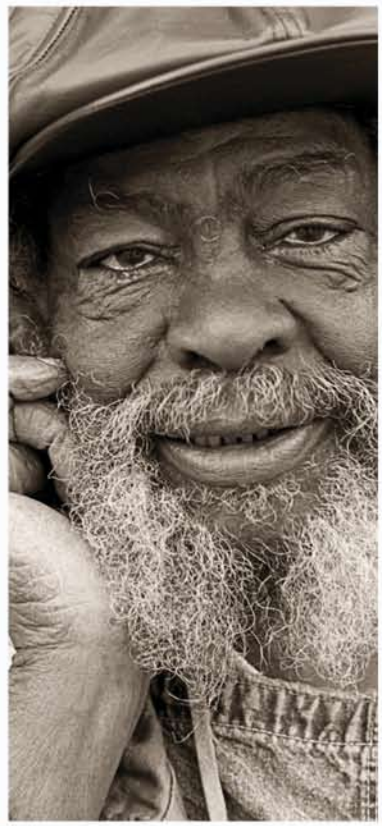
Washington State

Diabetes Disparities Report

A Review of Washington State Data



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Washington State Diabetes Disparities: A Review of Washington State Data

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Executive Summary

Diabetes Disparities in Washington State

Introduction

In Washington, diabetes has a direct impact on the lives of over a million people. In 2004, 298,000 people had diagnosed diabetes; an estimated 126,000 people had diabetes that had not yet been diagnosed, and another 963,000 had pre-diabetes (impaired glucose tolerance). Diabetes is a progressive disease capable of ravaging major organ systems, resulting in severe complications: blindness, foot amputations, kidney failure, heart disease and stroke. The human and financial costs associated with diabetes are significant: in 2003, the charges alone for 70,009 diabetes-related hospitalizations in Washington amounted to more than $1.27 billion dollars.

As distressing as Washington diabetes statistics are, it is equally distressing to realize that the burden of diabetes is even greater among certain population subgroups: older people, certain racial and ethnic groups, and those on the lower rungs of the social ladder. We refer to these persistent differences in health status between groups as *health disparities*. In this report we demonstrate that disparities exist in diabetes prevalence, health behaviors, health status, access to medical services, and rate of complications and deaths for low-income and certain racial/ethnic groups. These disparities carry high financial and social costs; yet they are not inevitable.

This report was written in response to a request for scientific information and data on disparities in diabetes that came from the Diabetes Leadership Team. The Leadership Team, a partnership of diverse stakeholders across Washington, is an outgrowth of a statewide assessment and planning process that culminated in the development of the Washington State Plan for Diabetes Prevention and Control. Goal 6 of the State Plan refers to reducing health disparities in diabetes: "Support evidence-based, culturally

and linguistically appropriate, sustainable strategies that affect social determinants of health and reduce disparities in health outcomes."[1]

The term *health disparities* refers to persistent differences in the rate of health risks, health care, health conditions, and health outcomes between population subgroups. In this report, we explore how social and economic conditions affect groups of individuals, leading to disparities in diabetes that our data show. And, because public health is concerned with prevention of disease and disability, we give examples of promising approaches that may be used to address the underlying social and economic conditions that give rise to health disparities.

The association between one's socioeconomic position in society and health is well documented. Previous research has shown that disparities in the health of a population are driven by inequalities in the social and economic conditions of life experienced by various subgroups within that population.[2] Poorer health among those with lower socioeconomic position are not driven by material deprivation alone. The higher levels of chronic stress experienced by people with lower socioeconomic position act in combination with genetic, behavioral, and environmental factors, leading to greater risk of developing diabetes.[3] In addition, discriminatory policies and practices—such as choosing to locate new grocery stores in suburban areas, rather than the inner city—exclude certain groups from access to social resources that promote good health, such as opportunities for education, employment, affordable housing, medical care, affordable healthy foods and places to get sufficient physical activity.[4]

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[1]Washington State Department of Health (2005). *Washington State Diabetes Plan.* Olympia, WA: Washington State Department of Health. Viewed 6/16/2006 from : www.doh.wa.gov/cfh/diabetes/diabetes_plan.htm

[2] Washington State Department of Health. (2002). Social Determinants of Health. In: *The Health of Washington State*, Olympia, WA: Washington State Department of Health. Accessed 5/28/2006 from: www.doh.wa.gov/HWS/2002.

