Clinical trials are currently underway to examine the effect of pre-exposure prophylaxis (PrEP) on HIV acquisition.

The CDC 2009 Compendium of Evidence-Based HIV Prevention Interventions lists 69 community, group and individual level behavioral interventions for MSM, drug users, heterosexual adults and youth.[3]

[3]www.cdc.gov/hiv/resources/reports/hiv_compendium/index.htm

HIV in King County

Findings from case surveillance

In 2007, the Washington State Department of Health estimated that 11,000 to 12,000 Washington residents, including 7,200 to 7,800 from King County, were living with HIV or AIDS. New HIV diagnoses reported in King County totaled 350-400 each year 1998 to 2004, but declined to 330 diagnoses per year between 2005 and 2007. In recent years there have been about 100 HIV-related deaths annually. The reported number of King County residents living with HIV/AIDS is increasing by 4-5% per year. **Figure 4** displays the number of people diagnosed and living with HIV, but is limited to cases that have been reported to Public Health. It is estimated that an additional 750 to 1,500 HIV-infected people have not yet been diagnosed. The peak of about 700 new HIV diagnoses in 1990 is based on reported data, some of which were collected retrospectively; it is more likely that new HIV infections peaked in King County in the early 1980s, before a diagnostic test became available in 1985.

Table 5 presents the number of reported cases by demographic characteristics. Ninety percent of people were presumed to be living with HIV or AIDS in King County as of 6/30/08 were male. Most, 68%, were White, 17% Black, 9% Hispanic, 3% Asian/Pacific Islander (A/PI), and 1% Native American & Alaska Natives (NA/AN). Eighty-one percent were born in the U.S. or its territories, 15% were foreign-born, and the birthplace was not reported for 5%. Compared with non-Hispanic Whites, the rates of HIV infection were four times higher among foreign-born Blacks, twice as high among U.S.-born Blacks and 1.5 times higher among NA/AN (data not shown).

Among cases with known exposure, 74% were MSM, 9% were MSM/IDU, 6% were IDU, 10% were likely infected heterosexually, and 1% each were born to HIV-infected mothers or received infected blood products (mostly prior to the routine HIV screening of the blood supply in 1985 in the U.S.). Seven percent of cases had no reported behavioral exposure to HIV.

Figure 4. New diagnoses of HIV, and persons reported living with HIV infection, King County 1986-2007 (reported through 6/30/2008)

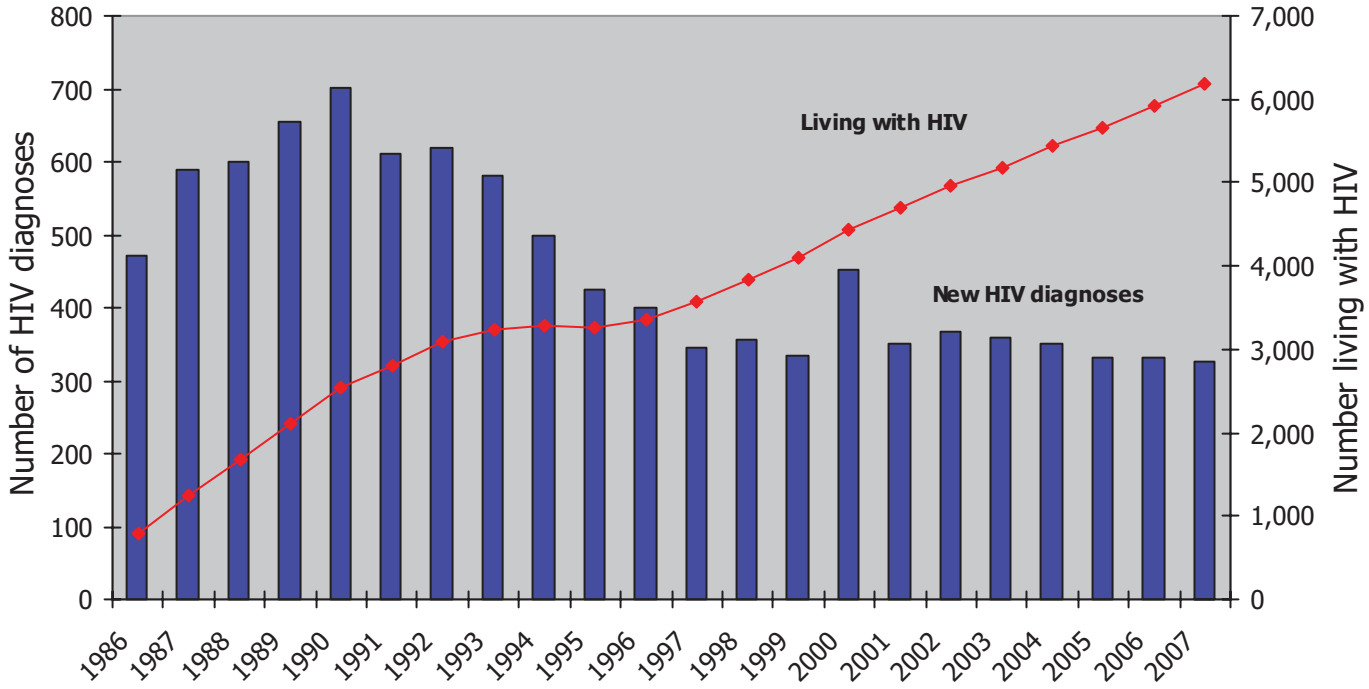


Table 5. Demographic characteristics of residents presumed living with HIV or AIDS, King County (reported through 6/30/2008)

	Actual reports N=6,283	
	N	%
Race/ethnicity		
White, not Hispanic	4,299	68%
Black, not Hispanic	1,041	17%
Foreign-born Black	*361*	*6%*
Native-born Black	*650*	*10%*
Hispanic	593	9%
Asian/Pacific Islander	197	3%
Native American/Alaska Native	86	1%
Multiple Race	54	1%
Unknown Race	13	<1%
Sex & race/ethnicity		
Male	5,657	90%
White	4,071	65%
Black	740	12%
Hispanic	549	9%
Asian/Pacific Islander	174	3%
Native American/Alaska Native	61	1%
Multiple or unknown race	62	1%
Female	626	10%
White	228	4%
Black	301	5%
Hispanic	44	1%
Asian/Pacific Islander	23	<1%
Native American/Alaska Native	25	<1%
Multiple or unknown race	5	<1%
HIV exposure category		
Men who have sex w/men (MSM)	4,344	69%
Injection drug user (IDU)	342	5%
MSM/IDU[a]	531	9%
Blood product exposure	36	<1%
Heterosexual contact[b]	601	10%
Perinatal exposure	21	<1%
Undetermined/other	408	7%
Current age as of 6/30/2008		
0-19 years	28	<1%
20-24 years	63	1%
25-34 years	734	12%
35-44 years	2,186	35%
45-54 years	2,269	36%
55-64 years	841	13%
65 years and over	162	3%
Place of birth		
Born in U.S.	5,083	81%
Born outside U.S.	912	15%
Unknown birthplace	288	5%

[a] Includes all MSM who have ever injected drugs.
[b] Includes presumed heterosexual cases (women who do not inject drugs but have had sex with men whose HIV status and risk factors are unknown).
Some categories may not add up to total due to missing data.

Figure 5 maps the average annual rates of new HIV/AIDS diagnoses by zip code in King County from 2005 to 2007. The map represents only the western, more densely-populated areas of the county; few cases occurred in the zip codes not shown on the map. The highest concentration of cases occurred in the central areas of Seattle, with progressively lower rates in zip codes further from the city center. However, the geographic residence of people with new diagnoses of HIV is shifting away from Seattle. The proportion of newly-diagnosed cases among Seattle residents dropped from 84% to 75% of newly-diagnosed cases between 1999 and 2007, while residents outside Seattle comprise an increasing proportion. South King County residents increased from 10% of new cases in 1999 to 16% of new cases in 2007, and East/North King County residents increased from 6% to 9% of new cases.

Figure 5. Average annual HIV/AIDS case rates by zip code, King County 2005-2007

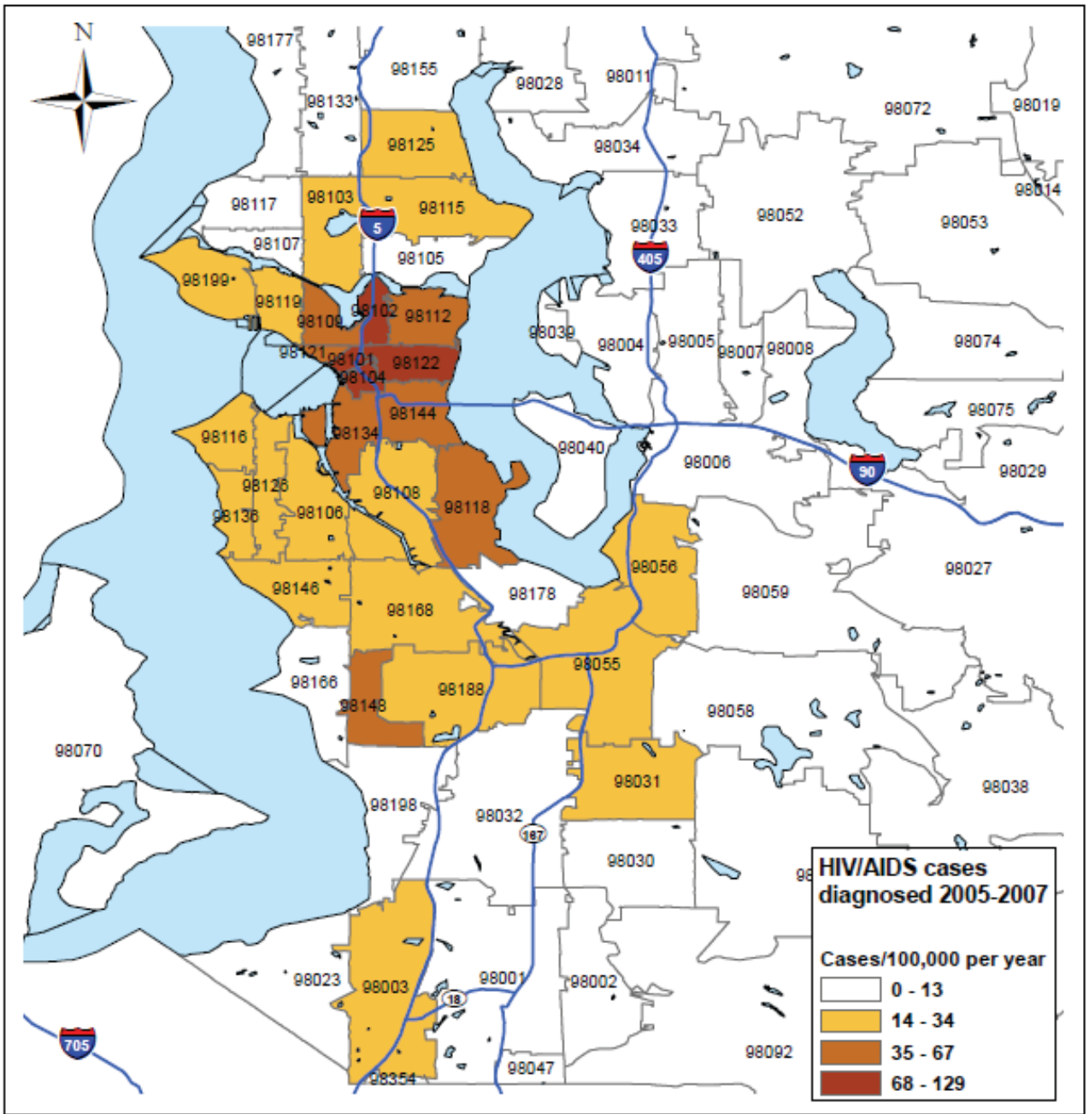


Table 6. Residents presumed living with HIV/AIDS by gender, race or ethnicity, and HIV exposure category, King County (reported as of 6/30/2008) N=6,216[a]

HIV exposure category	White[b]		Black[b]		Hispanic		Asian/PI[b,c]		Native Am/ AN[b,d]	
	N	%	N	%	N	%	N	%	N	%
Male										
Men who have sex w/ men (MSM)	3,378	83%	365	49%	399	73%	128	74%	33	54%
Injection drug use (IDU)	111	3%	70	10%	30	6%	5	3%	6	10%
IDU/MSM	420	10%	40	5%	37	7%	5	3%	17	28%
Heterosexual contact	47	1%	106	14%	24	4%	5	3%	1	2%
Other[e]	17	<1%	8	1%	2	<1%	2	1%	0	0%
Unknown exposure[g]	98	2%	151	20%	57	10%	29	17%	4	7%
Male total	**4,071**	**100%**	**740**	**100%**	**549**	**100%**	**174**	**100%**	**61**	**100%**
Female										
Injection drug use (IDU)	61	27%	37	12%	3	7%	1	4%	14	56%
Heterosexual contact[f]	145	64%	211	70%	32	73%	16	70%	10	40%
Other[e]	7	3%	16	5%	4	9%	1	4%	0	0%
Unknown exposure[g]	15	7%	37	12%	5	11%	5	22%	1	4%
Female total	**228**	**100%**	**301**	**100%**	**44**	**100%**	**23**	**100%**	**25**	**100%**
Total	**4,299**	**69%**	**1,041**	**17%**	**593**	**10%**	**197**	**3%**	**86**	**1%**

[a] Does not include 54 persons with multiple race and 13 persons with unknown race.
[b] And not Hispanic. All race and ethnicity categories are mutually exclusive.
[c] Asians, Native Hawaiians, and other Pacific Islanders.
[d] Native American or Alaska Native.
[e] Includes blood product exposure and perinatal exposure.
[f] Includes presumed heterosexual cases (females who deny injection drug use but have had sexual intercourse with a man whose HIV status and HIV risk behaviors are unknown).
[g] Includes cases with no reported risk factor.

While the distribution of exposure categories differs by race/ethnicity, gender, and birth country, 97% of all male cases were MSM, IDU, or foreign-born Blacks. MSM exposure accounts for the majority (49-83%) of HIV cases among men of all races (**Table 6**). MSM/ IDU is the second most common exposure among White men (10%), Hispanic men (7%), and NA/AN men (28%). Foreign-born Blacks make up 26% of cases among Black men and 55% of cases among Black women; most of these cases are due to heterosexual transmission.

The vast majority of HIV-infected women were either IDU or had a heterosexual risk (**Table 6**). Heterosexual risk cases are those with a known risk factor (with partners known to be HIV-infected, partners who were IDU, partners who are bisexual men, or partners with hemophilia), and females with no known risk factor but heterosexual intercourse. Heterosexual exposures accounted for the majority of HIV cases among White (64%), Black (70%), Hispanic (73%), and A/PI (70%) women. However, among NA/AN women with HIV, IDU was the most common risk behavior (56%).

Only moderate shifts have occurred in the proportion of persons newly diagnosed with HIV infection among different groups over the past nine years. Between the three-year periods 1999-2001 and 2005-2007, the proportion of cases increased among Hispanics (from 10% to 13%), A/PI (from 3% to 6%), and in persons over age 50 (from 7% to 11%). The proportion of total cases decreased for Whites (from 64% to 57%) and for those age 30-39 at the time of diagnosis (from 46% to 36%).

Over the past decade, the population of people living with HIV has aged, as HIV has become a chronic infection since the introduction of highly active antiretroviral therapy (HAART). In 1998, half of individuals living with HIV were under age 40; in 2006, the median age was 44. As a result of delayed progression of HIV to AIDS, the age of persons first diagnosed with AIDS has shifted toward older age groups, and the average age is gradually increasing.

AIDS diagnoses and deaths over time

As of December 31, 2007, a total of 7,765 King County residents had been diagnosed with AIDS and 4,254 (55%) had died (**Figure 6**). New diagnoses of AIDS peaked in 1993 at 611, declined to about 250 cases each year from 1998 through 2004, and declined again to about 200 diagnoses per year in 2007. The number of HIV/AIDS deaths peaked in 1995 at 455 deaths, and declined to about 100 deaths annually 1997 through 2007.

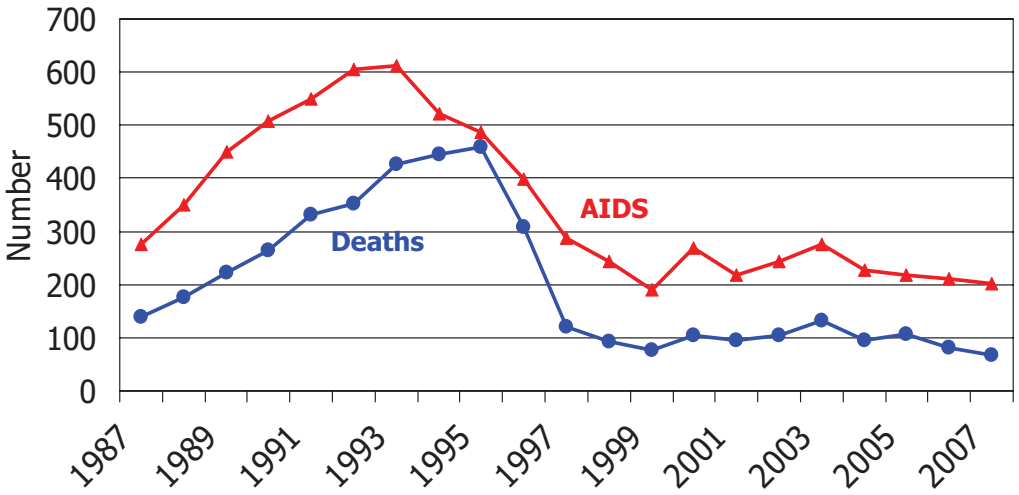
With the introduction of HAART in 1996, a dramatic decline in deaths and delay in progression to AIDS began. In addition, effective prevention for opportunistic infections (such as *Pneumocystis* pneumonia) and better monitoring of HIV disease progression (such as by assays of HIV viral load and drug resistance) may have contributed to the decrease in numbers of AIDS diagnoses and deaths.

Local trends in new AIDS cases and deaths have been roughly level since 2004 for the following reasons: some people do not receive effective treatments because their HIV infection is diagnosed late in the course of the disease, they have problems accessing treatment, or they refuse treatment. Other treatment failures are due to problems with taking medicines, adverse effects, or the development of HIV strains resistant to currently available antiretroviral drugs. Finally, as people with long-standing HIV infection age, they die more frequently of conditions unrelated to their HIV infection. **Figure 6** includes deaths among HIV-infected persons from all causes, not only from AIDS.

While the numbers of new AIDS diagnoses and deaths have declined since the 1980s, more King County residents than ever are living with AIDS. For example, about 2,000 people were living with AIDS in King County in 1994, and 3,600 were living with AIDS in 2007. An annual increase of 100-150 persons living with AIDS has occurred during the past 10 years.

Approximately 30% of people diagnosed with HIV are also diagnosed with AIDS simultaneously or within 12 months. Most of these diagnoses are based on a low CD4 count. In a small number of cases these results may reflect transient low CD4 levels among people with acute infection, but they usually indicate the person has been infected for some length of time and is "diagnosed late" (diagnosed with HIV too late to take optimal advantage of HAART and to prevent transmission). One goal of Public Health is to decrease the proportion of people who are diagnosed with HIV and AIDS late in the course of their disease, which occurs most frequently among foreign-born individuals.

Figure 6. New AIDS cases and deaths among HIV-infected individuals, King County 1987-2007



Findings from other projects and research studies

HIV incidence and resistance testing

Public Health participates in two CDC-funded projects in which leftover sera from HIV diagnostic specimens are used to help characterize the infection in newly-diagnosed people. Currently about half of all newly-diagnosed HIV cases in King County are being tested for genotypic resistance and markers of incident infection. These tests reveal several characteristics of the HIV viruses circulating within the local population:

- Approximately one-third of new HIV diagnoses were among persons likely infected within the preceding 12 months.
- 12% of people who had never taken HIV medications had high-level resistance to one or more classes of antiretroviral drugs; three percent were resistant to two or more classes of antiretroviral drugs. These proportions have not changed since preliminary resistance testing data first became available in 1998.
- 11% of people tested were infected with a subtype of HIV-1 other than subtype B (which is most prevalent in North America, Europe, and Australia). Most of these were among persons born in other countries who likely acquired HIV in their country of origin.

Medical Monitoring Project (MMP)

The MMP project is funded by CDC to evaluate selected risk behaviors and the care and services utilized by people living with HIV/AIDS. The MMP uses a multi-stage sampling methodology to capture a representative sample of people with HIV who are "in care" (regularly seen by a medical provider). State and local health departments identify all HIV care providers in their jurisdictions and then choose a representative sample of those providers to participate in the MMP. Public Health contacts all sampled providers; HIV-infected patients are then selected from among the clients of these sampled providers.