[3] Wilkinson, R. G., Pickett. K.E. (2006). Income inequality and population health: A review and explanation of the evidence. *Social Science and Medicine*, 62(7): 1768-1784.

[4] Amersbach,G. Through the lens of race: Unequal health care in America. *Harvard Public Health Review*, Winter 2002. Viewed 3/5/2006 from: http://www.hsph.harvard.edu/review/review_winter_02.

Report Findings

Diabetes Prevalence

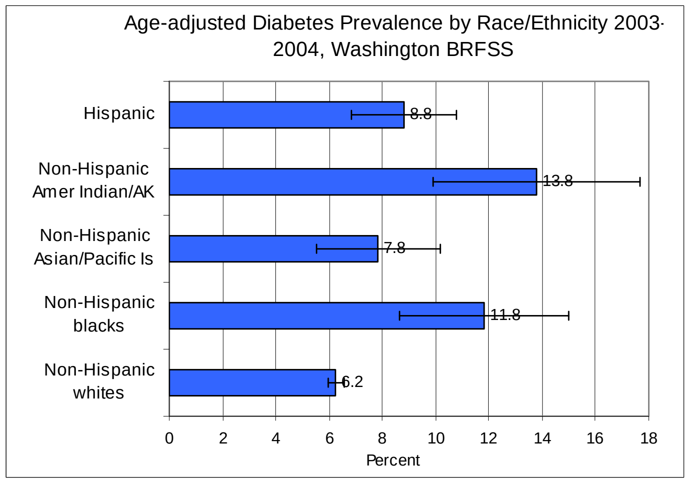
The risk of developing diabetes is heightened when family history of diabetes is combined with unhealthy behaviors such as smoking and overweight. For people with lower socioeconomic position, local neighborhood conditions and daily stresses can make it more likely to smoke cigarettes, eat a poor quality diet, lead a sedentary lifestyle, become overweight or obese. It can also be harder to get preventive medical care. Disparities in diabetes prevalence in Washington State are summarized below:

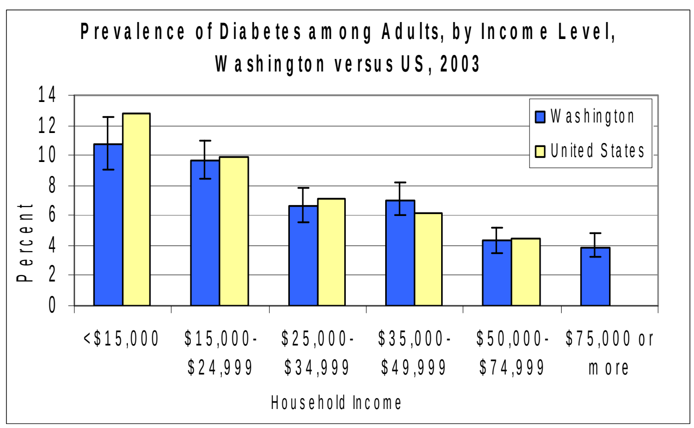
- Diabetes was higher among Non-Hispanic American Indians and Alaska Natives, Hispanics, and non-Hispanic Blacks, compared to non-Hispanic Whites.

- Diabetes was higher among those with less than high school education compared to those with a college education. Diabetes was also higher among those who were retired, unemployed or unable to work, compared to those who were employed.

- Diabetes decreased for each incremental increase in level of household income.

- High rates of diabetes were seen in neighborhoods with lowest levels of educational attainment and highest rates of poverty.





- The relationship between increased diabetes and lower socioeconomic position remained statistically significant after controlling for age, sex, physical activity level, obesity, access to preventive care and race and ethnicity.

Health Status of People With Diabetes

The main ways that socioeconomic position may affect the health of people who have diabetes are in: 1) less ability to self-manage diabetes; 2) less ability to access medical care; and 3) lower patient-provider adherence to recommended processes of care.