The MMP has two components: an interview and a medical record abstraction. MMP staff invite each selected patient to participate in a face-to-face interview. The interview takes approximately 45 minutes and includes questions concerning medical history, use of medical and social services, and risk behaviors. MMP staff then collect additional information from the patient's medical chart to complement data from the interview.

The HIV/AIDS Reporting System (HARS) risk categories were used to define risk groups among the MMP participants for the following analysis. Although the numbers are small, especially in the MSM/IDU and IDU risk groups, the data do highlight some areas that could be important for future prevention efforts. Among MMP participants, a higher percentage of MSM/IDU compared with non-IDU MSM and IDU reported four or more sex partners in the last 12 months (**Table 7**). MSM were

Table 7. Sexual behaviors reported by participants in the Medical Monitoring Project (MMP), King County 2007 and 2008[a]

	HARS risk categories[a]		
MMP sex practices	**MSM N=181**	**MSM/IDU N=35**	**IDU N=24**
# Sexual partners last 12 months			
0	32%	29%	50%
1	30%	14%	33%
2-3	11%	14%	13%
≥4	25%	43%	4%
Always used condom in last 12 months			
Yes	83%	71%	62%
No	17%	29%	38%
Knew HIV status of last partner			
Yes	76%	72%	75%
No	22%	28%	25%
Discussed HIV status before sex			
Yes	58%	60%	58%
No	25%	12%	25%
Unknown	17%	28%	17%

[a] HIV/AIDS Reporting System

somewhat more likely to report always using a condom during sex in the last 12 months than were MSM/IDU and IDU.

Table 8 shows drug use behaviors reported among those MMP participants who reported having ever injected drugs. Non-injection drug use was common in all groups, especially MSM/IDU. Methamphetamine was reported to be the most commonly injected drug among the MSM and MSM/IDU HARS risk categories while heroin was the most commonly injected drug among IDU.

National HIV Behavioral Surveillance (NHBS) System

The NHBS system is funded by the CDC in 21 large urban areas in the U.S. to monitor HIV-related behaviors and access to HIV prevention services among groups at highest risk for HIV.[4,5,6]

Table 8. Drug use behaviors reported by participants in the Medical Monitoring Project, King County 2007 and 2008

	HARS risk categories		
MMP drug & alcohol behaviors	**MSM N=181**	**MSM/IDU N=35**	**IDU N=24**
Ever injected drugs			
Yes	19%	86%	83%
No	81%	14%	17%
Injected drugs last 12 months			
Yes	1%	43%	13%
No	18%	43%	71%
Used non-injection drugs last 12 months			
Yes	49%	69%	58%
No	51%	31%	42%
Non-injection drugs most frequently used last 12 months			
Marijuana	35%	51%	42%
Poppers	20%	23%	4%
Methamphetamines	11%	37%	0%
Crack	4%	29%	38%
Cocaine	7%	11%	17%
Used drugs or alcohol during sex with last casual partner			
Yes	35%	56%	100%
No	65%	44%	0%
Binge drinking (5 or more drinks) in the last 30 days >4 times			
Yes	8%	11%	4%
No	92%	89%	96%

[4] Gallagher, Public Health Rep. 2007;122 Suppl. 1:56-62
[5] MacKellar, Public Health Rep. 2007;122 Suppl. 1:39-47
[6] Lansky, Public Health Rep. 2007;122 Suppl. 1:48-55

NHBS aims to survey samples that represent the community. Although the majority of survey participants are HIV-negative, persons with HIV infection are also included. Standardized CDC study protocols and questionnaires are used in each annual survey cycle. Surveys were conducted locally among the following groups from 2005 to 2008:

- The 2005 IDU1 study surveyed IDU 18 years and older using respondent-driven sampling (RDS). RDS starts with a few selected participants who recruit IDU peers, who in turn recruit their IDU peers. For RDS data analysis, the prevalence of factors of interest is estimated after adjustment for potential recruitment biases (such as network size and "who recruits whom").

- The 2007 HET1 study surveyed higher-risk heterosexuals 18–50 years old using venue-based sampling (VBS). In VBS, participants are recruited at venues in the community that are frequented by members of the survey population. For HET1, venues were located in three census tracts that were judged to have disproportionately high numbers of residents at elevated risk for heterosexually-transmitted HIV infection based on HIV case reports and high poverty rates reported in census data.

- The 2008 MSM2 study surveyed MSM 18 years and older using VBS. Eligible venues were located throughout King County, but most were in Seattle.

The sexual behaviors reported by participants of the three NHBS surveys are presented in **Table 9**. MSM2 participants reported a much higher number of sex partners than IDU1 and HET1 participants. About one-third of each study sample reported using a condom with their last partner. IDU1 and MSM2 participants were more likely to know the HIV status of their last sex partner than were HET1 participants. While about one-third of MSM2 participants reported unprotected anal intercourse with a man of opposite or unknown HIV status in the last year, only 11% reported that this was the case with their last partner.

Table 9. Sexual behaviors in the previous 12 months, Seattle-area NHBS participants, 2005, 2007 and 2008

	IDU1 (2005)[a] N=371		HET1 (2007)[b] N =509		MSM2 (2008)[c] N = 368	
	N	%	**N**	**%**	**N**	**%**
Number of sex partners						
0	66	17%	NA	NA	NA	NA
1	118	38%	208	41%	65	18%
2-4	110	30%	236	46%	118	32%
5-9	43	7%	40	8%	84	23%
10+	34	8%	25	5%	101	27%
Any female sex partners	NA	NA	NA	NA	26	7%
Any male-to-male sex[d]	33	7%	NA	NA	368	100%
Any exchanges for sex[e]	70	19%	40	8%	14	4%
Any UAI with a partner of opposite or unknown HIV status[f]	NA	NA	NA	NA	110	31%
Condom use with last sex partner	70	30%	152	31%	123	34%
Knew HIV status of last partner	190	72%	279	55%	250	69%
Unprotected anal or vaginal sex with a partner of opposite or unknown HIV status at last sexual contact	61	19%	183	37%	38	11%

[a] RDS-adjusted estimates. The estimated proportions may differ from the unadjusted proportions. MSM/IDU are included.
[b] All HET1 participants had at least one sex partner in the previous year.
[c] All MSM2 participants had at least one male sex partner in the previous year.
[d] HET1 participants reporting male-to-male sex were excluded from analysis.
[e] Exchanged sex for drugs, money or other items.
[f] UAI=unprotected anal intercourse. These data were only collected in the MSM2 cycle.
NA=not available or not applicable. Some categories may not add up to total due to missing data.

The drug and alcohol behaviors among the participants of the three NHBS surveys are presented in **Table 10**. Heroin was the most commonly injected drug among IDU1 participants. About one-third reported receptive syringe sharing while almost everyone had shared other paraphernalia. The majority had gotten syringes from needle exchanges or pharmacies. A very high percent of IDU1 participants used non-injection drugs, too, and non-injection drug use was common among HET1 and MSM2 participants, as was binge drinking.

Table 10. Drug and alcohol behaviors in the previous 12 months,[a] Seattle-area NHBS participants, 2005, 2007 and 2008

	IDU1 (2005)[b,c] N=371		HET1(2007)[d] N =509		MSM2 (2008) N = 368	
	N	**%**	**N**	**%**	**N**	**%**
Injected drugs, ever	371	100%	53	10%	58	16%
Injected drugs, 12 months	371	100%	NA	NA	21	6%
Most commonly injected drug						
Heroin	235	66%	NA	NA	NA	NA
Speedball	31	7%	NA	NA	NA	NA
Cocaine	25	8%	NA	NA	NA	NA
Methamphetamine	37	18%	NA	NA	NA	NA
Other drug	3	1%	NA	NA	NA	NA
Shared syringes (receptive)[e]	163	34%	NA	NA	NA	NA
Shared other injection equipment[e,f]	318	86%	NA	NA	NA	NA
Non-injection drug use						
Crack cocaine	289	76%	98	19%	22	6%
Powdered cocaine	193	50%	87	17%	92	25%
Amphetamine	150	34%	19	4%	58	16%
Ecstasy	32	6%	68	13%	67	18%
Drug or alcohol treatment	168	47%	93	18%	19	5%
Got syringes from needle exchange[e]	304	73%	NA	NA	NA	NA
Got syringes from a pharmacy[e]	228	62%	NA	NA	NA	NA
Binge drinking 4+ times in past 30 days[g]	95	23%	136	27%	120	33%

[a] Unless otherwise specified.
[b] RDS-adjusted estimates. The estimated proportions may differ from the unadjusted proportions. MSM/IDU are included.
[c] NHBS-IDU1 only included participants who had injected in the previous 12 months.
[d] HET1 did not include persons who had injected drugs in the previous 12 months.
[e] Because of small numbers, detailed injection related variables are not reported for MSM2.
[f] Includes receptive sharing of cookers, cottons, water, and backloading.
[g] Binge drinking was defined as drinking 5 or more drinks at one sitting.
NA=not available or not applicable. Some categories may not add up to total due to missing data.

Table 11 shows that the vast majority (80-98%) of NHBS participants in all groups had been tested for HIV and over 60% of IDU1 and MSM2 participants were tested in the past 12 months. Among HET1 participants, 39% had tested in the past year compared to 2-13% of persons of the same age groups who were surveyed in the Behavioral Risk Factor Surveillance System of the general population (**Table 12**). Among MSM2 participants, 53 of 60 (88%) persons who tested positive as part of the survey already knew their HIV-positive status. Over 40% of MSM2 participants who had tested in the last five years tested anonymously at their last test and over 40% had been tested with a rapid test at their last test.

The Behavioral Risk Factor Surveillance System (BRFSS)

The BRFSS is an annual CDC-funded national telephone survey conducted in Washington by the Washington State Department of Health. Adults 18 years and older are randomly selected for a telephone interview about health conditions and health-related behaviors. Respondents between the ages of 18 and 64 are asked about HIV testing practices. The results of the 2008 survey of King County residents are presented in **Table 12**. In 2008, 41% of respondents had ever been tested for HIV, and 6% had been tested within the past 12 months. Persons aged 25–34, Blacks, and those with a new sex partner in the past 12 months had the highest testing rates.

Table 11. HIV testing history and knowledge of HIV-positive status, Seattle-area NHBS participants, 2005, 2007 and 2008

HIV testing history	IDU1[a] (2005) N=371		HET1 (2007) N=509		MSM2 (2008) N = 368	
	N	%	N	%	N	%
HIV positive[b]	NA	NA	5	1%	60	16%
Self-reported HIV positive	4	<1%	2	<1%	53	14%
HIV test						
Ever	360	98%	406	80%	345	94%
In the past 12 months[c]	242	65%	201	39%	192	61%
In the past 6 months[c]	177	47%	119	23%	131	42%
In the past 3 months[c]	123	29%	72	14%	79	25%
Last test was anonymous[d]	111	35%	79	23%	112	41%
Last test was a rapid test[d]	86	27%	70	20%	114	42%

[a] RDS-adjusted estimates. The estimated proportions may differ from the unadjusted proportions.
[b] Serologic HIV testing was not conducted in the IDU1 cycle.
[c] Among participants not reporting themselves HIV positive.
[d] Among participants not reporting themselves HIV-positive and reporting an HIV test in the previous five years.
Some categories may not add up to total due to missing data.

Table 12. Adult King County residents ever HIV tested and HIV tested in the past 12 months, by selected characteristics, BRFSS 2008

	N	Ever tested for HIV[a]	Tested for HIV in past 12 months[a]
Sex & age group			
Male 18-24	49	29%	9%
Female 18-24	43	37%	8%
Male 25-34	115	46%	13%
Female 25-34	197	68%	10%
Male 35-44	237	41%	7%
Female 35-44	332	58%	2%
Male 45-64	546	30%	4%
Female 45-64	821	29%	1%
Race/ethnicity[b]			
White	2,005	41%	6%
Black	61	62%	19%
Hispanic	134	42%	7%
Native American/AK Native	19	20%	3%
Asian/Pacific Islander	157	31%	3%
New sex partner past 12 months			
Yes	164	50%	21%
No	1,023	41%	3%
Overall King County	**2,402**	**41%**	**6%**

[a] Proportions are weighted for probability of phone selection, number of adults in household, and number of telephone numbers in household.
[b] White, Black, Native American/Alaska Native, and Asian/Pacific Islander are all non-Hispanic. Some categories may not add up to total due to missing data.

HIV/AIDS key findings

- Despite nearly a quarter century of HIV testing, an estimated 10-20% of persons with HIV in King County are not aware of their infection. Persons unaware of their infection are gradually losing their immunity to life-threatening diseases without the benefit of monitoring, treatment, or risk-reduction counseling to prevent transmission.
- About 30% of persons with HIV infection are diagnosed too late to prevent progression to AIDS within 12 months of their HIV diagnosis. This rate is significantly higher among most foreign-born groups .
- Since more persons are acquiring HIV than are dying with HIV/AIDS each year, locally, nationally and globally, the "pool" of persons living with HIV infection is continuing to expand by about 5% per year.
- MSM comprise the majority of cases of HIV/AIDS nationally and locally. This group also has the highest rate of infection.
- HIV/AIDS disproportionately impacts not just sexual minorities but also racial and ethnic minorities, whether born in the U.S. or elsewhere. The highest HIV infection rates by race/ethnicity are now seen locally among foreign-born Blacks, followed by native-born Blacks, Hispanics, and Native Americans/Alaska Natives–all of whom have higher rates than Whites.
- HIV and AIDS in King County, while declining gradually in urban residents, are increasingly affecting more people living in suburban and rural areas.

Chapter IV. Hepatitis B and C

Hepatitis B

Background

Infection with hepatitis B virus (HBV) affects the liver. Worldwide an estimated 350 million people are chronically infected with HBV. In the U.S., an estimated 800,000–1.4 million persons have chronic HBV infection according to the Centers for Disease Control and Prevention (CDC).[7] In 2007, 4,519 acute laboratory-confirmed cases were reported to CDC from all states, but because many acute infections are asymptomatic and cases go undiagnosed, the number of new cases is estimated to be 43,000. There are an estimated 3,000 annual deaths in the U.S. related to HBV. The rate of new HBV infections has declined by about 82% since 1991 when a national strategy to eliminate HBV infection was put in place in the U.S., including routine HBV vaccination of infants and school entry vaccination requirements.

Surveillance systems and reporting requirements

In Washington state healthcare providers and laboratories are required to report cases of acute and chronic HBV to local public health jurisdictions. Chronic HBV became legally reportable in Washington in 2000 (in addition to acute cases). Since many acute infections are asymptomatic or have only mild symptoms and many cases go undiagnosed, HBV is likely to be greatly underreported. Barriers to screening among populations at risk for HBV are also likely to contribute to underdiagnosis and underreporting. In an evaluation comparing reported HCV cases with incident cases identified as part of a research study of injection drug users (IDU) in the Seattle area, a large percentage of HCV cases who seroconverted during a research project had not been reported by a private provider to local public health authorities.[8]

Clinical aspects

The incubation period for HBV is 45-160 days, averaging 120 days.[9] Most acute infections in children and between 50% and 70% of acute infections in adults are asymptomatic. Those with symptoms may experience nausea, loss of appetite, fatigue, abdominal cramps, jaundice, dark yellow urine and pale stool that last for several weeks and can persist for up to six months. Acute infection in 90-95% of adults will resolve within six months. However, over 90% of infants and 50% of young children with acute HBV infection will develop a chronic infection, which increases the risk of liver cirrhosis and hepatocellular carcinoma; one-quarter of people infected as infants develop liver disease later in life. Several antiviral drugs are available for treatment of chronic HBV infection to prevent the development of progressive liver disease, specifically cirrhosis, liver failure, and hepatocellular carcinoma. More research is needed to determine the long-term outcomes of therapy and its impact on HBV-related mortality.

Transmission

HBV infects the liver and is present in blood, semen and other body fluids. HBV is 50–100 times more infectious than HIV and is spread through exposure to infective body fluids via sharing of contaminated drug use equipment or personal hygiene items (razors and toothbrushes), sexual contact, and from mother to child during childbirth. Prior to routine screening of the blood supply, blood and blood products were also a source of transmission. Healthcare workers are at risk through accidental needle sticks or other exposures resulting from contact with contaminated body fluids. HBV has been spread to patients in healthcare settings when standard infection control precautions were not followed and syringes, injectable medications, intravenous fluids, or endoscopy/colonoscopy and dialysis equipment became contaminated. Sexual transmission is about three times more efficient from infected men to women than from infected women to men. Men who have sex with men (MSM) are at higher risk and about 15–25% of all new HBV infections in the U.S. are among MSM.[10] The virus is stable in the environment for up to seven days and indirect exposure through fomites is possible.

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[7] www.cdc.gov/print.do?url=http%3A//www.cdc.gov/hepatitis/Statistics.htm.
[8] Hagan H, Snyder N, Hough E, Yu T, McKeirnan S, Boase J, Duchin J. Case-reporting of acute hepatitis B and C among injection drug users. J Urban Health. 2002; 79:579-585.
[9] www.cdc.gov/hepatitis/HBV/ProfResourcesB.htm#section1, Hepatitis ABC fact sheet.
[10] www.cdc.gov/hepatitis/Populations/msm.htm.

Prevention

HBV vaccines have been available since 1981. Universal immunization of infants has been recommended since 1991 and is also recommended for all children entering school and children younger than 19 years who have not been vaccinated. Vaccination is also recommended for persons at higher risk of HBV infection, including sex partners and household contacts of persons with chronic HBV infection, MSM, IDU, healthcare and public safety workers, persons with HIV or hepatitis C infection, and certain other groups. All pregnant women should be screened for HBV carrier-status, and newborn infants of HBV carriers should be treated promptly with a post-exposure prophylaxis regimen of vaccine and hepatitis B immune globulin (HBIG).

All donor blood, blood products, tissues, and organs are screened for HBV in the developed world. Standard infection control precautions should be followed for all medical and dental procedures. Injection drug use should be avoided and those who do inject illicit drugs should avoid sharing of injection equipment. Persons at risk of sexual HBV exposure should practice safe sex. Persons with HBV infection should avoid sharing personal items (toothbrushes, razors, etc.) with others.

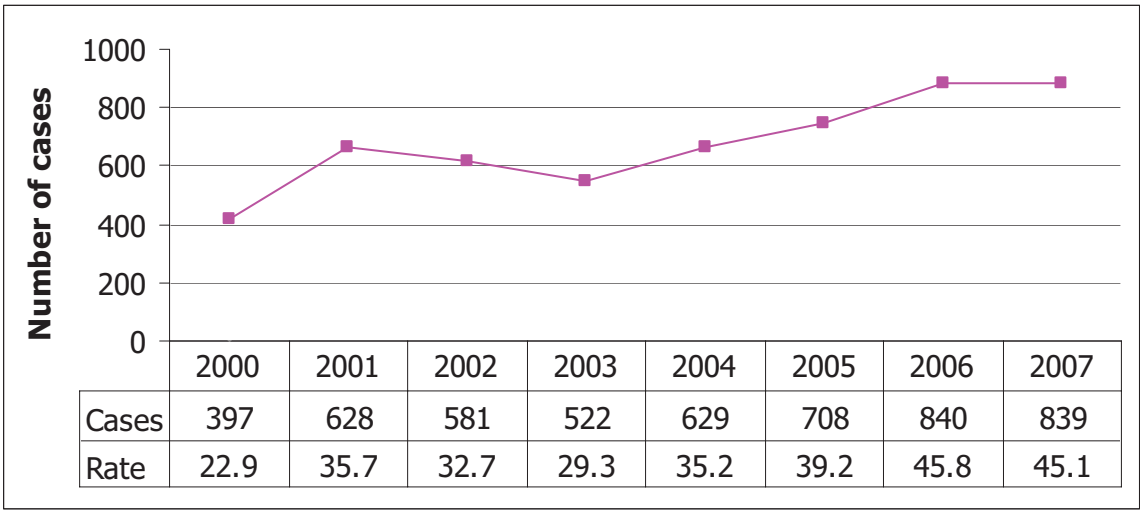
Hepatitis B in King County

Findings from case surveillance

In King County, 23 acute HBV cases and 839 chronic HBV cases were reported in 2007. Most acute cases (78%) were men, 48% were suspected to have a sexual exposure, and <1% were exposed perinatally. The number of acute HBV cases reported annually has decreased since the 1980s; this decrease has been attributed to improved vaccination coverage and HIV prevention efforts among high-risk populations. About half (53%) of the chronic HBV cases occurred in men. The rate of chronic HBV case reports increased from 22.9 per 100,000 in 2000 to 45.8 per 100,000 in 2006 and 45.1 in 2007 (**Figure 7**). Information on race/ethnicity and source of exposure are missing for a large proportion of reported chronic HBV cases.