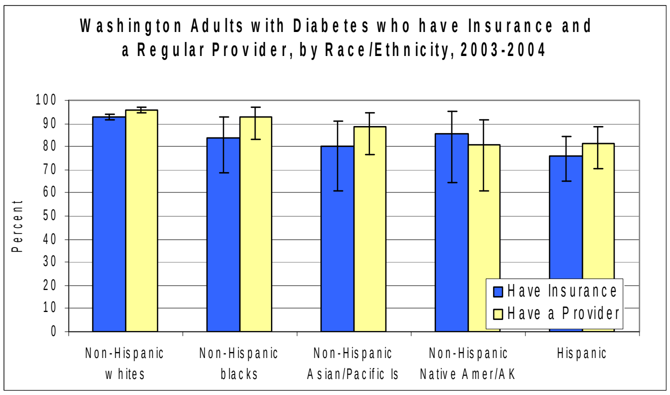
Disparities in the health status of people with diabetes in are summarized below:

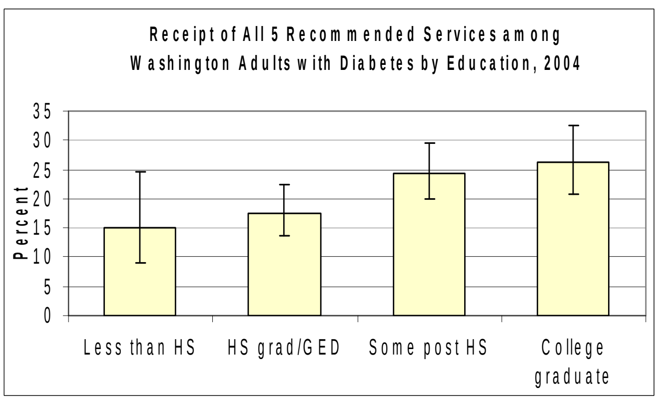
- Among adults with diabetes, those with lower levels of education and household income were more likely to smoke, and less likely to be physically active at the recommended level. Those with lower education levels were also more likely to be obese.

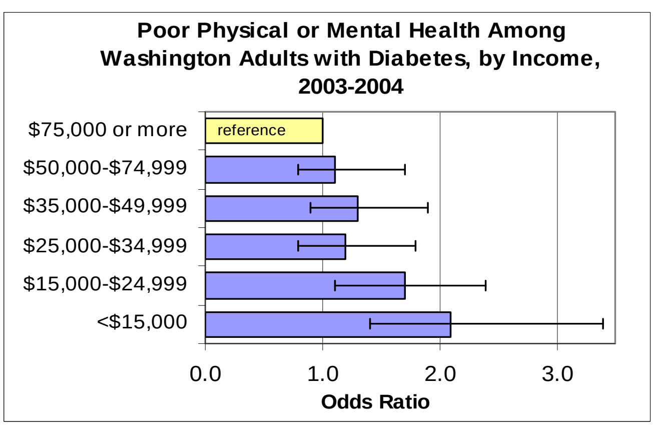
- Adults with diabetes were more likely to have access to health care than those without diabetes. But among adults with diabetes, those with low income and education were less likely to have health care coverage than those with higher income and education. Access to health care for those with diabetes was significantly lower among non-Hispanic blacks, Asian and Pacific Islanders, and Hispanic adults, compared to non-Hispanic whites.

- Adults with diabetes who had lower levels of income and education were less likely to receive all five recommended services (A1c test twice yearly, annual foot and dilated eye exams, and pneumococcal and influenza vaccinations).

- Adults with diabetes who had incomes less than $15,000 were twice as likely to report poor physical or mental health compared to those with incomes over $75,000.