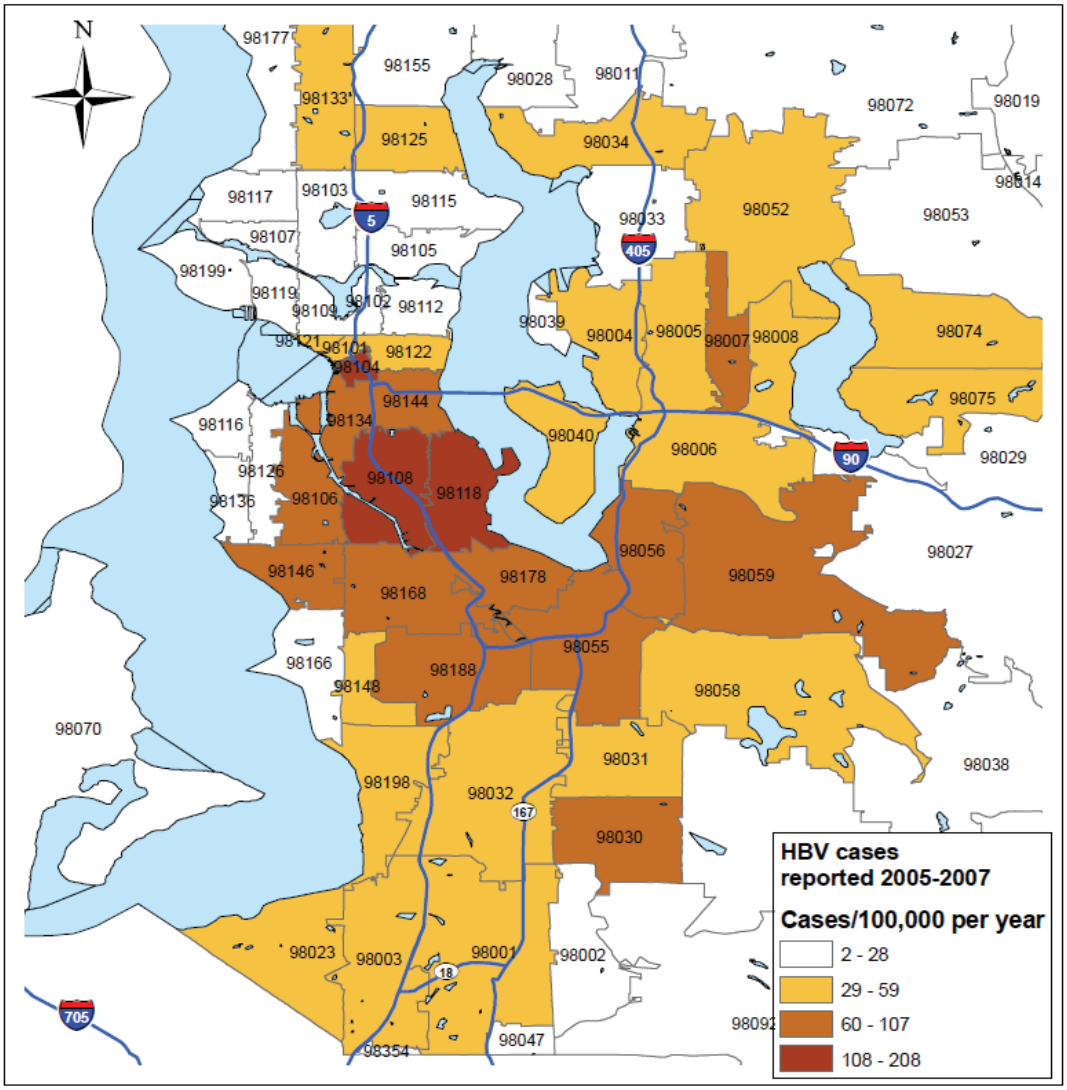
Figure 8 maps the average annual rates of acute and chronic HBV cases reported in King County residents from 2005 to 2007, by zip code. The zip codes represent the residence at the time of diagnosis, which may be different from the residence at the time of HBV acquisition. The zip code may also reflect the location of a shelter or other transitional residence. The map represents only the western, more populated portion of King County; there were very few cases in the zip codes that are not shown. The highest rates of reported cases were in central and south Seattle, and in south King County.

Figure 7. Number of chronic hepatitis B cases by year, King County 2000-2007



	2000	2001	2002	2003	2004	2005	2006	2007
Cases	397	628	581	522	629	708	840	839
Rate	22.9	35.7	32.7	29.3	35.2	39.2	45.8	45.1

Figure 8. Annual average acute and chronic hepatitis B case rates by zip code, King County 2005-2007



Findings from other projects and research studies

According to the Washington State Department of Health, the hepatitis B vaccination coverage in King County at school entry is 92.4%. In a local study that recruited IDU 15 years and older from 1994 to 1997, prevalence of exposure to HBV as measured by HBV core antibody (anti-HBc) was 62%, with less than 5% showing evidence of chronic infection (HBV surface antigen, HBsAg).[11] In an analysis of data from four local studies of IDU aged 18-30 years, we found that HBV seroprevalence (anti-HBc) declined from 42% in 1994 to 15% in 2004, indicating a decrease in incidence in this age group (**Figure 9**).[12] In the same analysis, we also found that the prevalence of self-reported HBV vaccination among 18-30 year-old IDU increased from between 17% and 21% in 1994-1997 to between 50% and 54% in 2002-2004.

Results from the National HIV Behavioral Surveillance (NHBS) system showed that 24% of IDU reported a prior HBV-seropositive test compared to 6% of MSM (**Table 13**). The self-reported HBV vaccination rate in NHBS was 30% for IDU, 42% for high-risk heterosexuals (HET), and 69% for MSM.

[11]Hagan H, McGough J, Thiede H, et al. Syringe exchange and risk of infection with hepatitis B and C viruses. *Am J Epidemiol* 1999; 149:203-213.
[12]Burt RD, Hagan H, Garfein RS, Sabin K, Weinbaum C, Thiede H. Trends in hepatitis B virus, hepatitis C virus, and human immunodeficiency virus prevalence, risk behaviors, and preventive measures among Seattle injection drug users aged 18-30 Years, 1994-2004. J Urban Health 2007 May; 84:436-454.

Figure 9. Hepatitis B prevalence and 95% confidence levels in 18-30 year-old IDU in four Seattle-area studies, 1994–2004

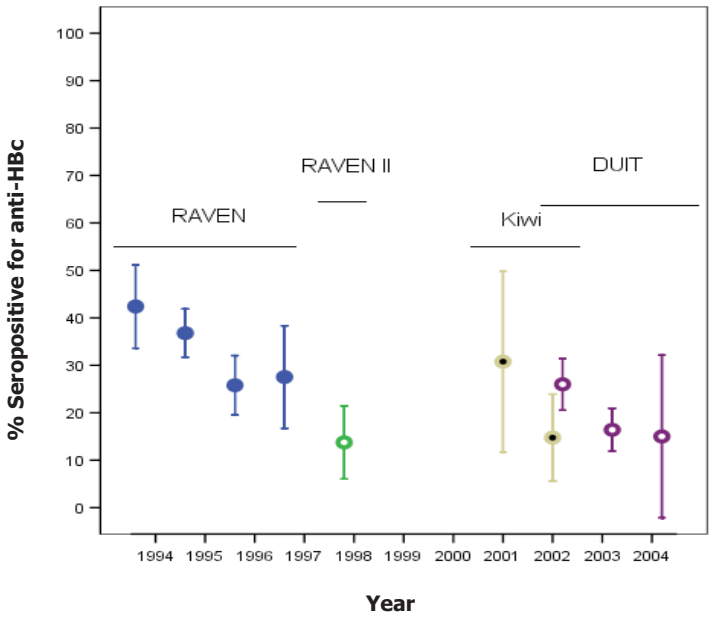


Table 13. Self-reported hepatitis B diagnosis and vaccination, Seattle-area NHBS participants, 2005, 2007 and 2008.

	IDU1 2005 N=371	HET1 2007 N=509	MSM2 2008 N=368
HBV diagnosis (seropositive test)[a]	24%	1%	6%
HBV vaccination	30%	42%	69%

[a] Does not necessarily indicate chronic infection.

Hepatitis B key findings

- The number of acute HBV cases has decreased annually both nationwide and in King County since the 1980s.
- The annual rate of reported chronic HBV cases in King County is about 45/100,000.
- Rates of reported HBV cases are highest in central and south Seattle, and in south King County.
- Due to underdiagnosis and underreporting, the actual number of both acute and chronic HBV cases in King County is higher than the number of reported cases. Missing data on case race and exposure limit our ability to characterize the local epidemiology of hepatitis B.
- Between 1994 and 2004, HBV prevalence declined in younger IDU who participated in local studies, indicating a decline in incidence.
- HBV vaccination rates increased from 1994 to 2004 in younger IDU who participated in local studies.
- The self-reported HBV vaccination rate was 69% in MSM who participated in NHBS in 2008.
- In 2007 and 2008, the HBV immunization rate in children entering school in King County was 92%.

Hepatitis C

Background

The hepatitis C virus (HCV) was identified in 1988. HCV infects the liver and at least six distinct genotypes (genotypes 1-6) have been identified. Type 1 is the most common genotype in the U.S. Worldwide, an estimated 130–170 million people are chronically infected with HCV. According to the CDC, 2.7–3.9 million persons in the U.S. have chronic HCV infection,[13] and there are an estimated 12,000 deaths related to HCV in the U.S. annually. In 2007, 849 acute cases were reported to CDC from all states, but because many acute HCV infections are asymptomatic and many cases go undiagnosed, the estimated number of new cases in 2007 was 17,000. Similar to HBV, the rate of acute HCV infections has been declining over time.

Surveillance systems and reporting requirements

Healthcare providers and laboratories are required to report cases of acute and chronic HCV to local public health jurisdictions within one month of diagnosis. Chronic HCV became reportable in 2000 (in addition to acute cases). Since many new infections are asymptomatic and many cases go undiagnosed, HCV is likely to be greatly underreported. Barriers to screening among populations at risk for HCV are also likely to contribute to underdiagnosis and underreporting. In an evaluation comparing reported HCV cases with incident cases identified as part of a research study of injection drug users (IDU) in the Seattle area, a large percentage of HCV cases who seroconverted during a research project had not been reported by a private provider to local public health authorities.[14]

Clinical aspects

The incubation period of HCV ranges from 14–180 days, averaging 45 days.[15] Most acute HCV infections are asymptomatic. Between 20–30% of persons with acute HCV may experience nausea, loss of appetite, fatigue, abdominal pain, or jaundice. Approximately 75–85% will develop chronic infection, 60–70% will develop chronic liver disease, 5–20% will develop cirrhosis over a 20–30 year period, and 1–5% will die from liver cirrhosis or cancer as a result of chronic HCV infection. Chronic HCV infection is the leading cause of liver transplants in the U.S. Treatment with pegylated interferon and ribavirin results in an undetectable viral load in up to 50% of patients with genotype 1 (the most common genotype in the U.S.) and in up to 80% of patients with genotypes 2 and 3.

Transmission

HCV is transmitted primarily by direct exposure to the blood of an infected person. It is less infectious than HBV, but more infectious than HIV. Prior to the introduction of screening of the blood supply for HCV in 1992, transfusion of blood and blood products was the source of a large proportion of infections. Since 1992, most infections have occurred through sharing of contaminated syringes and other drug-use paraphernalia among IDU. Healthcare workers are at risk through accidental needle sticks or other exposures resulting in contact with contaminated blood. HCV has been spread to patients in healthcare settings when standard infection control precautions were not followed and syringes, injectable medications, intravenous fluids, or endoscopy/colonoscopy and dialysis equipment became contaminated. The risk of transmission from an infected mother to her infant is about 4%. Sex is an inefficient means of transmission; however, there are recent reports of apparent sexual spread of HCV among MSM with HIV infection.

Prevention

All blood, blood products, tissues, and organs are screened for HCV in developed countries. Standard infection control precautions should be followed for all medical and dental procedures. Injection drug use should be avoided and those who do inject illicit drugs should avoid sharing injection equipment. Persons at risk of sexual HCV exposure should practice safe sex. There is no vaccine for HCV.

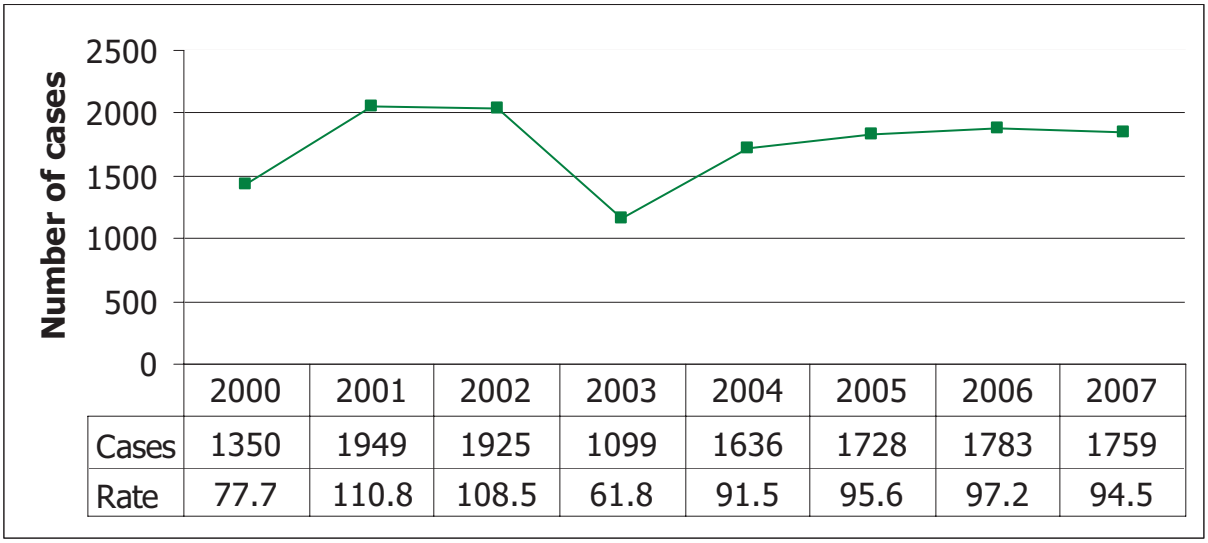
[13] www.cdc.gov/print.do?url=http%3A//www.cdc.gov/hepatitis/Statistics.htm.
[14] Hagan H, Snyder N, Hough E, Yu T, McKeirnan S, Boase J, Duchin J. Case-reporting of acute hepatitis B and C among injection drug users. J Urban Health. 2002; 79:579-585.
[15] www.cdc.gov/hepatitis/HBV/ProfResourcesB.htm#section1, Hepatitis ABC fact sheet.

Hepatitis C in King County

Findings from case surveillance

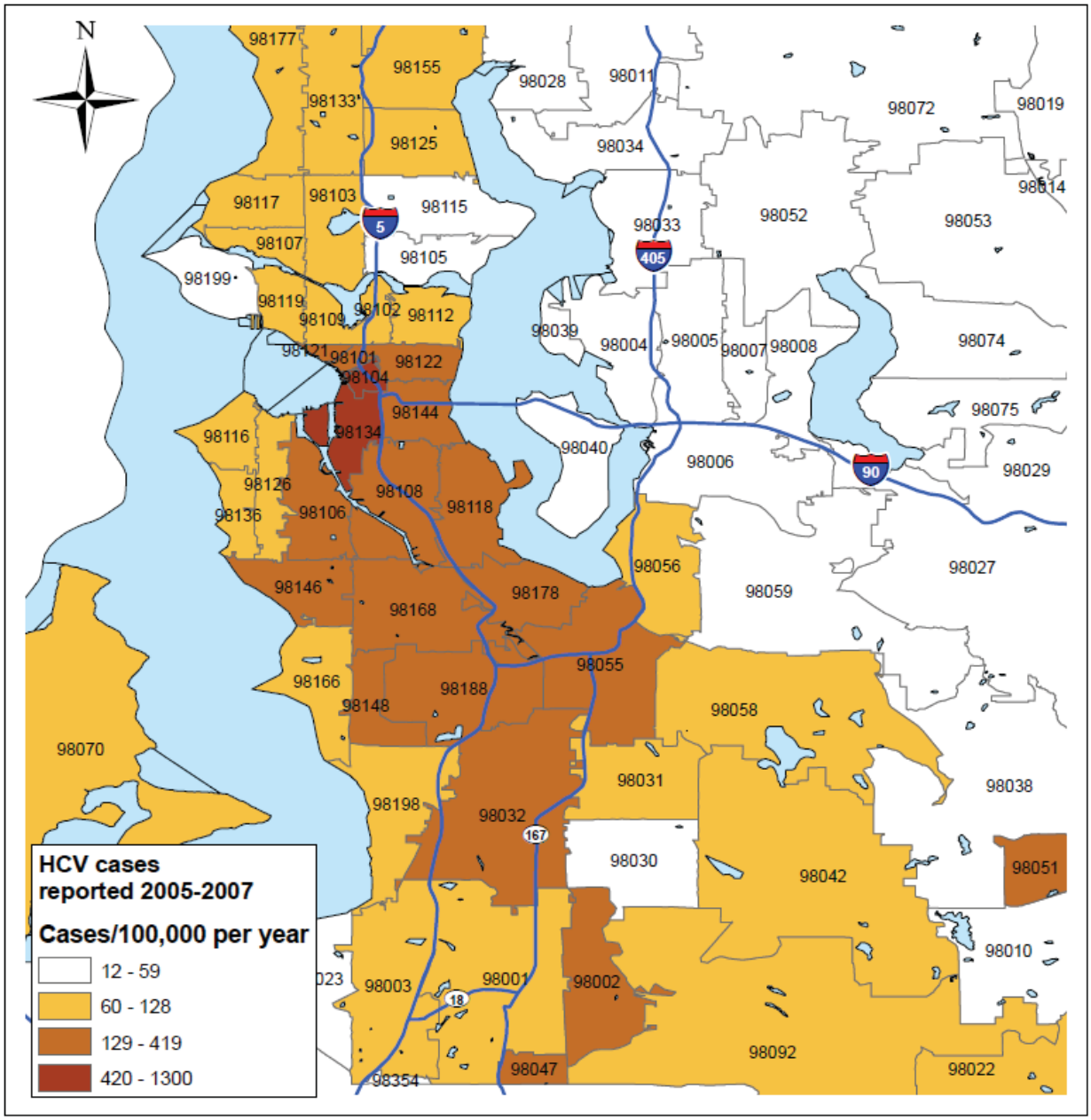
Seven acute HCV cases and 1,759 chronic HCV cases were reported in King County in 2007; most of the chronic cases (63%) were in men. The rate of chronic HCV case reports remained fairly stable between 2004 and 2007 (**Figure 10**). Because a delay of many years between the time of infection and diagnosis is quite common, reports of chronic HCV cases are expected to remain high in future years. Information on race/ethnicity and source of exposure are missing for a large proportion of reported chronic HCV cases. **Figure 11** maps the average annual rates of acute and chronic HCV cases reported in King County residents from 2005 to 2007 by zip code. The zip codes represent the residence at the time of diagnosis which may be different from the residence at the time of HCV acquisition. The zip code may also reflect the location of a shelter or other transitional residence. The map represents only the western, more populated portion of King County; there were very few cases reported from the zip codes that are not shown. The highest rates of reported cases were in central and south Seattle, and in south King County.

Figure 10. Number of chronic hepatitis C cases by year, King County 2000-2007



	2000	2001	2002	2003	2004	2005	2006	2007
Cases	1350	1949	1925	1099	1636	1728	1783	1759
Rate	77.7	110.8	108.5	61.8	91.5	95.6	97.2	94.5

Figure 11. Annual average acute and chronic hepatitis C case rates by zip code, King County 2005-2007



Findings from other projects and research studies

In a local study that recruited IDU 15 years and older from 1994 to 1997, prevalence of antibodies to HCV was 85%.[16] In an analysis of data from four local studies of IDU aged 18-30 years, we found that HCV seroprevalence declined from 68% in 1994 to 32% in 2004, indicating a decrease in incidence (**Figure 12**).[17] Results from the National HIV Behavioral Surveillance (NHBS) system showed that 91% of IDU reported a prior HCV test and 62% reported being infected with HCV compared to 3% of participants in the HET and MSM studies (**Table 14**).

[16]Hagan H, McGough J, Thiede H, et al. Syringe exchange and risk of infection with hepatitis B and C viruses. Am J Epidemiol 1999; 149:203-213.
[17]Burt RD, Hagan H, Garfein RS, Sabin K, Weinbaum C, Thiede H. Trends in hepatitis B virus, hepatitis C virus, and human immunodeficiency virus prevalence, risk behaviors, and preventive measures among Seattle injection drug users aged 18-30 Years, 1994-2004. J Urban Health 2007 May; 84:436-454.

Figure 12. Hepatitis C prevalence in 18-30 year-old IDU in four Seattle-area studies, 1994–2004

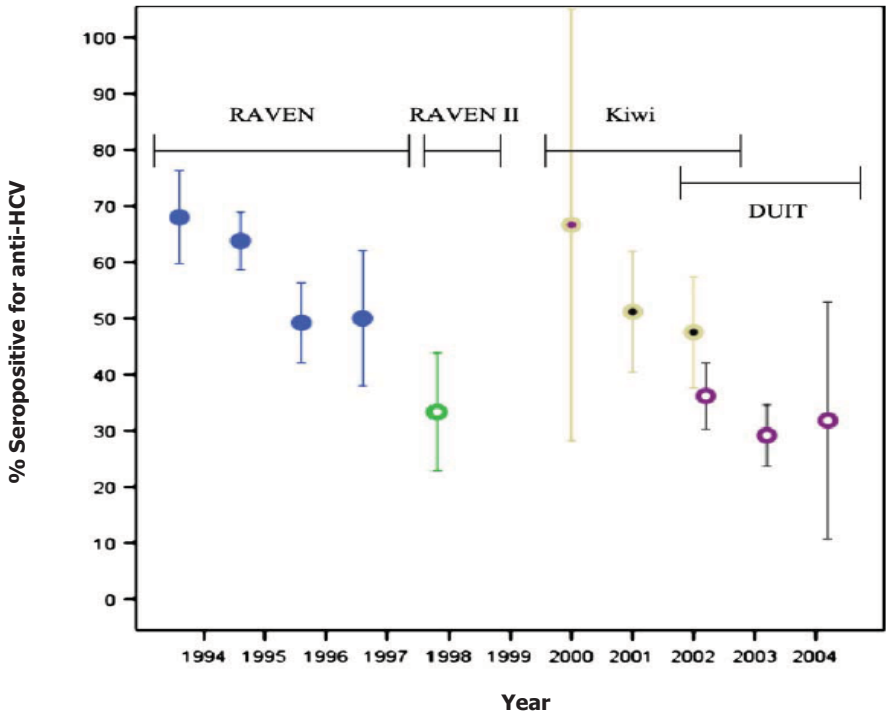


Table 14. Self-reported hepatitis C testing history and diagnosis, Seattle-area NHBS participants, 2005, 2007 and 2008

	IDU1 2005 N=371	HET1 2007 N=509	MSM2 2008 N=368
Ever had an HCV test	91%	64%	71%
HCV infected	62%	3%	3%

Hepatitis C key findings

- The number of acute HCV cases nationwide decreased annually since 1990.
- The annual rate of reported chronic HCV cases in King County is about 95/100,000 and has remained stable in recent years.
- Reported HCV case rates are highest in central and south Seattle, and in south King County.
- Due to underdiagnosis and underreporting, the actual number of people with HCV in King County is higher than the number of reported cases. Missing data on case race and exposure limit our ability to characterize the local epidemiology of hepatitis C.
- HCV prevalence declined between 1994 and 2004 in younger IDU who participated in local studies, indicating a decline in incidence.

Chapter V. Sexually Transmitted Diseases (Gonorrhea, Chlamydia, Syphilis)

Background

Sexually transmitted diseases (STDs) have a major impact on public health, both locally and nationally. STDs, including chlamydia, gonorrhea, syphilis, herpes, and human papillomavirus (HPV), negatively affect more than 65 million Americans and approximately 19 million new cases of STDs occur in the U.S. each year, with almost half occurring among adolescents and young adults aged 15–24 years.[18] Chlamydia infection and gonorrhea are the two most commonly-reported notifiable diseases in the U.S. People have a greater chance of contracting HIV if they already have an STD, and HIV is more easily transmitted to others if the infected person has an STD. Although there has been some progress in the prevention, diagnosis, and treatment of STDs over the past several years, certain STDs continue to increase within specific populations.

Surveillance systems and reporting requirements

This chapter describes case numbers and rates of infection for three STDs in King County residents: chlamydia, gonorrhea and syphilis. These three infections are notifiable diseases in Washington, so medical providers and laboratories are required by law to report all laboratory-confirmed cases of these infections to local health jurisdictions.

Notifiable disease data are subject to several limitations. The considerable differences in numbers and rates of infection between subgroups may be due not only to differences in incidence but also due to differences in screening and testing practices. For example, the rate of chlamydia infections in King County is substantially higher among women than men, reflecting national recommendations that young women be screened for chlamydia annually, even if asymptomatic, while there is no similar recommendation for young men. While these three infections are all notifiable conditions in Washington, these data are subject to under-reporting by physicians and laboratories. In addition, some of these infections do not cause symptoms, and therefore often go undiagnosed.

Transmission

All three of these STDs are caused by bacteria that can be transmitted through vaginal, anal or oral sex, but other routes of transmission also exist. Pregnant women with syphilis can pass the disease on to the babies they are carrying in utero. Both chlamydia and gonorrhea bacteria can infect a baby as it passes through the vaginal tract during birth. Syphilis can be blood-borne and infect injection drug users through needle-sharing with infected persons.

[18]CDC. National Center for HIV, viral Hepatitis, STD, and TB Prevention. 2007 Disease Profile. CDC 2009:27. Atlanta, GA. www.cdc.gov/nchhstp.

Chlamydia

Clinical aspects

Chlamydia is an STD caused by the bacterium *Chlamydia trachomatis*. Most women, and many men, infected with *C. trachomatis* are asymptomatic or have only mild symptoms. However, chlamydia can cause substantial damage to the reproductive system of women. Untreated infection in women can lead to pelvic inflammatory disease (PID), which can cause permanent damage to the fallopian tubes, uterus, and surrounding tissues. This damage can lead to an array of health problems, including infertility, chronic pelvic pain, and ectopic pregnancy.

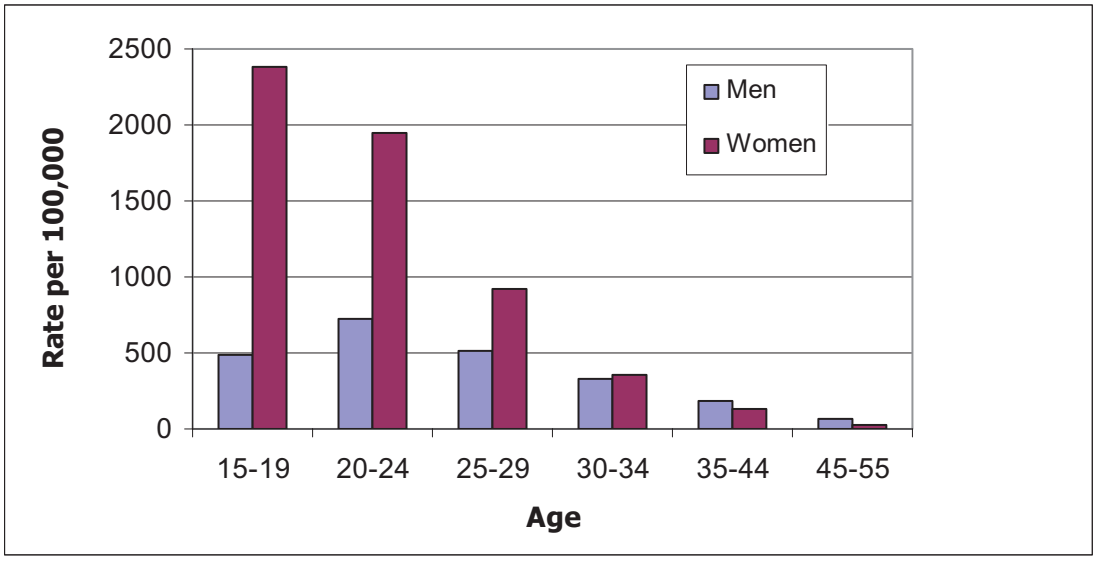
Chlamydia in King County

Findings from case surveillance

In 2007, 5,682 cases of chlamydia were reported in King County residents, representing an overall reported incidence rate of 310 cases per 100,000 people. This is an increase of 6.8% over the number of cases reported in 2006. However, this change in incidence may be a consequence of increased chlamydial testing or reporting of identified cases. The prevalence of chlamydial infection in young women in King County appears to be stable[19]. In 2007, 3,860 cases were reported among women, for a reported incidence rate of 419 per 100,000 women, and 1,812 cases were reported among men, for a reported incidence rate of 198 per 100,000 men. Rates in women were much higher than rates in men of the same age group because asymptomatic women are often screened for chlamydia, whereas men are not (**Figure 13**). Chlamydia rates were highest among young women aged 15-24.

Among women, reported incidence was highest among Black women (1,830 per 100,000 women), followed by Native American (1,359 per 100,000), Asian/Pacific Islander (A/PI) (428 per 100,000), and White women (262 per 100,000) (**Figure 14**). Among men, incidence of reported chlamydia infection was lower overall than incidence in women, and most strikingly lower among NA and A/PI men (210 and 146 per 100,000, respectively). Black men had the highest reported rates of chlamydia among men, with an incidence of 1,047 per 100,000; White men had the lowest incidence (140 per 100,000).

Figure 13. Incidence rate of chlamydia, by gender and age group, King County 2007



[19] Public Health—Seattle & King County, 2007 Sexually Transmitted Diseases Epidemiology Report

Figure 14. Incidence rate of chlamydia, by gender and race, King County 2007

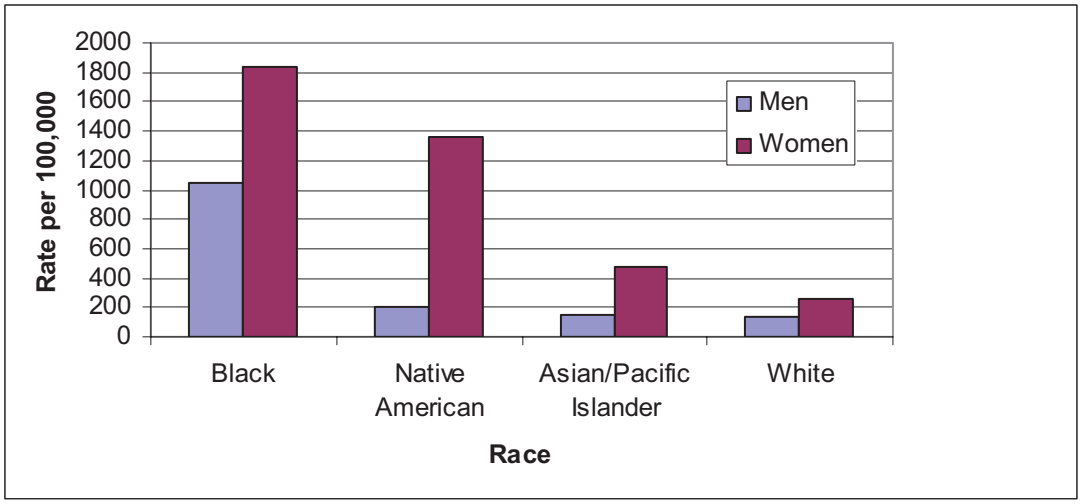
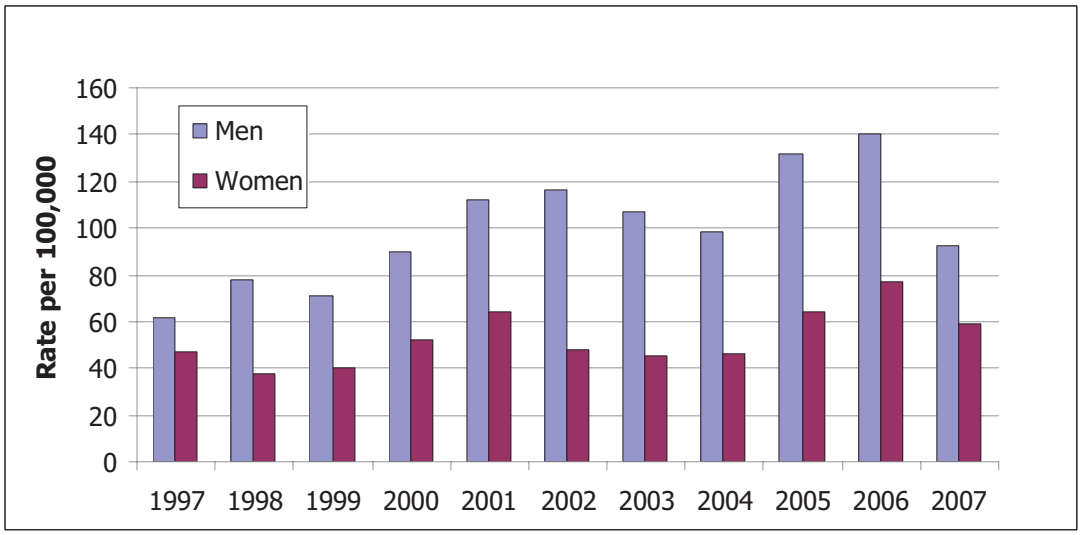


Figure 15. Incidence rate of gonorrhea by gender, King County 1997-2007



Gonorrhea

Clinical aspects

Gonorrhea is an STD caused by the bacterium *Neisseria gonorrhoeae*. Left untreated, gonorrhea can cause substantial health problems. In men, the vast majority of urethral gonorrhea infections cause a discharge and painful urination. However, pharyngeal and rectal infections with gonorrhea are usually asymptomatic. Genital tract infections in women are typically asymptomatic, and untreated gonorrhea in women can lead to pelvic inflammatory disease (PID), which can result in infertility and ectopic pregnancy.

Gonorrhea in King County

Findings from case surveillance

In 2007, there were 1,409 reported cases of gonorrhea in King County, resulting in an overall incidence rate of 77 cases per 100,000 persons. The incidence of gonorrhea in King County fell 29% from 2006 to 2007 (**Figure 15**). Interpreting King County epidemiologic gonorrhea data is complicated by the fact that there are two ongoing, essentially separate epidemics occurring, one among men who have sex with men (MSM), and another among heterosexuals. Because data on sexual orientation are incomplete on almost one-quarter of male gonorrhea case reports, Public Health cannot relia-

bly determine the sexual orientation of many male cases. As a result, incidence of gonorrhea among women can be used to monitor the epidemic among heterosexuals. Among women 15-29 years old, gonorrhea incidence fell in 2007 after a rapid increase from 2004 to 2006. Gonorrhea rates were highest in persons aged 15 to 29 years old, and peaked among women at ages 15-19 and among men at ages 20-29 (**Figure 16**).

In 2007 the incidence of gonorrhea was 14 and 8 times higher among Black and Native American women, respectively, compared to White women (**Figure 17**). Among men, the 2007 gonorrhea rate was nine times higher among Black men compared to White men.

Figure 16. Incidence rate of gonorrhea, by gender and age group, King County 2007

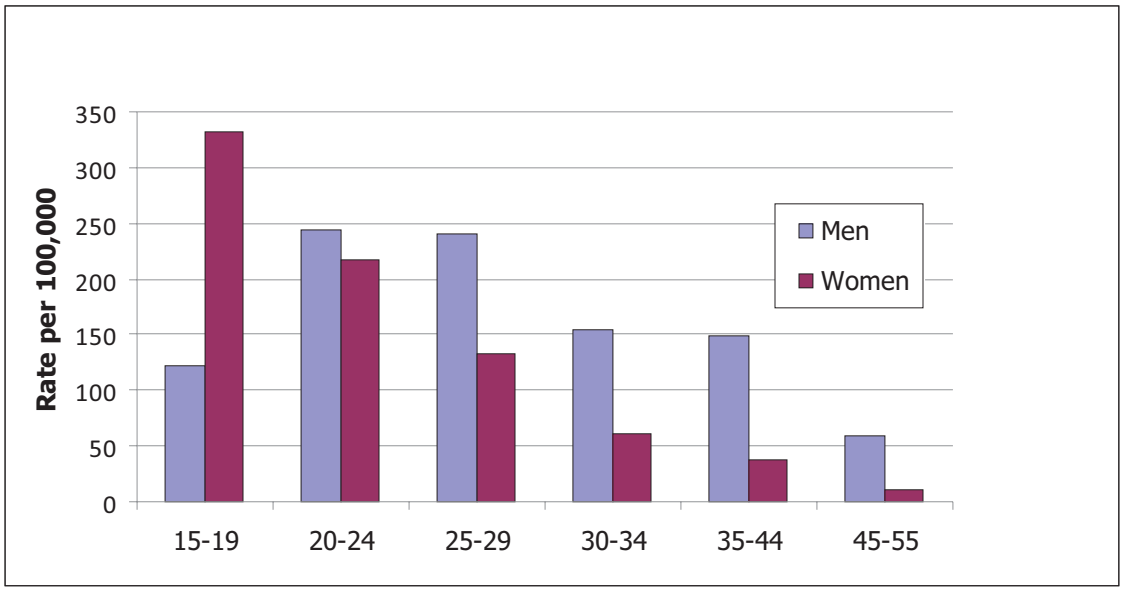


Figure 17. Incidence rate of gonorrhea, by gender and race, King County 2007

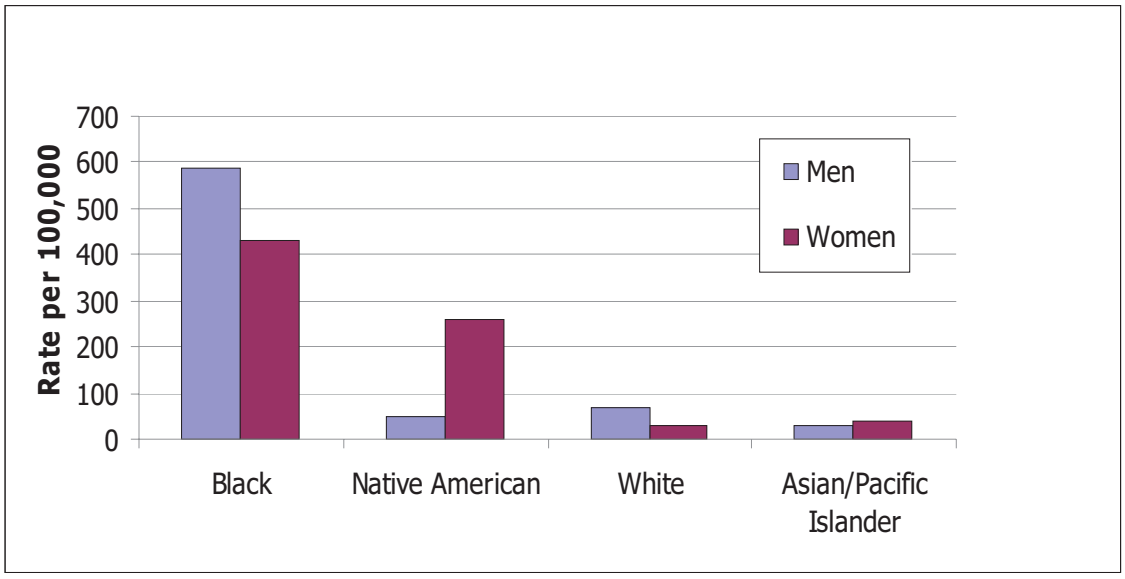
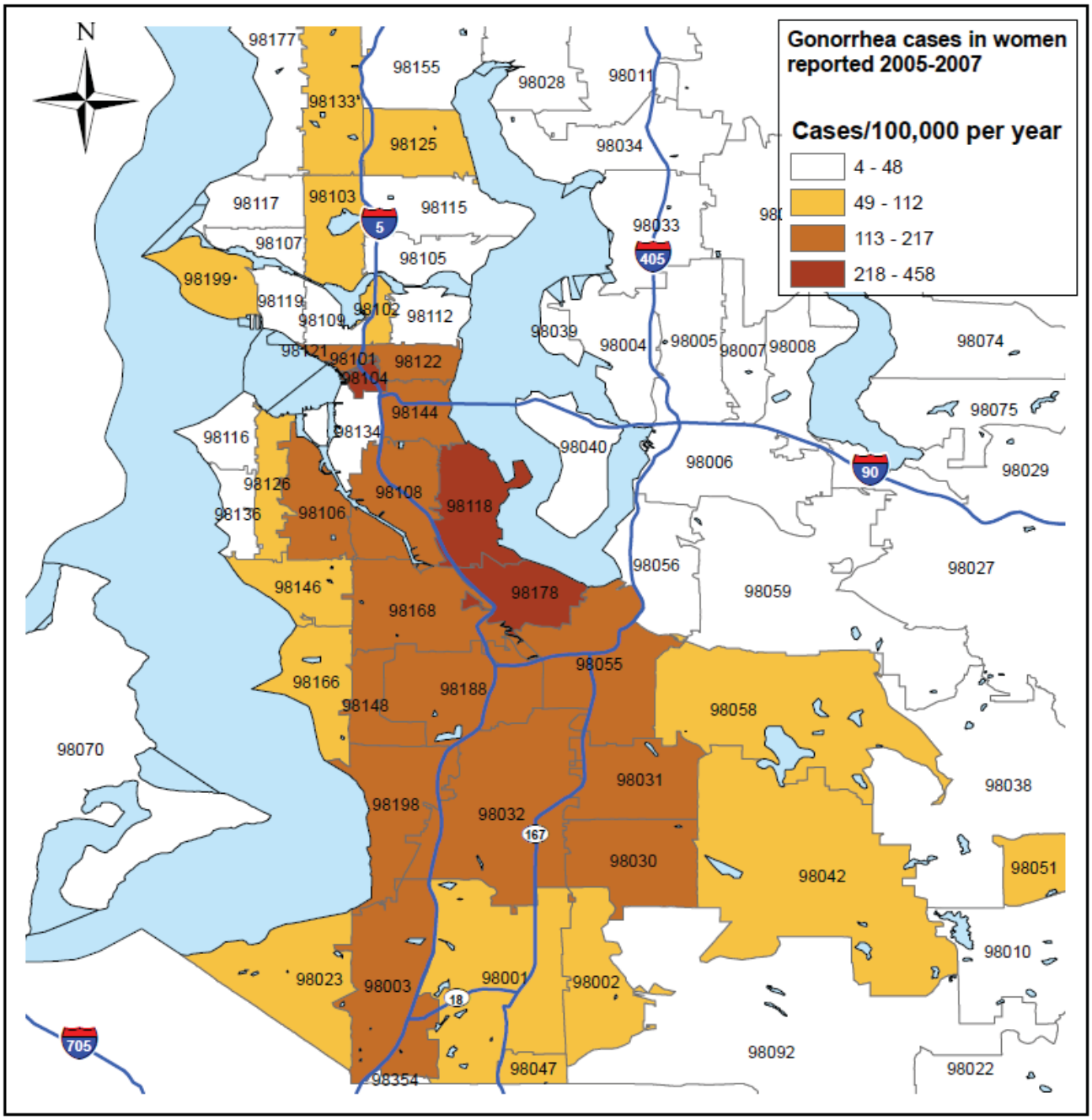


Figure 18 maps the average annual incidence rate of female gonorrhea cases in King County from 2005 to 2007 by zip code. The map represents only the western, more densely-populated areas of the county; few cases occurred in the zip codes not shown on the map. The highest concentration of cases occurred in central and south Seattle and south King County.