Diabetes-Related Hospitalizations and Deaths

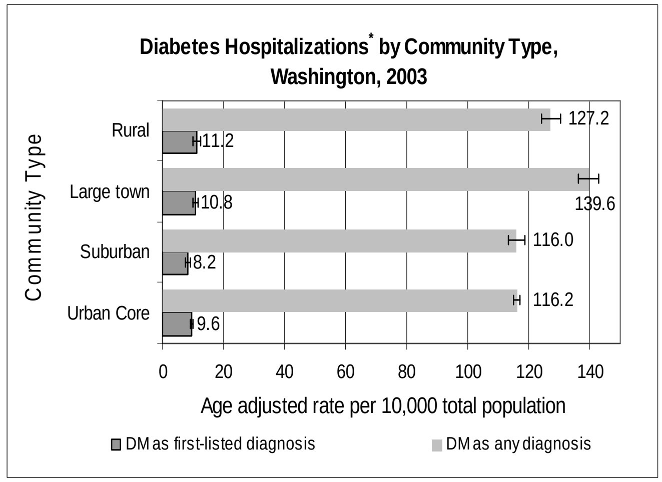
Poorly controlled diabetes can lead to complications that may result in hospitalizations or death, including diabetic ketoacidosis; pneumonia or influenza; lower extremity conditions and/or amputations; heart disease and stroke. Disparities in diabetes hospitalizations and deaths may reflect experiences of discrimination, chronic stress, poor social and physical environments, and lack of access to preventive care and medical services. Disparities in the diabetes-related hospitalizations and deaths are summarized below:

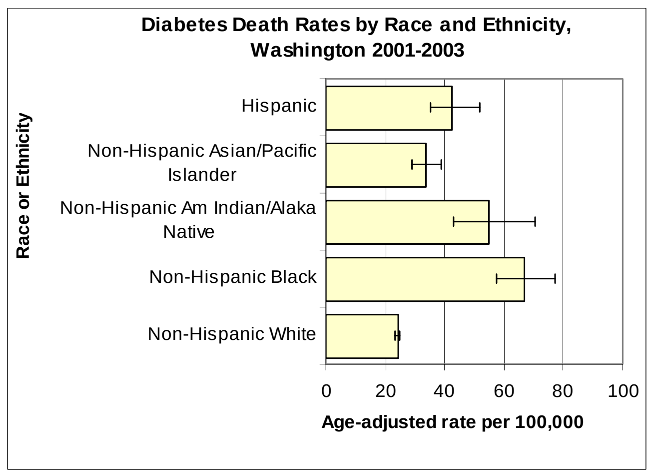
- Higher rates of diabetes-related hospitalizations occurred in rural communities and in large towns than in urban communities. This was true whether diabetes was considered only as the first-listed diagnosis or whether all hospital discharges related to diabetes were considered.

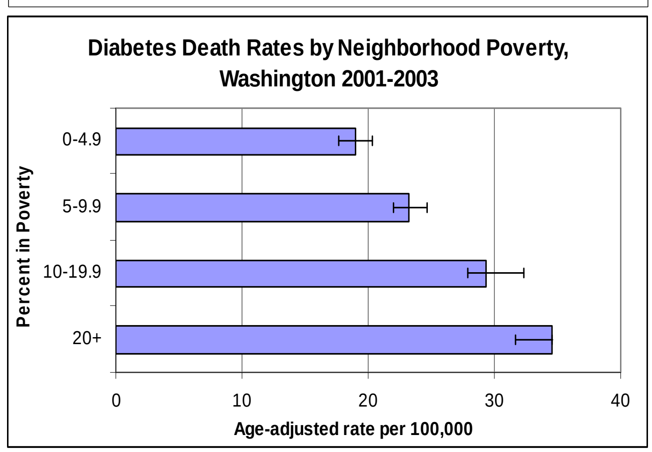
- Compared to the state rate of 9.6 per 10,000, higher rates of diabetes hospitalizations occurred in Stevens, Grays Harbor, Adams, Yakima, Lewis, Clallam, Franklin, Skagit, Whatcom, Pierce and Spokane counties.

- Hospitalizations for diabetes ketoacidosis were more common among younger people and were more likely to be paid for by Medicaid, indicating that a high proportion of those with poorly managed diabetes are young people with low incomes.

- Higher rates of diabetes deaths were observed among non-Hispanic Black, American Indians and Alaska Natives, Hispanics, and Asian, Native Hawaiian and Pacific Islanders compared to non-Hispanic Whites.







- Higher diabetes death rates were observed in neighborhoods with higher percentages of residents living in poverty or lower percentages of residents who were college graduates.

The factors driving disparities in diabetes prevalence, health behaviors and management for people with diabetes, diabetes-related hospitalizations and deaths are driven by unequal access to societal resources among people with lower socioeconomic position.