Figure 18. Average annual female gonorrhea case rates by zip code, King County 2005-2007



Syphilis

Clinical aspects

Syphilis is an STD caused by the bacterium *Treponema pallidum*. Syphilitic infections are divided into four stages: primary, secondary, early latent, and late latent. The first three of these stages are frequently grouped as "early syphilis". The primary stage of syphilis is marked by the appearance of chancres, and the secondary stage is characterized by rash and, less frequently, mucous membrane, eye, ear and brain involvement. Persons with latent stage syphilis are asymptomatic; if the infection progresses to the late latent stage, it can lead to damage of the internal organs (e.g., brain, nerves, and heart). Syphilis in pregnant women can result in perinatal transmission of disease causing congenital syphilis, which can be fatal to the infected fetus. Among infants, congenital infection can also cause developmental delay, seizures, and death if left untreated.

Syphilis in King County

Findings from case surveillance

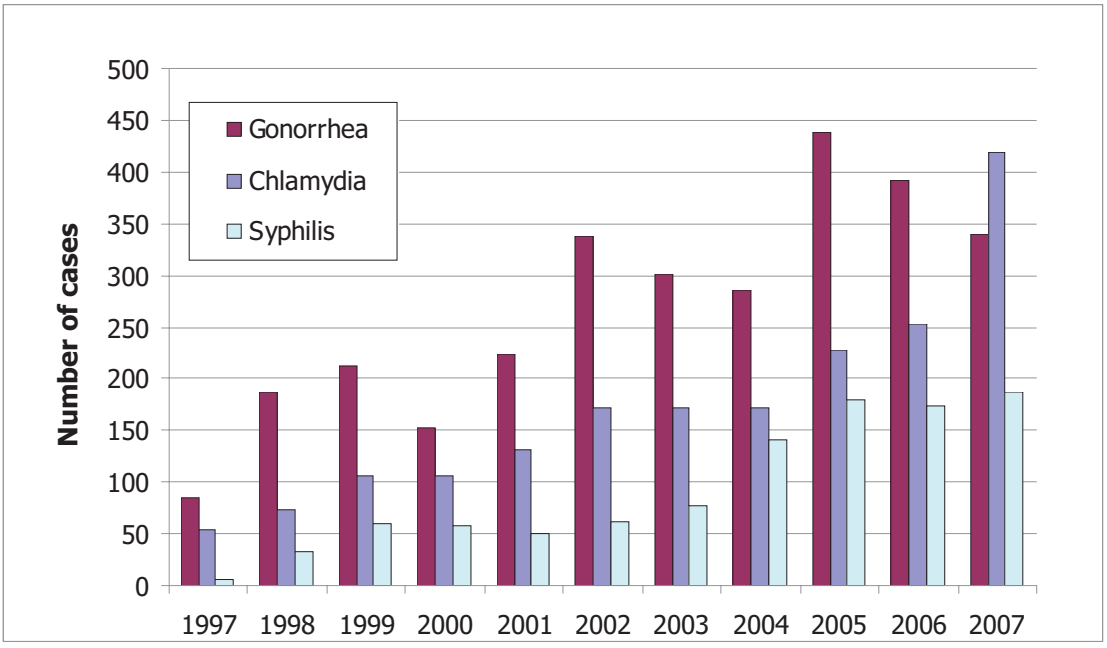
Although syphilis disease has four stages, this report only presents data on the early stages of infection since these are the stages during which the infection is transmissible. The total number of early syphilis cases (primary, secondary, and early latent) grew slightly from 185 cases in 2006 to 194 cases in 2007. The overall 2007 incidence rate of early syphilis was 11 cases per 100,000 persons. Early syphilis incidence among MSM was over 800 times greater (436 per 100,000 MSM) than that among heterosexual men (0.5 per 100,000 men) in 2007.

STDs in MSM

Findings from case surveillance

MSM in King County continue to experience higher rates of all reportable STDs relative to heterosexuals. All three of the STDs in this chapter can be spread through oral sex, with the pharynx as the site of infection, and through anal sex, with the rectum being the site of infection. As mentioned earlier, data on sexual orientation are incomplete for almost one-quarter of male gonorrhea case reports. The STD Program conducts further investigation of a random sample of gonorrhea cases, including ascertainment of gender of sexual partners; gonorrhea case rates in MSM and heterosexual men are estimated based on this additional information. In 2007, the rate of gonorrhea among MSM was 786 per 100,000 compared to 60 per 100,000 in heterosexual men and women. The annual numbers of new gonorrhea, chlamydia and early syphilis cases in MSM increased annually from 1997 to 2005 (**Figure 19**). In 2006 and 2007, the number of new syphilis cases in MSM remained sta-

Figure 19. Number of gonorrhea, chlamydia, and early syphilis cases among MSM, King County 1997-2007



ble and the number of gonorrhea cases declined. The decline in gonorrhea cases was observed among heterosexual men and women as well as among MSM. Chlamydia cases in MSM continued to rise in 2006 and 2007, possibly partly due to improved case ascertainment compared to previous years. The number of cases of gonorrhea in MSM are mapped by King County zip code in **Figure 20**. The map represents only the western, more populated portion of King County; there were very few cases reported from the zip codes that are not shown. The highest numbers of reported cases were in central Seattle.

Like most urban areas in the U.S. and most of the Western world, King County is experiencing an ongoing epidemic of syphilis among MSM. The total number of early syphilis cases grew slightly from 185 in 2006 to 194 cases in 2007; 188 (97%) were among MSM. The early syphilis incidence among MSM was over 800 times greater (436 per 100,000 MSM) than that among heterosexual men (0.5 per 100,000 men) in 2007. The number of syphilis cases reported in MSM from 2005-2007 is mapped by zip code in **Figure 21**. The map represents only the western, more populated portion of King County; there were very few cases reported from the zip codes that are not shown. The highest number of reported cases were in central Seattle.

Findings from other STD projects and research studies

Three groups were studied as part of the National HIV Behavioral Surveillance (NHBS) project in King County: injection drug users (IDU) in 2005, heterosexuals (HET) in 2007, and MSM in 2008. Rates of self-reported STD diagnosis within the previous 12 months were 7%, 9%, and 8%, respectively.

Figure 20. Total number of MSM gonorrhea cases by zip code, King County 2005-2007

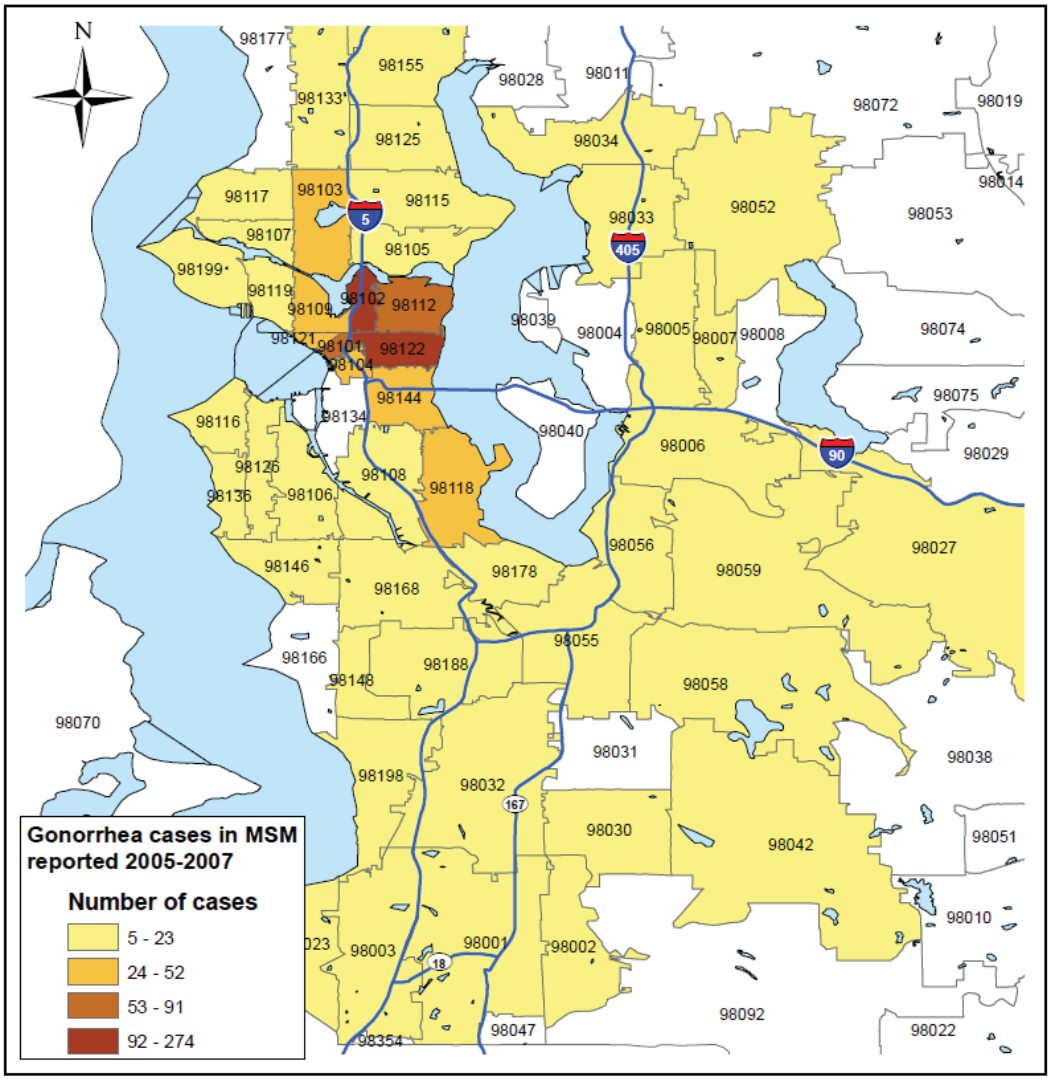
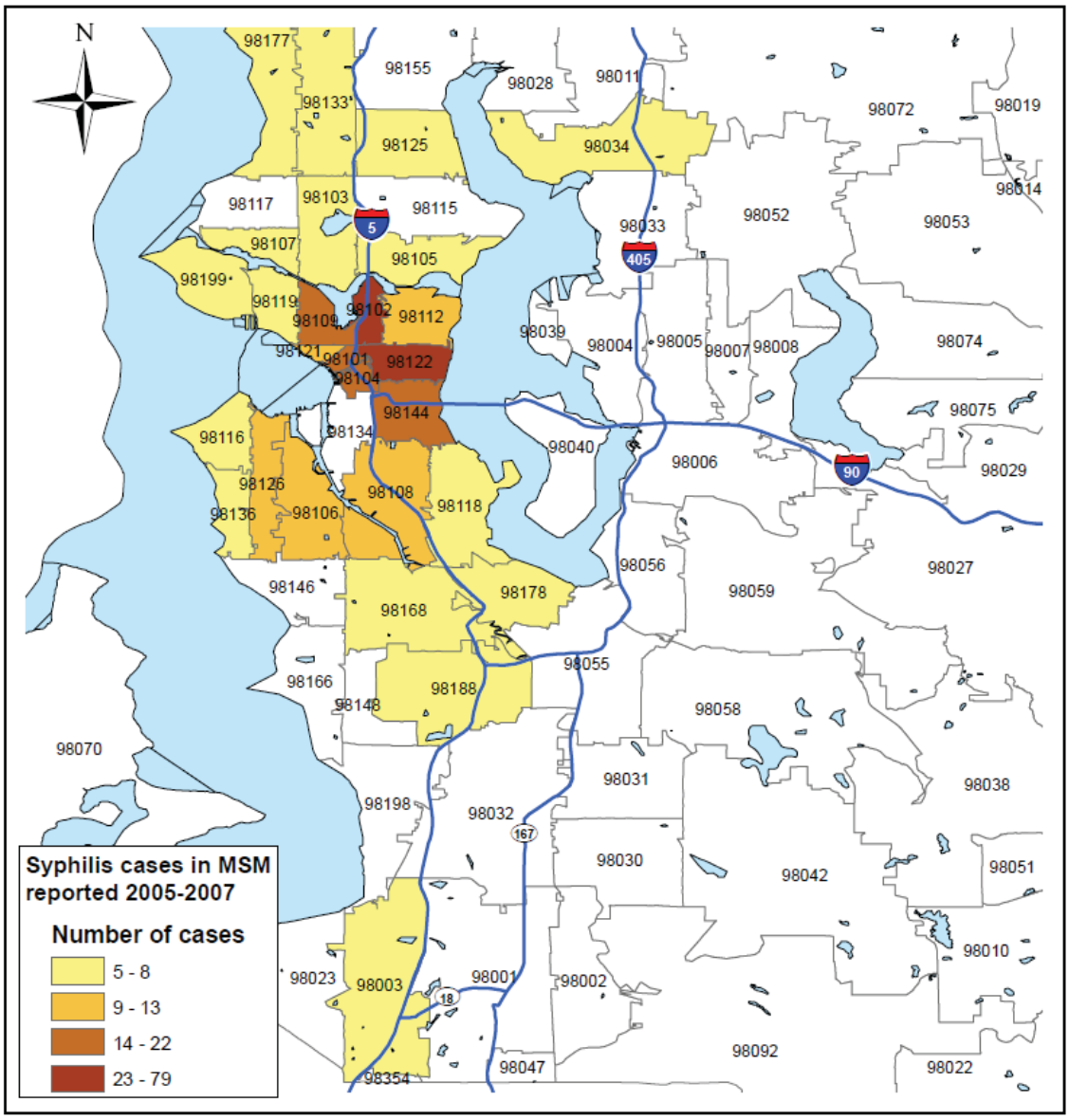


Figure 21. Total number of MSM syphilis cases by zip code, King County 2005-2007



STD key findings

- The three STDs discussed in this chapter—gonorrhea, chlamydia and syphilis—contribute to other reproductive health problems such as infertility, PID and ectopic pregnancy.
- Asymptomatic women are often screened for chlamydia infection, so women have much higher rates of reported chlamydia than men, both nationally and in King County.
- Racial minorities have much higher rates of chlamydia than Whites, and gonorrhea rates are 14 and 8 times higher among Black and Native American women than White women, respectively, and nine times higher in Black men than White men.
- King County is experiencing an ongoing epidemic of syphilis in MSM; 97% of the 194 cases reported in 2007 occurred in MSM.
- The disproportionately high rates of STDs in MSM indicates that there is ongoing sexual risk behavior among some MSM in King County. In spite of this, new HIV cases have not increased in MSM.

Chapter VI. Tuberculosis

Background

Tuberculosis (TB) remains a serious public health threat worldwide. One-third of the world's population has latent TB infection and two million people a year die of TB disease globally. In total, 13,299 TB cases (a rate of 4.4 cases per 100,000 persons) were reported in the U.S. in 2007. Nationally in 2007, the number of TB cases reported and the TB case rate decreased 3.3% and 4.2%, respectively, compared to 2006.

Surveillance systems and reporting requirements

Healthcare providers and laboratories are required to immediately report TB to their local health jurisdiction. The Public Health TB Control Program has been very successful in ensuring that TB cases complete treatment, and in screening and evaluating the contacts of these cases. To manage TB disease with the tools currently available, the TB Control Program focuses on three fundamental principles: (1) case management of patients with active TB disease in order to ensure 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 or recently infected; and (3) collaborative efforts with a number of public health and community partners to enhance targeted TB testing and treatment of latent TB infection.

Clinical aspects

TB is an infectious disease caused by the bacterium *Mycobacterium tuberculosis*. The term "latent TB" is used to describe infection with inactive TB mycobacteria. The latency period (the time between acquisition of TB infection and the development of active TB disease) is highly variable. Constitutional symptoms of active TB disease include cough, weight loss, fever and night sweats. TB disease can occur anywhere in the body, but usually occurs in the lungs. If the disease affects the lungs, symptoms can include coughing, chest pain, and coughing up blood.

Latent TB infection must be distinguished from active TB disease. People who have latent TB have been exposed to the disease and infected, but have no symptoms; these persons are not contagious to others, although they are at risk for eventually developing active disease. According to the National Health and Nutrition Examination Survey, a group of health surveys conducted each year involving populations across the country, more than 11 million persons in the U.S. report having latent TB. An estimated 5–10% of persons with latent TB will eventually have active disease. In the absence of preventive therapy, TB disease causes death in approximately half of persons who have active TB. In addition, HIV-infected persons who also have TB disease are more likely to die, even with treatment. In 2005, the most recent year for which mortality data are available, 646 persons in the U.S. died from active TB, representing a rate of 0.2 deaths per 100,000 persons.

Transmission

TB bacteria are spread by airborne transmission. People with active TB in their lungs or pharynx aerosolize TB bacteria into the air when they cough or sneeze. When other people breathe these bacteria into their lungs, they can become infected. People with weakened immune systems, such as those with HIV/AIDS, are more likely to progress to active TB disease.

Prevention

A prompt, effective and complete course of chemotherapy for individuals with active pulmonary TB is the key to preventing further spread of the disease. Such individuals should be isolated during the initial phase of their treatment, if appropriate, until they are no longer shedding the bacteria. All contacts of people with infectious TB should be screened for TB disease, and offered a course of appropriate preventive therapy if infected.

Tuberculosis in King County

Findings from case surveillance

In 2007, 161 cases of active TB disease were reported to Public Health, representing an 11% increase from 2006 (**Figure 22**). King County had a TB rate of 8.6 cases per 100,000; this rate remains higher than the national rate (4.4 per 100,000 in 2007) (**Table 15**). The median age of TB cases was 36 years (**Table 16**).

Figure 22. Tuberculosis incidence rates and cases, King County 1969-2007

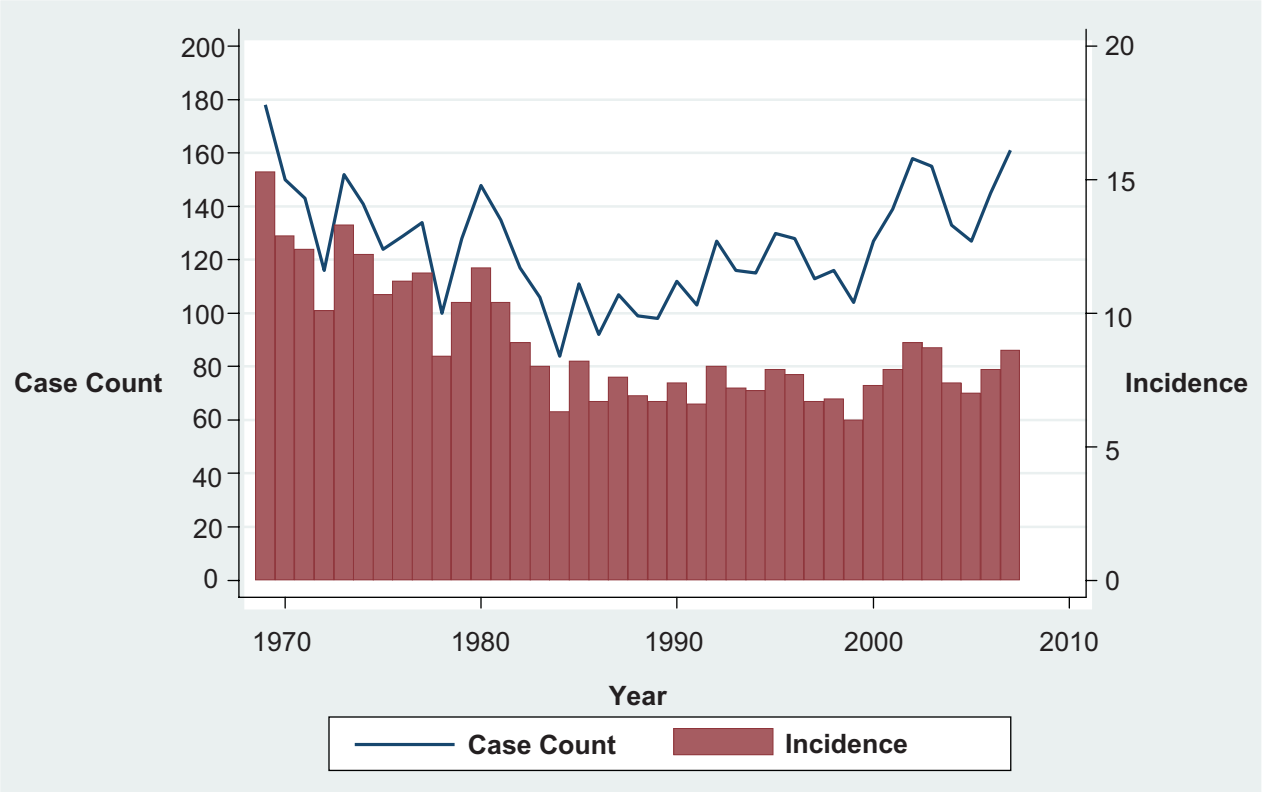


Table 15. Tuberculosis incidence rates per 100,000 population for U.S., Washington and King County 2003-2007

		2003	2004	2005	2006	2007
U.S.	Count	14,852	14,517	14,093	13,767	13,293
	Rate	**5.1**	**4.9**	**4.8**	**4.6**	**4.4**
Washington	Count	250	245	256	262	291
	Rate	**4.0**	**3.9**	**4.0**	**4.1**	**4.4**
King County	Count	155	134[a]	125[a]	145	161
	Rate	**8.7**	**7.4[a]**	**6.9[a]**	**7.9**	**8.6**

[a] 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.

There were 13 pediatric cases (aged 0-14 years), 11 of whom were identified and diagnosed through contact investigations (i.e., family members had active TB disease) and two who 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 U.S. The five most common countries of origin for TB cases were Vietnam, Somalia, Ethiopia, India, and the Marshall Islands (**Figure 23**). In addition, racial and ethnic minorities continue to have disproportionately high numbers of tuberculosis cases (**Figure 24**). As an example, Blacks have a rate of 46.2 cases per 100,000 individuals. Blacks born outside the U.S. made up 38 (75%) of the 51 Black cases in King County in 2007.

A map showing the average annual case rates in King County by zip code is presented in **Figure 25**. TB rates are highest in central and south Seattle and south King County. The map represents only the western, more populated portion of King County; there were very few cases reported from the zip codes that are not shown. The highest rates of reported cases were in central and south Seattle, and in south King County.

Table 16. Tuberculosis incidence rates per 100,000 by age group, King County 2003-2007

Age Group (years)	2003	2004	2005	2006	2007
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 23. Tuberculosis cases by country of birth, King County 2007

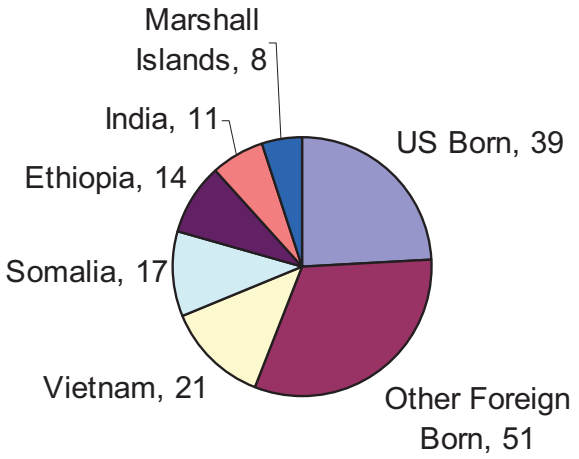
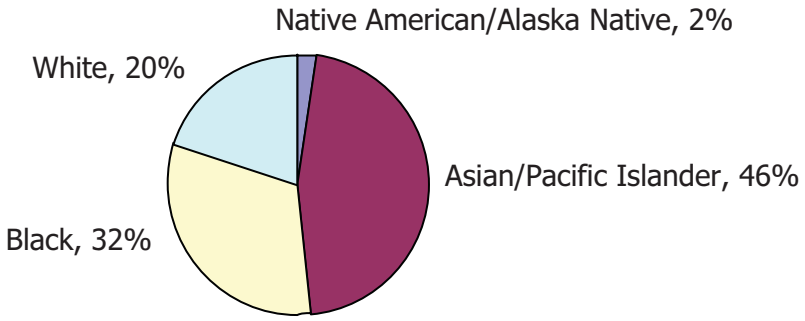


Figure 24. Tuberculosis cases by race, King County 2007



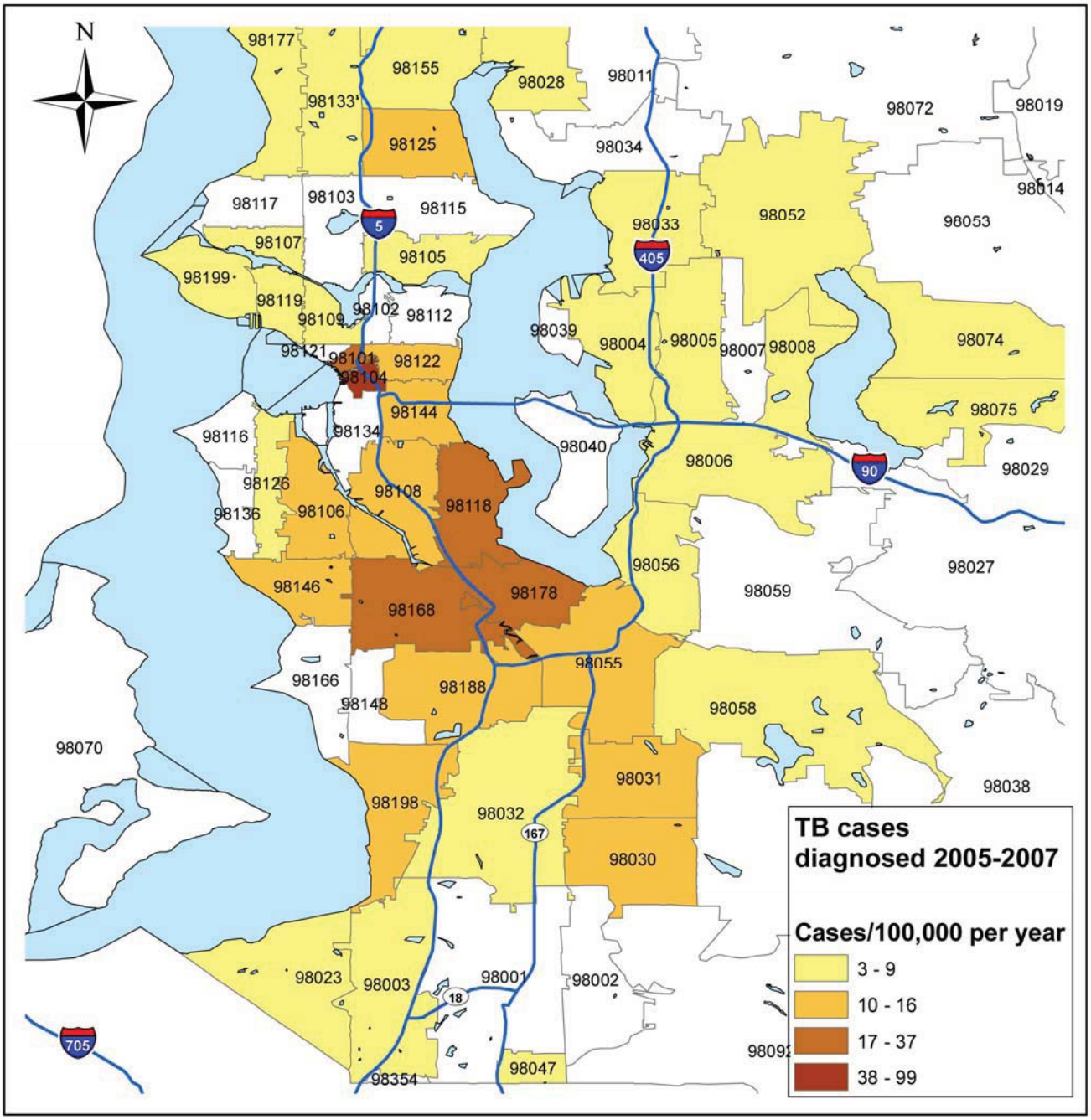
Resistance and multi-drug resistance

In 2007, 19 (15%) of the culture-positive TB cases in King County with drug susceptibilities available were drug resistant to at least one TB medication. Multi-drug resistant TB (MDR TB), defined as resistance to at least isonizid and Rifampin (the two key drugs for TB treatment), 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. Extensively drug resistant TB (XDR TB) is a relatively rare type of multi-drug resistant TB resistant to almost all drugs used to treat TB. No cases of XDR TB were reported in King County in 2007.

TB in the homeless

Fifteen homeless persons were diagnosed with active TB in 2007, comprising 9% of all TB cases in King

Figure 25. Average annual tuberculosis case rates by zip code, King County 2005-2007



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 U.S. The 12 U.S.-born homeless cases represented 31% of all U.S.-born cases in 2007, and 38% (11 cases) in 2006. 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 fluctuated widely by state.

An outbreak among Marshall Islanders

Between February and December 2007, 14 cases of TB were diagnosed among the Marshall Islander community, some of whom were born in the U.S.; twelve of these cases resided in King County. In the prior 15 years, no case of TB was reported among Marshallese in the state of Washington. Public Health, in collaboration with the Washington State Department of Health and other local health jurisdictions, conducted an investigation to identify and manage active TB cases and their close contacts with latent TB in the Marshallese community of Washington state.

Findings from other projects and research studies

Genotyping of selected specimens has been performed at the CDC or a CDC-affiliated laboratory since 2000, but universal genotyping was implemented in 2004. **Table 17** summarizes the results of all specimens tested from King County. Large clusters were identified and investigated further. Information on social networks was used to supplement demographic and medical information obtained from the patient chart and case report. The incidence of strains is monitored continuously, as an increase in a particular strain may represent undiscovered ongoing transmission.

The TB Control Program at Public Health participates in several projects which are looking to improve the detection of TB, prevent disease transmission, and improve the lives of persons who have been diagnosed with this disease. The TB Control Program 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, multicenter trials of new diagnostic tools and regimens for the treatment of TB infection and disease. The TB Control Program is also part of the Tuberculosis Epidemiologic Studies Consortium (TBESC), which 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 TB and assuring that findings are generalized across the U.S. and Canada. Currently, the Seattle TBESC site participates in five projects for the TBESC.

Table 17. Tuberculosis genotype clusters by year, King County 2004-2007

Year	No. of isolates	No. clustered	% clustered	No. clusters	Mean isolates/ cluster
2004	112	52	46%	19	2.7
2005	101	58	57%	27	2.1
2006	113	48	42%	30	1.6
2007	118	63	53%	34	1.9

Tuberculosis key findings

- While TB cases nationally decreased 3% from 2006 to 2007, TB cases in King County increased by 11%.
- The King County case rate of 8.6 TB cases per 100,000 persons is almost double the U.S. rate of 4.4 cases per 100,000.
- In 2007, most TB cases diagnosed in King County were born outside the U.S., primarily in Southeast Asia or Africa.
- In 2007, two cases of multi-drug resistant (MDR) TB were diagnosed in King County; no cases of extensively-drug resistant (XDR) TB have ever been diagnosed in King County.

Chapter VII. Co-infections

Introduction

This chapter describes co-infections of HIV and hepatitis C (HCV), sexually-transmitted diseases, or tuberculosis (TB). Co-infection is simultaneous infection with more than one pathogen occurring in a single individual; this analysis does not include persons who had multiple infections at different times. Co-infections occur when infectious diseases impact the same populations, share transmission routes and networks, and in some instances, have synergistic effects in transmission. Monitoring and evaluating co-infection prevalence and trends may improve understanding of the characteristics of the groups at highest risk and help target prevention and care services.

Data from Public Health surveillance case registries in King County were matched to identify and describe characteristics of co-infections, using strict confidentiality protections. The variables first and last name, gender, and date of birth were used to match cases from different surveillance registries. Public Health surveillance registries are population-based and provide good data sources for assessing co-infections. However, using surveillance data has some limitations because limited data are available on demographic characteristics and suspected transmission routes, and data quality, completeness, and representativeness vary between surveillance registries. It is also possible that co-infections were missed if there were errors in the data used for matching. Furthermore, in the case of chronic infections, such as HIV and HCV, infections may have been diagnosed outside King County and therefore not reported to Public Health in King County. Case-matches of surveillance data will subsequently underestimate co-infections with HIV and HCV. We also used information from case investigations of syphilis, gonorrhea, and TB, which ascertain the HIV status of cases regardless of where HIV was reported, to describe co-infections with HIV.

HIV/hepatitis C co-infection

Background

HIV and HCV are among the most common infectious diseases in humans. HIV/HCV co-infection is of particular concern because co-infection with HIV leads to more rapid progression to HCV-related liver disease and increases the risk of liver cirrhosis and cancer. Co-infection with HCV may increase the risk of HIV treatment-related liver toxicity, but the effect of HCV on HIV disease progression to AIDS is unclear. In the U.S., approximately 25% of the 1.1 million persons estimated to be infected with HIV are also infected with HCV.[20] HIV treatment guidelines recommend that all persons diagnosed with HIV be screened for HCV infection.

Transmission

HIV and HCV are both blood-borne infections that can be transmitted via exposure to contaminated blood through sharing of injection equipment, medical devices, or insufficiently screened blood products or other donor-derived tissue. HIV is also spread perinatally and sexually, however these routes of transmission are less common for HCV. HCV is rarely transmitted through heterosexual intercourse, even within HIV-infected couples. Outbreaks of acute HCV, apparently spread by sexual contact among HIV-infected MSM, however, have become a recent concern,[21] as HCV is emerging as an STD within this specific population; HIV-positive MSM have rising rates of HCV, while HIV-negative MSM do not.

HIV/HCV co-infection in King County

Findings from case surveillance

Registries of HIV and HCV cases reported in King County were matched to identify co-infections. We included 8,261 HIV/AIDS cases diagnosed by December 31, 2007 (and reported by June 30, 2008) and not known to have died by January 1, 2000, and 13,218 HCV cases reported from 2000 to 2007. We identified a total of 486 people co-infected with HIV and HCV (**Table 18**). Because information on risk exposure was missing for 63% of HCV cases, we used risk information from HIV case reports. As expected, injection drug use was the most common risk factor for co-infection with these two blood-borne pathogens, accounting for 63% of co-infected cases. Male–male sex was listed as the exposure in 28% of the co-infections; however, based on additional exposure information from HCV case reports, some of these cases also had a history of injection drug use.

Overall, six percent of HIV cases in the time period of

[20] www.cdc.gov/hiv/resources/qa/HIV-HCV_Coinfection.htm.
[21] Urbanus AT. Viral hepatitis among men who have sex with men, epidemiology and public health consequences. Eurosurveillance Weekly November 26, 2009;14:47.

this review were also reported with HCV. This is considerably lower than the 25% national estimate, probably because injection drug use accounts for a much smaller proportion of HIV infections in King County than nationally (**see HIV, Chapter III**). Interestingly, only 18% of HIV cases with MSM/IDU exposure and 29% of cases with IDU exposure were reported with HCV. Local studies have found that HCV prevalence in IDU is around 75-80% and we would expect similar prevalence of HCV among IDU reported with HIV (**see hepatitis C, Chapter IV**). Clearly, the result of this match represents an underestimate of co-infections. It is possible that some of the people reported with HIV and IDU exposure were either diagnosed with HCV before chronic HCV became reportable in 2000, or were diagnosed in another county or state.

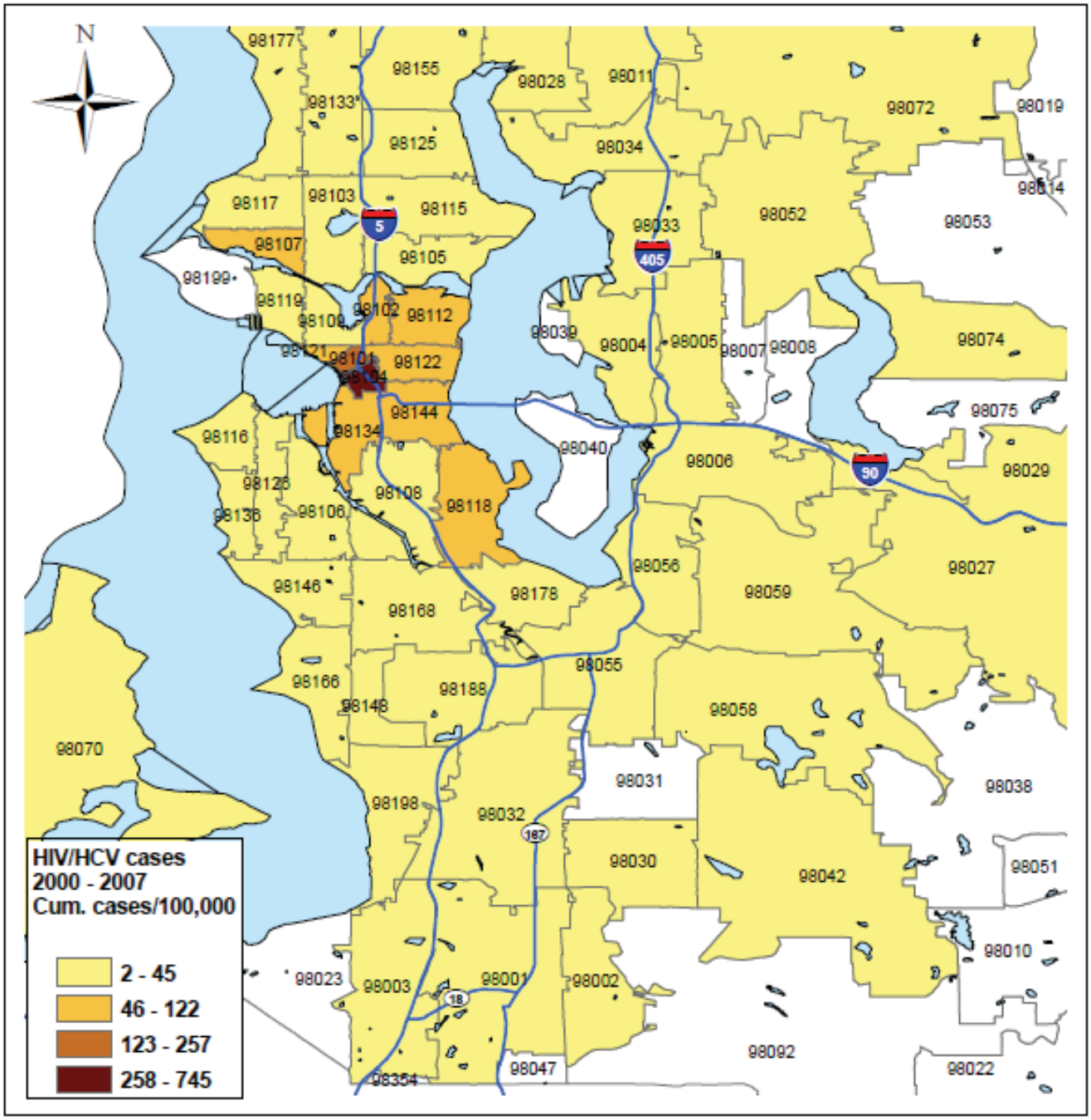
Table 18. Characteristics of persons with HIV, persons with HCV, and persons co-infected with HIV and HCV, King County 2000-2007