What Can Be Done to Reduce or Eliminate Disparities in Diabetes?

Much of the current interventions to reduce diabetes disparities focuses on ensuring that public health and health care services for all people with diabetes are accessible, of high quality, and linguistically and culturally competent. This report shows that to be effective in reducing disparities, we must also address the underlying social and economic inequalities that drive disparities. Changing social, economic, and cultural determinants of health is complex -- but achievable.[5] One role for public health is to educate policy makers and the public about the evidence linking social and economic conditions to health, as we have attempted to do in this report. With this knowledge, decision makers can consider effects of broader social and economic policies, such as those related to education, housing, and community development on health disparities related to diabetes. In addition, some communities have used a combination of policy, environmental, and systems change as a local strategy to reduce health disparities, as listed below. Some strategies (1, 2) are becoming more common as public health practices, while others are examples of experimental public health projects (3, 4).

1. To address unequal access to affordable, nutritious food, some communities have created community gardens; provided shuttles to transport people to supermarkets at convenient times; and encouraged small local grocery or convenience stores to carry fresh produce and stock healthy food options, such as non-fat milk;

[5] Heymann, S. J. (2000). Health and social policy. In L. F. Berkman & I. Kawachi (Eds.), *Social Epidemiology* (pp.368-382). Oxford: Oxford University Press.

2. To improve community environments to promote physical activity, mental well being and quality of life, some communities have worked with law enforcement officials to make neighborhoods safer, used community centers to offer free or low-cost fitness facilities, and incorporated parenting skills training into existing health classes;

3. To coordinate policies that promote education, literacy, and employment, some communities have recruited older community residents to assist young people to improve literacy skills (which also reduces social isolation among the elderly), and developed partnerships with local employers to alter workplace policies to make jobs more accessible and create safer, less stressful work environments;

4. To provide access to quality, affordable housing, some possible interventions that some communities have tried helping people find affordable housing and navigate the complex application process; facilitating relationships between housing developers and residents to ensure new housing meets the needs of the community.

In addition, researchers have proposed social and economic policy interventions that go beyond anti-poverty programs, such as mobilizing low-SEP voters to participate more fully in civic life and revising the tax structure to redistribute wealth.[6] Some of these strategies have yet to be tried; all require evaluation to assess their effectiveness in reducing health disparities.

Next Steps

Findings from this report will be disseminated through the Washington State Diabetes Network, a broad array of organizations and people working in public, private, tribal, community and academic/training sectors to prevent and control diabetes among residents of Washington. The members of the Washington State Diabetes Network will use this information to address Goal 6 of the Washington Diabetes State Plan, which "supports evidence-based, culturally and linguistically appropriate, sustainable strategies that affect social determinants of health and reduce disparities in health outcomes." The Washington State Diabetes Network has the ability to facilitate the development of innovative partnerships to redress inequalities in access to societal resources. Improvements in living conditions, healthy environments, opportunities for education and employment, and improved access to healthcare can lead to reductions in disparities in diabetes prevalence, as well as disparities in outcomes for people with diabetes.

In September 2007, the third annual meeting of the Diabetes State Network will *address the social determinants of health, applying innovative community-level approaches and learning*

[6] Daniels, N., Kennedy, B., & Kawchi, I. (2000, February). Justice is good for our health. *Boston Review*, Retrieved March 6, 2006, from http://www.bostonreview.net/BR25.1/daniels.html

to work more effectively with diverse groups disproportionately affected by diabetes. Three breakout sessions will address 1) reducing barriers to quality care; 2) culturally and linguistically appropriate approaches to prevent diabetes and complications at the community level and 3) innovative strategies to foster health equity. This last session will include a review of the social determinants framework as it applies to diabetes, provide examples of innovative strategies to address root causes of diabetes disparities, and a discussion of next steps in engaging state network members in exploring new ways to address disparities.