	HIV[a]		HCV[b]		HIV/HCV co-infections		HIV cases reported with HCV
	N	%	N	%	N	%	%
Total	8,261	NA	13,218	NA	486	NA	6%
Year of diagnosis (HIV) or report (HCV)							
Before 2000	5,014	60%	NA	NA	NA	NA	NA
2000–2003	1,785	22%	6,319	48%	NA	NA	NA
2004–2007	1,462	18%	6,899	52%	NA	NA	NA
Sex							
Male	7,504	91%	8,548	65%	412	85%	5%
Female	757	9%	4,659	35%	74	15%	10%
Age (years)							
18-29	2,272	28%	992	8%	26	5%	NA
30-39	3,229	39%	2,502	19%	168	35%	NA
40-49	1,996	24%	5,027	38%	214	44%	NA
50+	764	9%	4,697	36%	78	16%	NA
Race/ethnicity[c]							
White	5,688	69%	4,656	63%	311	64%	5%
Black	1,367	17%	1,687	23%	101	21%	7%
Hispanic	761	9%	429	6%	35	7%	5%
Asian/Pacific Islander	215	3%	318	4%	13	3%	6%
Native American/AK Native	123	2%	229	3%	14	3%	11%
Other/multiracial	96	1%	72	1%	12	3%	13%
Residence (zip code)[d]							
Seattle & Shoreline	6,172	83%	8,634	67%	405	86%	7%
South King County	726	10%	2,899	23%	46	10%	6%
East King County	547	7%	1,257	10%	21	5%	4%
Risk exposure[c]							
MSM (HIV only)	5,630	68%	NA	NA	136	28%	2%
MSM/IDU (HIV only)	827	10%	NA	NA	147	30%	18%
IDU	536	7%	4,643	35%	158	33%	29%
Heterosexual (HIV only)	557	7%	NA	NA	18	4%	3%
Sexual (HCV only)	NA	NA	71	2%	NA	NA	NA
Transplants/Blood products	51	1%	109	1%	8	2%	16%
Other	2	<1%	63	<1%	NA	NA	NA
Unknown	658	8%	8,332	63%	19	4%	3%

[a] HIV cases diagnosed by 12/31/2007, reported by 6/30/2008 and alive 1/1/2000.
[b] HCV cases reported from 1/1/2000–12/21/2007.
[c] Information on race/ethnicity and risk exposure for HIV/HCV cases was based on information from HIV cases.
[d] Zip code of HIV/HCV co-infection was based on information from HCV cases.
NA=not available or not applicable. Some categories may not add up to total due to missing data.

Figure 26 maps the cumulative HIV/HCV co-infection rates in King County residents from 2000 to 2007 by zip code. The zip code represents the residence at the time of HCV diagnosis which maybe different from the residence at the time of HCV acquisition. The zip code may also reflect the location of a shelter or other transitional residence. The map represents only the western, more populated portion of King County; there were very few-cases in the zip codes that are not shown. The highest rates of co-infected cases were in Seattle, but co-infections also occurred in many other parts of the county.

Figure 26. Cumulative HIV/HCV co-infection rates by zip code,[a] King County 2000-2007



[a] Zip code at time of HCV report

HIV/HCV co-infection key findings

- As expected, the majority of co-infections were among IDU, since HCV is primarily spread through exposure to contaminated blood through sharing injection equipment.
- Six percent of King County HIV cases were reported with HCV, compared to an estimated 25% of HIV cases nationwide. Injection drug use accounts for a much smaller proportion of HIV cases in King County than in the U.S. as a whole.
- Regular HCV screening of HIV-infected IDU and MSM may offer opportunities for early treatment during the acute phase, providing a more favorable clinical outcome. Early clinical intervention may, in turn, reduce HCV transmission to HIV-positive and other partners.
- While HIV/HCV co-infections were documented in many parts of King County, the highest rates of co-infection were in central and south Seattle.
- Data from surveillance registries are limited, and registry matches underestimate the true number and rate of co-infections.

HIV/gonorrhea and HIV/syphilis co-infections

Background

Sexually transmitted diseases (STDs) are among the most common infectious diseases reported to public health surveillance systems. In the U.S., an estimated 1.1 million persons are infected with HIV, and approximately 19 million new STD cases occur annually.[22] Infection with STDs can facilitate HIV transmission, and persons infected with STDs are at higher risk of HIV acquisition. Testing and treatment for STDs can be an effective tool to prevent the spread of HIV. STD trends also serve as indicators of changes in risk behaviors that also affect the spread of HIV; these trends can be helpful in forecasting how and where HIV rates are likely to change.

Transmission

Gonorrhea and syphilis can be transmitted through vaginal, anal or oral sexual activity. HIV is transmitted through vaginal or anal sexual activity; oral transmission of HIV is much less common. Individuals who are infected with an STD are two to five times more likely than people not infected with an STD to acquire HIV from an HIV-infected sexual partner.[23] For example, syphilis infection may produce genital or anal ulcers that facilitate entry of HIV into the bloodstream. Co-infection with HIV and gonorrhea enhances HIV transmission to uninfected sexual partners by increasing viral shedding and increasing HIV viral load in genital secretions.

HIV/STD co-infection in King County

Findings from case surveillance

To identify co-infections, Public Health HIV/AIDS surveillance data were linked with Public Health STD surveillance data. A total of 13,084 cases with gonorrhea and/or early syphilis diagnosed between 2000 and 2007 were matched with 8,261 HIV cases diagnosed by December 31, 2007 (and reported by June 30, 2008) and not known to have died by January 1, 2000, resulting in 587 matches. Cases were considered matches if the HIV diagnosis preceded the STD diagnosis or if both HIV and the STD were diagnosed in the same year. Since some of the persons with HIV were diagnosed in another county or state and not reported to Public Health in King County, the results of this match underestimate co-infections.

We identified 409 cases of HIV/gonorrhea co-infection between 2000 and 2007 (**Table 19**). These 409 cases were 3% of all the reported gonorrhea cases in this time period and 5% of the total HIV cases. Nearly all of the gonorrhea cases among HIV-infected persons were among men (97%). Over two-thirds (68%) were younger than 40 years of age. Seventy percent were White and almost all (93%) were MSM based on their HIV risk exposure.

The STD Program conducts more detailed investigations of a random sample of reported gonorrhea cases, including ascertainment of HIV status. From 2007 to 2008, 96 of these cases were further investigated. Among these 96 cases, 24 (25%) were also infected with HIV.

We identified 238 HIV/early syphilis co-infections from 2000 to 2007. These 238 cases were 21% of reported early syphilis cases and 3% of HIV cases. All of the co-infected cases were male and 99% were MSM according to their HIV risk exposure (**Table 20**). Seventy-one percent of the co-infected cases were younger than 40 years of age and 71% were White.

The STD Program conducted detailed investigations of all reported syphilis cases, including ascertainment of HIV status. From 2007 to 2008, 356 MSM were reported with syphilis. Among these 356 cases, 213 (60%) were also infected with HIV.

[22] CDC, National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention. 2007 Disease Profile. Atlanta, GA; 2009:p.27.
[23] www.cdc.gov/std/hiv/default.htm.

Table 19. Characteristics of persons with HIV, persons with gonorrhea, and persons co-infected with HIV and gonorrhea, King County[a] 2000-2007

	HIV[a]		Gonorrhea[b]		HIV/gonorrhea co-infections		% HIV cases reported with gonorrhea
	N	%	N	%	N	%	
Total	8,261	NA	12,282	NA	409	NA	5%
Sex							
Male	7,504	91%	7,814	64%	398	97%	5%
Female	757	9%	4,458	36%	11	3%	2%
Age (years)							
0-17	NA	NA	786	6%	NA	NA	NA
20-29	2,272	28%	6,023	49%	90	22%	NA
30-39	3,229	39%	3,149	26%	187	46%	NA
40-49	1,996	24%	1,742	14%	101	25%	NA
50+	764	9%	582	5%	31	8%	NA
Race/ethnicity[c]							
White	5,688	69%	2,993	47%	288	70%	5%
Black	1,367	17%	2,585	40%	57	14%	4%
Hispanic	761	9%	338	5%	43	11%	6%
Asian/Pacific Islander	215	3%	336	5%	14	3%	7%
Native American/AK Native	123	2%	173	3%	2	<1%	2%
Other/multiracial	96	1%	NA	NA	5	1%	5%
Residence (zip code)[d]							
Seattle & Shoreline	6,172	75%	7,468	61%	302	74%	5%
South King County	726	9%	2,368	19%	33	8%	5%
East King county	547	7%	718	6%	15	4%	3%
Unknown zip code	816	10%	1,728	14%	59	14%	7%
Risk exposure[e]							
MSM (HIV)	5,630	68%	NA	NA	314	77%	6%
MSM/IDU (HIV)	827	10%	NA	NA	66	16%	8%
Male-male sexual partner (STD)	NA	NA	1,517	12%	NA	NA	NA
IDU (HIV)	536	7%	NA	NA	10	2%	2%
Heterosexual (HIV)	557	7%	NA	NA	11	3%	2%
Heterosexual partner (STD)	NA	NA	2,773	23%	NA	NA	NA
Transplants/Blood products (HIV)	51	1%	NA	NA	2	<1%	4%
Unknown (HIV & STD)	658	8%	7,976	65%	6	2%	1%

[a] HIV cases diagnosed by 12/31/2007, reported by 6/30/2008 and alive in 1/1/2000.
[b] Gonorrhea cases reported from 1/1/2000–12/21/2007.
[c] Information from HIV cases was used to describe race/ethnicity for HIV/gonorrhea co-infections.
[d] Zip code: HIV cases: closest to HIV diagnosis, gonorrhea cases: at date of report.
[e] Risk exposure information from HIV cases was used to describe risk exposure for HIV/STD co-infections.
NA=not applicable or not available. Some categories may not add up to total due to missing data.

Table 20: Characteristics of persons with HIV, persons with early syphilis, and persons co-infected with HIV and early syphilis, King County 2000-2007

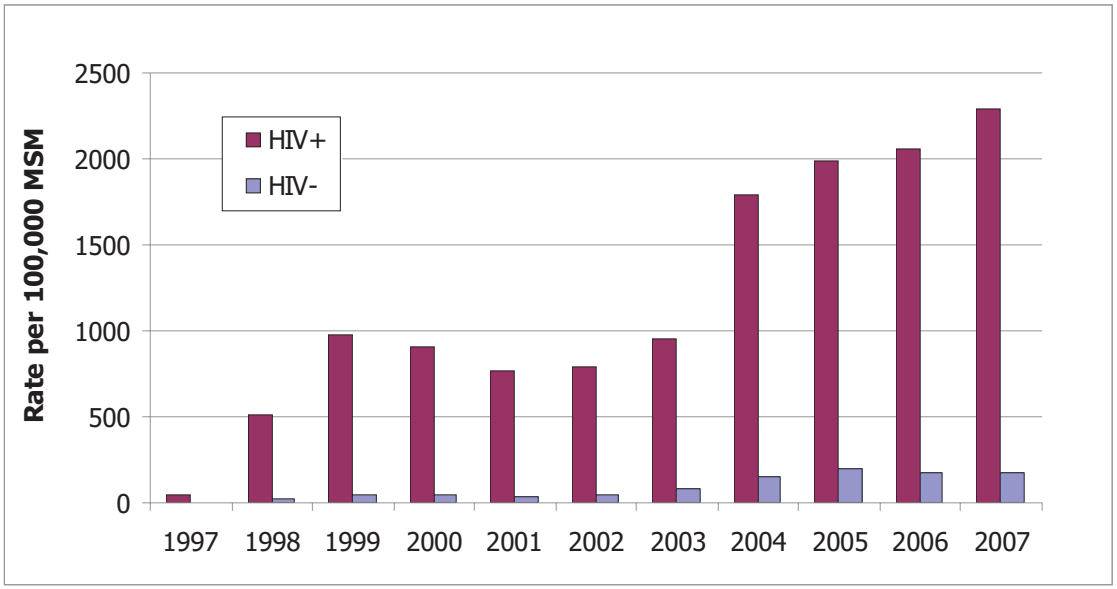
	HIV[a]		Early syphilis[b]		HIV/early syphilis co-infections		% HIV cases reported with early syphilis
	N	%	N	%	N	%	
Total	8,261	NA	1,113	NA	238	NA	3%
Sex							
Male	7,504	91%	1,080	97%	238	100%	3%
Female	757	9%	32	3%	0	NA	0%
Age (years)							
0-17	NA	NA	4	<1%	NA	NA	NA
18-29	2,272	28%	243	22%	49	21%	NA
30-39	3,229	39%	444	40%	107	50%	NA
40-49	1,996	24%	329	29%	70	29%	NA
50+	764	9%	93	8%	11	5%	NA
Race/ethnicity[c]							
White	5,688	69%	784	70%	170	71%	3%
Black	1,367	17%	123	11%	25	11%	<1%
Hispanic	761	9%	98	9%	29	12%	4%
Asian/Pacific Islander	215	3%	45	4%	8	3%	4%
Native American/AK Native	123	2%	13	1%	1	<1%	1%
Other/multiracial	96	1%	NA	NA	5	2%	5%
Residence (zip code)[d]							
Seattle & Shoreline	6,172	75%	951	85%	210	88%	3%
South King County	726	9%	77	7%	10	4%	1%
East King county	547	7%	56	5%	13	6%	2%
Unknown county	816	10%	29	3%	5	2%	<1%
Risk exposure[e]							
MSM (HIV)	5,630	68%	NA	NA	204	86%	4%
MSM/IDU (HIV)	827	10%	NA	NA	30	13%	4%
Male-male sexual partner (STD)	NA	NA	597	54%	NA	NA	NA
IDU (HIV)	536	7%	NA	NA	3	1%	<1%
Heterosexual (HIV)	557	7%	NA	NA	0	NA	0
Heterosexual partner (STD)	NA	NA	52	<1%	NA	NA	NA
Transplants/Blood products (HIV)	51	1%	NA	NA	0	NA	0
Unknown (HIV & STD)	658	8%	464	42%	1	<1%	<1%

[a] HIV cases diagnosed by 12/31/2007, reported by 6/30/2008 and alive in 1/1/2000.
[b] Syphilis cases reported from 1/1/2000–12/21/2007.
[c] Information from HIV cases was used to describe race/ethnicity for HIV/syphilis co-infections.
[d] Zip code: HIV cases: closest to HIV diagnosis, syphilis cases: at date of report.
[e] Risk exposure information from HIV cases was used to describe risk exposure for HIV/STD co-infections.
NA=not applicable or not available. Some categories may not add up to total due to missing data.

Figure 27 shows the incidence rate of early syphilis among MSM from 1997 to 2007 by HIV status. Syphilis incidence among HIV-positive MSM increased rapidly early in the syphilis epidemic, and continues to increase, while incidence among HIV-negative MSM remains relatively stable. HIV information for **Figure 27** was based on data obtained as part of the syphilis case report; some of these HIV cases were diagnosed elsewhere and were not reported to Public Health in King County, therefore they were not identified by our match.

Figures 28 and **29** map the total number of HIV/gonorrhea co-infected cases among MSM and the total number of HIV/syphilis co-infected cases among MSM in King County from 2000 to 2007, by zip code at the time of STD diagnosis. The maps represent only the western, more densely-populated areas of the county; few cases occurred in the zip codes not shown on the map. The distribution of HIV/gonorrhea co-infections and the distribution of HIV/syphilis co-infections are very similar. The highest concentration of cases occurred in the central areas of Seattle, with progressively lower rates in zip codes further from the city center.

Figure 27. Incidence rates of early syphilis among MSM, by HIV status, King County 1997-2007

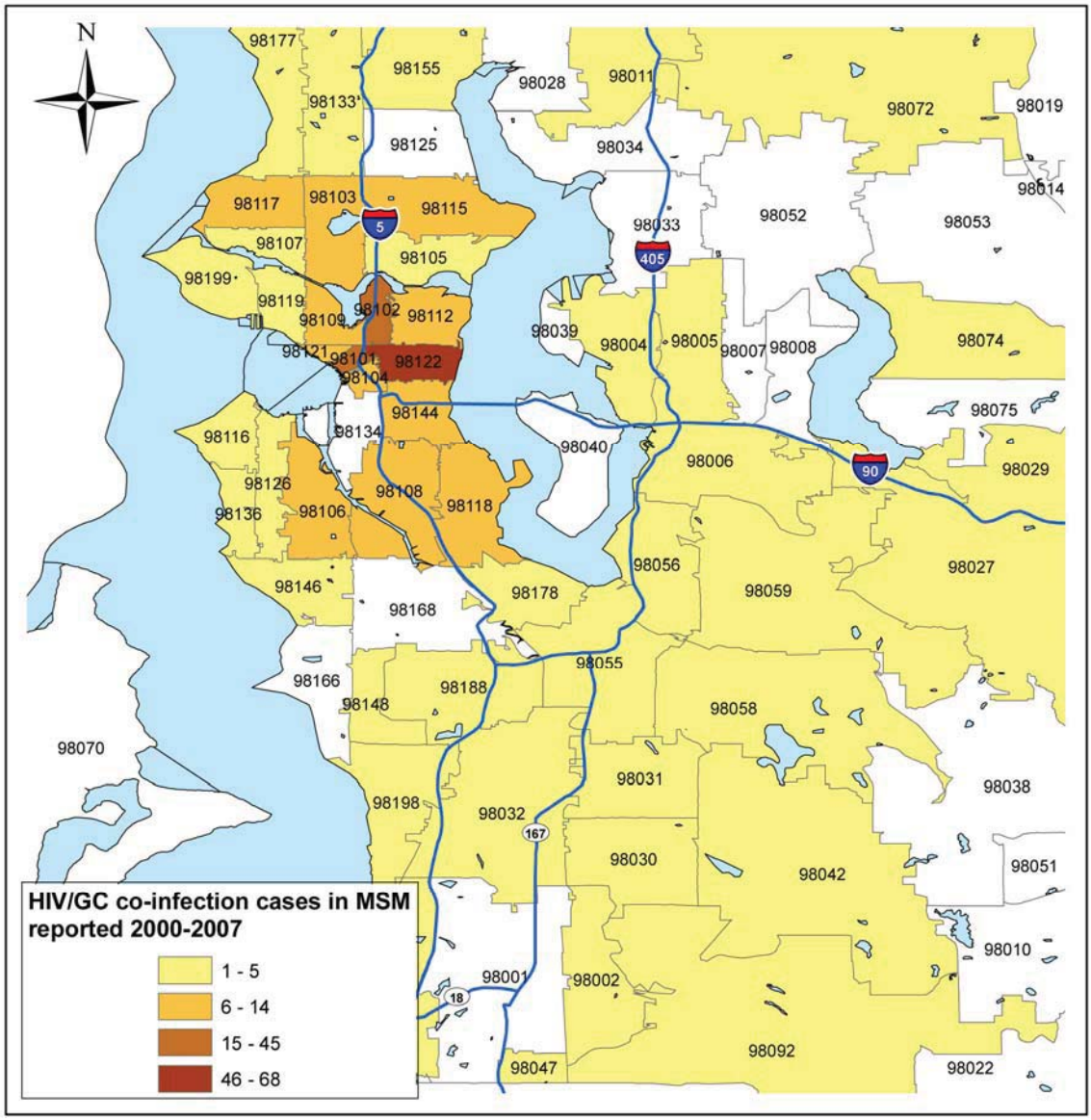


Findings from other projects and research studies

Among 368 MSM interviewed for the National HIV Behavioral Surveillance (NHBS) project in 2008, seven percent of HIV-negative MSM self-reported having been diagnosed with an STD in the previous 12 months; among the HIV-positive participants, 13% self-reported having been diagnosed with an STD in the previous 12 months, twice the rate of the HIV-negative participants.

Several chart-review studies conducted by Public Health looked at STDs in HIV-infected people in King County. In the Adult Spectrum of Disease (ASD) study examining HIV-infected persons seeking outpatient care, the overall rate of diagnosis of any STD was 6% per year from 1989-2004. Gonorrhea rates among participants averaged 2% per year, syphilis 1% per year, chlamydia 1% per year, and non-gonococcal urethritis (in men) 2% per year. Among the 95 HIV-infected persons whose medical care was reviewed through the Medical Monitoring Project (MMP) in 2005, the overall prevalence of any STD was 12%, of gonorrhea 3%, of syphilis 2%, and of chlamydia 2%. In the Care and Prevention survey conducted in 2007, the overall prevalence of any STD among HIV-positive persons was 6%, including 3% with gonorrhea, 4% with syphilis, and 4% with chlamydia.

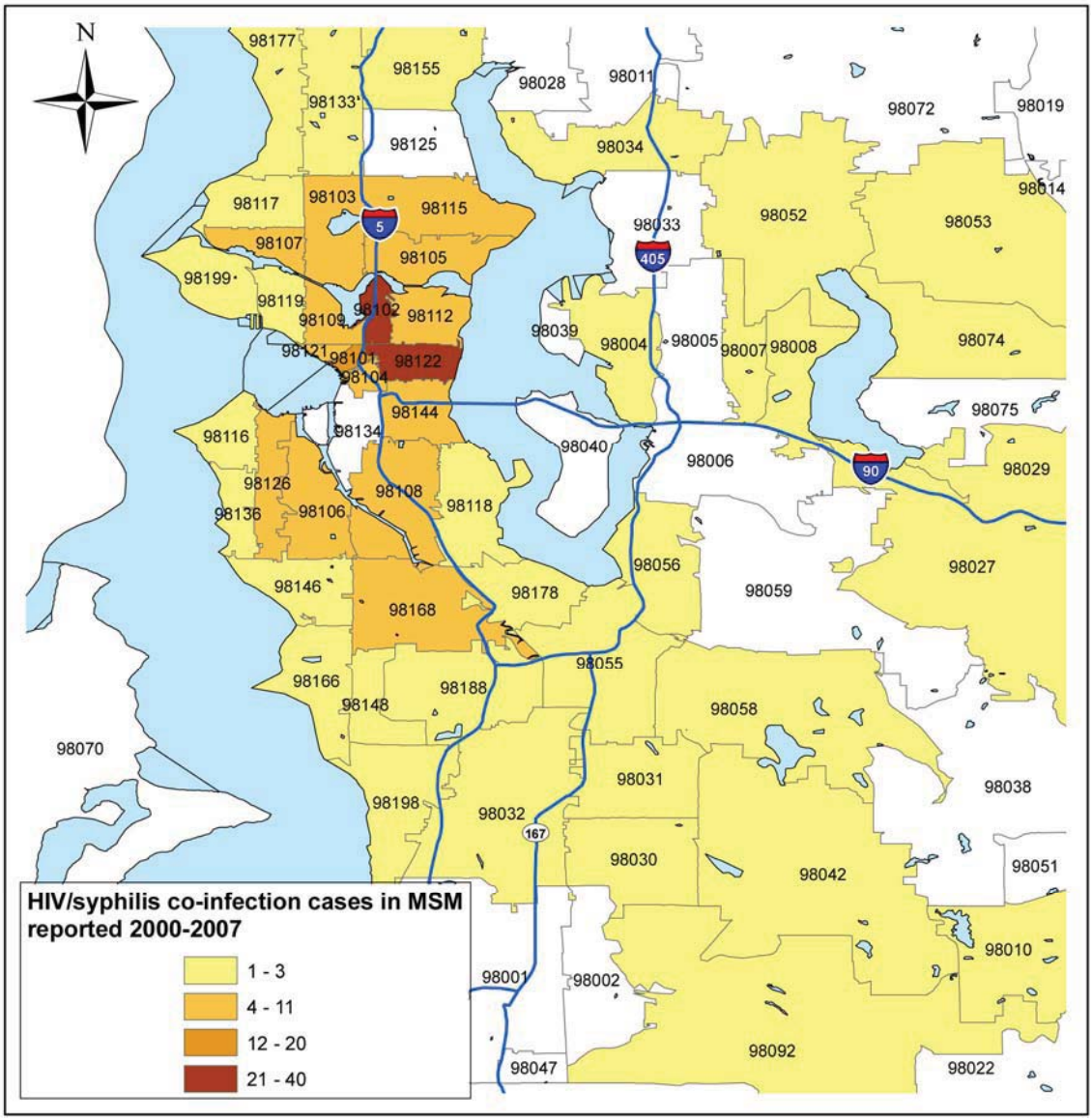
Figure 28. Total number of HIV and gonorrhea co-infections in MSM, King County 2000-2007



HIV/gonorrhea and HIV/syphilis co-infection key findings

- Co-infection data for HIV and gonorrhea and HIV and syphilis demonstrate that there is ongoing sexual risk-taking among HIV-infected MSM.
- People diagnosed with early syphilis in King County are primarily HIV-infected MSM. Rates of gonorrhea are higher in MSM who are HIV-positive than in MSM who are HIV-negative.
- Sexually transmitted infections (STDs) among MSM with HIV infection have increased since HAART made HIV a chronic manageable disease; this is of special concern because STDs facilitate HIV transmission.
- Data from case surveillance registries are limited, and registry matches underestimate the true number and rate of co-infections.
- The highest concentration of HIV/STD co-infections occurred in the central areas of Seattle, with progressively lower rates in zip codes further from the city center.

Figure 29. Total number of HIV and syphilis co-infections in MSM, King County 2000-2007



HIV/tuberculosis co-infection

Background

In spite of fewer people in this country suffering with tuberculosis (TB) relative to other countries, TB remains a serious threat, especially for HIV-infected persons. Worldwide, TB is one of the leading causes of death among people infected with HIV. Offering HIV testing is an important part of TB management, as early detection of HIV infection in a patient with TB allows early, intense treatment to minimize further morbidity and mortality as well as development of drug resistance. According to CDC guidelines, all individuals at high risk, including HIV-infected persons, recent immigrants, and IDU, should be screened for latent TB annually. The CDC reported that over one-third of U.S. TB cases did not have an available HIV status in 2007. Of those with available HIV status, 11% of TB cases nationally were co-infected with HIV.

HIV/TB co-infection in King County

Findings from case surveillance

In 2007, HIV test results were obtained for 93% of TB cases in King County. Among this group, nine TB cases were co-infected with HIV, representing 6% of all TB cases (**Table 21**). Rates of HIV co-infection among persons with TB are comparable to the national rate (7%). People 25-44 years of age had higher rates of co-infection than TB patients in general. In King County, 5% (6 of 122 cases) of foreign-born TB cases and 8% (3 of 39 cases) of U.S.-born TB cases were co-infected with HIV in 2007. Case management of HIV/TB co-infected patients typically requires increased coordination between the TB Control Program and the HIV care provider.

Table 21. HIV-positive TB patients by age group, King County 2003-2007[a]

	25-44 years of age		All ages	
Year	**N**	**%**	**N**	**%**
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%

[a] Percentages based on cases with HIV test results

HIV/TB co-infection key findings

- Screening of TB patients for HIV infection is higher in King County (93%) than nationally (<66%).
- 5-10% of TB cases in King County each year are co-infected with HIV.
- In King County, TB patients aged 25-44 have higher rates of HIV co-infection than TB patients overall.

CHAPTER VIII. Appendices

Glossary

AIDS: Acquired immunodeficiency syndrome, the end-stage of HIV infection.

AIDS case definitions and HIV classification systems:

2008 CDC HIV classification system For adults and adolescents (≥ 13 years of age):

- **HIV infection, stage 1**: No AIDS-defining condition and either CD4 T-lymphocyte count of ≥500 cells/μL or CD4 T-lymphocyte percentage of total lymphocytes of ≥29.
- **HIV infection, stage 2**: No AIDS-defining condition and either CD4 T-lymphocyte count of 200--499 cells/μL or CD4 T-lymphocyte percentage of total lymphocytes of 14--28.
- **HIV infection, stage 3 (AIDS):** CD4 T-lymphocyte count of <200 cells/μL or CD4 T-lymphocyte percentage of total lymphocytes of <14 or documentation of an AIDS-defining condition (see OI below). Documentation of an AIDS-defining condition supersedes a CD4 T-lymphocyte count of ≥200 cells/μL and a CD4 T-lymphocyte percentage of total lymphocytes of ≥14.
- **HIV infection, stage unknown:** No information available on CD4 T-lymphocyte count or percentage and no information available on AIDS-defining conditions.

Opportunistic Illnesses (OI) or AIDS-defining conditions:

- Candidiasis of bronchi, trachea, or lungs
- Candidiasis of esophagus†
- Cervical cancer, invasive
- Coccidioidomycosis, disseminated or extrapulmonary
- Cryptococcosis, extrapulmonary
- Cryptosporidiosis, chronic intestinal (>1 month's duration)
- Cytomegalovirus disease (other than liver, spleen, or nodes)
- Cytomegalovirus retinitis (with loss of vision)[1]
- Encephalopathy, HIV related
- Herpes simplex: chronic ulcers (>1 month's duration) or bronchitis, pneumonitis, or esophagitis
- Histoplasmosis, disseminated or extrapulmonary
- Isosporiasis, chronic intestinal (>1 month's duration)
- Kaposi sarcoma†
- Lymphoma, Burkitt (or equivalent term)
- Lymphoma, immunoblastic (or equivalent term)
- Lymphoma, primary, of brain
- *Mycobacterium avium* complex or *Mycobacterium kansasii*, disseminated or extrapulmonary†
- *Mycobacterium tuberculosis*, pulmonary†,
- *Mycobacterium tuberculosis*, disseminated† or extraplumonary†
- *Mycobacterium*, other species or unidentified species, disseminated† or extrapulmonary†
- *Mycobacterium avium* complex or *Mycobacterium kansasii*, disseminated or extrapulmonary†
- *Mycobacterium tuberculosis*, pulmonary†,
- *Mycobacterium tuberculosis*, disseminated† or extraplumonary†

- *Mycobacterium*, other species or unidentified species, disseminated† or extrapulmonary†
- *Pneumocystis jirovecii* pneumonia†
- Pneumonia, recurrent†
- Progressive multifocal leukoencephalopathy
- *Salmonella* septicemia, recurrent
- Toxoplasmosis of brain, onset at age >1 month†
- Wasting syndrome attributed to HIV

† Condition that might be diagnosed presumptively.

CD4: CD4 is a receptor used by HIV to gain access into host T lymphocyte cells. HIV infection causes reduction in the number of T lymphocyte cells with CD4 receptors. CD4+ T lymphocyte counts are used to define the stage of HIV infection (see AIDS case definition).

CDC: Centers for Disease Control and Prevention, a federal health promotion agency headquartered in Atlanta. The CDC's National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention is an integrated program that conducts public health surveillance, prevention research, and programs to prevent and control these 'intersecting' diseases.

95% confidence intervals (CI): The 95% CI is used to illustrate the uncertainty of a point estimate such as a rate, and is defined as follows: the range of values within which, upon repeated measure, the rate can be expected to fall 95% of the time**.**

Cumulative cases: All cases occurring during an extended period of time.

HAART: Highly active antiretroviral therapy or the HIV "drug cocktail".

HARS: HIV/AIDS Reporting System.

HBV: Hepatitis B virus, an infection of the liver which can be acute or chronic.

HCV: Hepatitis C virus, an infection of the liver which usually results in a chronic infection.

HIV: Human immunodeficiency virus and the cause of AIDS.

Incidence: The number of new cases within a given time period (usually one year).

Incidence rate: The number of new cases per unit of population (usually 100,000 persons) within a given time period (usually one year).

IDU: Injection drug user. For the purposes of defining HIV exposure, any injection drug use not prescribed by a medical professional since 1978 and prior to HIV diagnosis is included.

MSM: Men who have sex with other men, whether or not they self-identify as gay or homosexual; includes both homosexual and bisexual men.

Post-exposure prophylaxis (PEP): Treatment given to prevent development of disease after exposure to an infection. Examples include treatment of infants born to mothers who are HBV carriers with HBV vaccine and HBV immune globulin and treatment of healthcare workers potentially exposed to HIV with HAART.

Prevalence: The number of existing cases in a population at a specific point in time.

Prevalence rate: The total number of existing cases per unit of population (usually 100,000 persons) within a given time period (usually one year).

Public Health: Public Health–Seattle & King County.

Rate: A fixed ratio between two things; a quantity, amount, or degree of something measured per unit of something else, usually a period of time.

Reporting delay: The time between diagnosis of a disease and the receipt of the case report by the health department.

Reporting completeness: The proportion of all diagnosed cases which are reported to the health department after allowing for reporting delay time.

RDS: Respondent-driven sampling. A sampling method that which starts with a few participants from a specific population (such as injection drug users) recruiting peers in the same population for a small incentive. The newly-recruited participants then in turn recruit their peers from the specific population. For RDS data analysis the prevalence of factors of interest is estimated after adjustment for potential recruitment biases such as network sizes and "who recruits who".

STD: Sexually-transmitted disease. STDs are also referred to as sexually transmitted infections (STIs).

VBS: Venue-based sampling. A sampling method where participants are systematically recruited at randomly chosen venues that are frequented by the target survey population.

Viral load: The number of HIV virus particles in one microliter of blood of an HIV-infected person. Used as a marker of HIV replication and treatment efficacy.

Data sources

A summary of the main data sources used to develop **The Epidemiology of Intersecting Infections** is presented below.

HIV/AIDS case reporting data (HARS) (1982-ongoing): This database includes demographic, geographic, exposure, diagnostic, and laboratory data for HIV and AIDS cases residing in King County at time of diagnosis. These data provide good population-based epidemiological information on HIV/AIDS in King County because HIV case reporting is almost 90% complete. HIV/AIDS reporting is the only population-based source of HIV epidemiology data and is widely used for prevention and care services planning. Because standard medical therapy has increased the time between acquiring HIV infection and developing AIDS, AIDS data no longer accurately reflects the epidemiology of recently-infected populations. HIV infection reporting was implemented in Washington in 1999, and provides epidemiological data on the earlier stages of HIV. HIV reporting data do not include infected persons who are not yet diagnosed. HIV and AIDS reporting data include limited information that is readily available from medical records. The database is called HARS – the HIV/AIDS Reporting System.

The Public Health–Seattle & King County (Public Health) HIV/AIDS Epidemiology Program collects and manages HIV/AIDS data in King County. With the assistance of local health departments, the Washington State Department of Health Infectious Disease and Reproductive Health Assessment Unit conducts surveillance in the rest of the state and manages the statewide case registry.

Adult Spectrum of HIV-related Diseases Study (ASD) (1989-2004): The Adult Spectrum of HIV-related Diseases (ASD) Study was a medical record review follow-up study of persons with HIV infection seen in outpatient settings. ASD was funded by the Centers for Disease Control and Prevention (CDC) and Seattle-King County was one of 11 participating sites nationwide. Demographic, exposure, clinical, laboratory, treatment, and health utilization information was gathered semi-annually. These data are somewhat representative of people with HIV infection seeking care at a variety of outpatient facilities in King County.

Behavioral Risk Factor Surveillance System (BRFSS) (1995-ongoing): The Behavioral Risk Factor Surveillance System (BRFSS) is a national, annual telephone health survey sponsored by the CDC. It enables the CDC, state health departments, and other health agencies to monitor modifiable risk factors for chronic diseases and other leading causes of death. Each state uses the national questionnaire and may add additional questions of local interest.

Care and Prevention Project (CAP, 2007): The Care and Prevention Project (CAP) was conducted in Washington state starting in January 2007. In King County, CAP was conducted at fourteen selected medical facilities; enrollment ended May 2007. CAP combines the work of two prior CDC surveillance initiatives, the Adult Spectrum of HIV Disease (ASD) Project, a longitudinal medical record abstraction study and the Supplement to HIV/AIDS Surveillance (SHAS) Project, a cross-sectional interview, by combining the data collection methods of both projects. The primary aim of CAP is to assess and evaluate the health status and well-being of HIV-infected patients receiving care in Washington state. The project combines patient interview data with clinical data from medical record abstractions on patients receiving medical care at the participating facilities.

Demographic, socioeconomic, and geographic population data: Projected and adjusted demographic population data for King County and smaller geographical areas of King County are based on the U.S. Census Bureau count for the 2000 Census and forecasted by the state of Washington Office of Financial Management for recent years.

DUIT (Collaborative Injection Drug Users Study III/Drug Use Intervention Trial): DUIT was a CDC-funded behavioral intervention trial of injection drug users 15 to 30 years old in five cities, including Seattle-King County. Baseline data collection, including HIV and hepatitis B and C testing, occurred from May 2002 to January 2004 via audio computerized administered self-interview (ACASI). Participants were randomized to an intervention or a comparison group, each consisting of six small group sessions. Follow-up assessments were conducted after completion of these sessions.

Hepatitis reporting data: The hepatitis B and C case reporting registries includes demographic, geographic and diagnosis data on persons with hepatitis B and C which are legally notifiable under the Washington state administrative code. Statistics are compiled by the Public Health Communicable Disease Epidemiology & Immunization Section.

HIV Incidence Surveillance (HIS) (2004-ongoing): HIV Incidence Surveillance is (HIS) is a supplemental HIV/AIDS surveillance activity funded by the CDC. HIS uses remnant HIV diagnostic sera to determine if a newly-diagnosed HIV infection was recently acquired. These results, supplemented with information about a person's HIV test history, are applied to the Serologic Testing Algorithm for Recent HIV Seroconversion (STARHS) to produce national and local HIV incidence estimates. Washington is one of 25 U.S. health jurisdictions conducting HIS.

Kiwi Study (1998-2002): The KIWI study was an HIV incidence and prevalence survey funded by CDC to collect data on HIV, HCV and sexual and injection risk behaviors among 1,811 injection drug users who were booked into the King County correctional facilities between August 1998 and December 2002.

Medical Monitoring Project (MMP, 2005-ongoing): The Medical Monitoring Project (MMP) is a study of individuals receiving care for HIV in Washington state. Washington is one of 23 states and metropolitan areas across the nation taking part in MMP in collaboration with the CDC. Local MMP staff members conduct face-to-face interviews and medical record abstractions with randomly selected people living with HIV across the state. The project is designed to produce information that is representative of people of living with HIV/AIDS in Washington state.

Mortality statistics: Death certificates include information about cause of death among King County residents. Persons with HIV or AIDS who live in King County at the time of death are included, while HIV and AIDS case counts are based on residence at the time of their diagnosis. These data are available to the Public Health HIV/AIDS Epidemiology Program through the VISTA database and data analysis system maintained by the Assessment, Policy Development & Evaluation Unit of Public Health. Mortality statistics are based on data collected by Public Health's Office of Vital Statistics.

National HIV Behavioral Surveillance system (NHBS, 2005-ongoing): NHBS is funded by the CDC in 21 large urban areas to monitor HIV-related behaviors and access to HIV prevention services among groups at highest risk for HIV. The groups are men who have sex with men, injection drug users, and high-risk heterosexuals. A sample of one of the high-risk populations is surveyed each year using standardized CDC protocols and questionnaires.

RAVEN and RAVEN II Studies: (1994-1998): The RAVEN study was funded by the National Institute for Drug Abuse and the CDC. Injection drug users both in drug treatment programs and not in treatment programs were interviewed at baseline and again one year later about sexual and drug use behaviors. HIV, hepatitis C, hepatitis B, HTLV I and II, herpes simplex virus type 2, and syphilis status were assessed at baseline and at follow-up. This study provided information on the prevalence and incidence of HIV and other parenterally-transmitted pathogens among injection drug users both in and out of treatment, and the relationship between past or newly-acquired infection and sexual and drug use behaviors. The Raven II study recruited injection drug users with specific demographic characteristics at similar sites in 1998.

Sexually transmitted disease reporting data: The STD case reporting registry includes demographic, geographic and diagnosis data on persons with STDs which are legally notifiable under the Washington state administrative code. Statistics are compiled by the Public Health STD Program.

Tuberculosis Reporting Data: The TB case reporting registry includes demographic, geographic and diagnosis data on persons with TB which is legally notifiable under the Washington state administrative code. Statistics are compiled by the Public Health TB Program.

Variant, Atypical, and Resistant HIV Surveillance (VARHS) (2003-ongoing): Variant, Atypical and Resistant HIV Surveillance (VARHS) is a supplemental HIV/AIDS surveillance activity funded by the CDC. VARHS uses genotypic tests to determine viral subtype and the presence of any drug resistant mutations. The objectives of VARHS are to monitor the frequency of important antiretroviral resistance mutations, follow the outcomes of individuals infected with HIV with and without mutations, and measure the prevalence of different HIV-1 viral strains/types. Washington is one of 11 national health jurisdictions conducting VARHS.