Chapter 1: Factors Driving Disparities in Diabetes

> "How bad is the diabetes epidemic?" asked Frank Vinicor, Associate Director for Public Health Practice at the Centers for Disease Control. "There are several ways of telling. One might be how many different occurrences in a 24-hour period of time, between the time you wake up in the morning and when you go to sleep. So, 4,100 people diagnosed with diabetes, 230 amputations, 120 people who enter end stage kidney disease programs and 55 people who go blind. That's going to happen every day, on the weekends and on the Fourth of July," he said. "That's diabetes."
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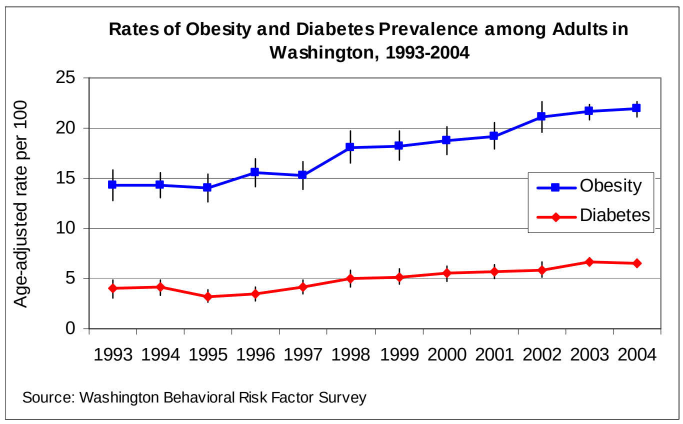
> *Kleinfield, N.R. (2006). Diabetes and its awful toll quietly emerge as a crisis. New York Times January 9, 2006.*

The Burden of Diabetes in Washington State

In Washington, diabetes has a direct impact on the lives of nearly 1.4 million people: in 2004, 298,500 people had diagnosed diabetes; an estimated 126,000 people had diabetes that had not yet been diagnosed, and another 963,000 ages 40-74 years had pre-diabetes.[7] Even people who do not have the disease are affected by it, through taxes and insurance premiums, and in time spent caring for relatives with diabetes. Like the rest of the nation, diabetes has reached epidemic levels in Washington and is expected to get worse. Diabetes prevalence has grown by 59 percent over the past 11 years, from 4.1 percent in 1994 to 6.5 percent in 2004 (Figure 1). As the prevalence of diabetes has increased, so have diabetes death rates: from 18 deaths per 100,000 in 1990 to 26 deaths per 100,000 in 2003. About 40 percent of this rapid increase can be attributed to a shift towards an aging population and population growth in racial and ethnic groups at higher risk for diabetes.[8] But the remaining 60 percent of the increase in diabetes prevalence may be due to the rise in obesity, a leading risk factor for diabetes, which has increased dramatically over the past 15 years (Figure 1). Many experts attribute the obesity epidemic to the increasing



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[7] Pre-diabetes, or impaired glucose tolerance, is defined as fasting blood sugar greater than 99 mg/dL but less than 126 mg/dL. See Appendix C, page 48, "Estimates of Diabetes and Pre-diabetes in Washington State" for methods used to estimate how many people in Washington had prediabetes in 2004.

[8] Boyle, J.P., Honeycutt, A.A., Narayan, K.M.V., Hoerger, T.J., Geiss, L.S., Chen, H., et al. (2001). Projection of diabetes burden through 2050: impact of changing demography and disease prevalence in the U.S. *Diabetes Care*, 24(11):1936-1940.

availability and marketing of cheap, ready-made foods laden with fat and sugar, and a culture that encourages overeating while making it harder to be physically active on a daily basis.[9]

> ***What is Diabetes?***
>
> Diabetes is a condition in which the body has trouble turning food into energy. Normally, the body breaks down digested food into a sugar called glucose, the body's primary fuel. In a healthy person, the hormone insulin helps glucose enter cells. But diabetes either prevents the pancreas from producing enough insulin, or prevents the body from using it properly. Cells starve while glucose builds up in the blood. In Type 1 diabetes, the immune system destroys cells in the pancreas that make insulin. In Type 2, which accounts for an estimated 90 to 95 percent of all cases, the body's cells are not sufficiently receptive to insulin or the pancreas makes too little of it, or both. While family history (genetics) is thought to play a role in both types, Type 2 diabetes is spurred by obesity and lack of physical activity. Type 2 diabetes can often be postponed or possibly prevented by eating less, being physically active, and controlling one's weight. For more information, see http://www.diabetes.org/about-diabetes.jsp

Diabetes is a progressive disease capable of ravaging major organs and bodily systems, resulting in severe, life-altering complications. In Washington, adults with diabetes are 3.2 times more likely than adults without the disease to have high blood pressure, and 3.7 times more likely to have heart disease.[10] One in five adults with diabetes has poor vision because diabetes damages tiny blood vessels in the retina;[11] some eventually go blind. Diabetes is the leading cause of end-stage kidney disease, a condition that may require dialysis several times a week. Most people with diabetes suffer nervous-system damage and poor circulation, which can lead to amputation of toes, a foot or an entire leg. Even a tiny cut on the foot may become gangrenous because it may not be seen or felt. In 2003 alone, nearly a thousand people with diabetes in Washington had a lower extremity amputation. In total, there were 70,009 diabetes-related hospitalizations in Washington in 2003.[12]

The Caro Research Institute, a consulting firm that evaluates the burden of diseases, estimates that a person with uncomplicated diabetes incurs $1,600 in medical costs per year. The price quickly escalates when complications set in: Washington diabetes-related hospitalizations charges in 2003 averaged $23,600 for one admission of coronary heart disease; $20,400 for an amputation; $11,000 for a stroke; $9,500 for pneumonia or influenza, and $7,300 for diabetic ketoacidosis. Total charges for diabetes-related hospitalizations in Washington amounted to more than $1.27 billion dollars in 2003.

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[9] Drewnowski, A., Damon, N. (2005). Food choices and diet costs: an economic analysis. *Journal of Nutrition*, 135(4):900-4.

[10] Statistics on hypertension among adults with diabetes from the 2003 Washington State BRFSS; on heart disease, from the 2001 Washington State BRFSS.

[11] Diabetic retinopathy is a complication of diabetes and a leading cause of blindness. It occurs when diabetes damages the tiny blood vessels inside the retina, the light-sensitive tissue at the back of the eye.

[12] Lower extremity conditions include peripheral arterial disease, ulcer inflammation, infection and neuropathy.

As distressing as the Washington figures are for diabetes, even more alarming is the greater burden among certain population subgroups. For example, diabetes prevalence among non-Hispanic blacks and American Indians and Alaska Natives is twice that of non-Hispanic whites. Because certain population subgroups with higher diabetes rates also find it difficult to get preventive health care, or get care that is culturally or linguistically inappropriate, their disease may be poorly managed, resulting in higher likelihood of complications, hospitalization and death. These persistent differences between population subgroups are often referred to as *health disparities*,[13] and they are not unique to diabetes. Researchers have noted this pattern for a number of health conditions in a variety of historical periods and population groups.[14]

The population subgroups experiencing disparities tend to have a lower rank in the social hierarchy due to their educational attainment, employment status, occupational class, income level, race or ethnicity. This rank is often referred to as socioeconomic position (SEP). In addition to poorer health status and health outcomes among those at the lowest rungs of the social ladder, international studies among industrialized nations have shown that for each incremental decrease in socioeconomic status, there is a corresponding decrease in health status.[15] This stepwise, inverse relationship between socioeconomic position and health is sometimes referred to as a "gradient effect".

Given the severity and growing magnitude of the diabetes burden, what are public health programs doing to prevent and control diabetes? And, given the greater diabetes burden among certain sub-groups, what is being done to address health disparities?

Public Health Initiatives to Address Diabetes and Disparities

Over the past decade, public health activities in the United States related to diabetes have focused on raising awareness of diabetes in the general population and in high risk populations; screening people for diabetes, increasing quality of health services and ensuring access to medical services for those with diabetes. Since 1998, the Diabetes Prevention and Control Program (DPCP) in the Washington State Department of Health have worked in partnership with Qualis Health to improve quality in the system of diabetes care, using the Planned Care Model.[16] The Planned Care Model identifies the essential elements of a health care system that encourage high-quality chronic disease

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[13] In this report, disparities refers to persistant differences in the rate of health risks, health care, health conditions, and health outcomes between population subgroups. Please see Appendix E, Glossary of Key Public Health Terms, for additional terms associated with health disparities.

[14] Lynch, J., Kaplan, G. (2000). Socioeconomic Position. Pages 13-15 in: Berkman, L.F., Kawachi, I. (editors), *Social Epidemiology*. New York: Oxford University Press.

[15] Wilkinson, R., Marmot, M. (2003). *Social Determinants of Health: The Solid Facts, 2nd Edition*. Geneva: World Health Organization.

[16] Wagner, E.H., Austin, B.T., Von Korff, M. (1996). Organizing care for patients with chronic illness. *Milbank Quarterly*, 74(4):511-544.

care.[17] By implementing evidence-based changes within each element and by defining and tracking successful patient population outcomes, productive interactions are fostered between informed patients who take an active part in their care and providers with resources and expertise. The Washington DPCP has improved clinical outcomes using the Planned Care Model through the Washington State Collaborative (WSC), a systematic 13-month training and implementation program provided to voluntary provider teams throughout Washington State.[18] The WSC benefits high-risk populations by improving the quality of health system services for those who received care in federally qualified Community Health Centers and rural clinics. Currently, the Department of Health is exploring use of the Planned Care Model in clinic settings that serve Medicaid patients in order to improve the quality of care for low-income and racial/ethnic groups.

Other public health programs conducted by the DPCP have been specifically crafted to promote awareness among racial and ethnic groups who are at greater risk for diabetes and encouraging them to seek medical screening. These programs are part of a national public health focus on the diabetes prevention, based on recent clinical research showing that moderate changes in diet, exercise and weight control can delay or possibly prevent onset of diabetes and minimize complications for those who already had the disease.[19] This research was the foundation for culturally specific materials developed by the National Diabetes Education Program (NDEP) that are currently used by the DPCP.[20] NDEP and other Health and Human Services project materials have been used in awareness campaigns in Hispanic, African American, American Indian and Asian communities throughout the state.

Along with raising awareness and encouraging those at high risk to seek medical screenings, efforts conducted by DPCP's statewide partners to address health inequalities focus on removing barriers to health care. *Financial barriers* to health care may exist in the form of lack of health insurance, insurance that is insufficient to cover needed services, or inability to cover services outside a health plan/insurance program. *Structural barriers* exist in the form of lack of primary care providers, medical specialists, or other health care professionals to meet special needs, or lack of health care facilities.

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[17] These elements are the community, the health system, self-management support, delivery system design, decision support and clinical information systems.

[18] Daniel, D.M., Norman, J., Davis, C., Lee, H., Hindmarsh, M.F., McCulloch, D.K., Wagner, E.H., Sugarman, J.R. (2004). A state-level application of the chronic illness breakthrough series: Results from two collaboratives on diabetes in Washington State*. Journal of the Joint Commission on Quality Safety*, 30: 69-79.

[19] Knowler, W.C., Barrett-Connor, E., Fowler, S.E., Hamman, R.F., Lachin, J.M., Walker, E.A., Nathan, D.M. (2002). Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *New England Journal of Medicine*, 346(6):393-403.

[20] The four focus areas for the NDEP are: primary prevention of diabetes; diabetes control or the prevention of complications due to diabetes; detection of undiagnosed diabetes; and addressing issues associated with the economic case for quality diabetes care associated with health care payers, purchasers, and policymakers.

Finally, *personal barriers* to care exist in the form of cultural or spiritual insensitivities on the part of the health care system, language barriers, lack of knowledge about accessing the health system; and experiences of discrimination or lack of confidentiality.

Barriers to health care among high-risk populations are currently addressed by a major project conducted in partnership with the Seattle-King County Health Department. The Seattle-King County *Reach 2010* project targets communities of African Americans, Asian Americans and Pacific Islanders, and Hispanic/Latinos, and includes the following activities:

- Support groups, diabetes education and chronic disease self-management classes provided for individuals with or at risk of diabetes, their families and their friends.
- Interpreter services and translated educational materials provided in Spanish, Cantonese, Mandarin, Vietnamese, Tagalog, Cambodian, and Korean.
- Improving systems of care through use of patient registries to track patients' diabetes care and identify patients who may be referred to REACH activities.
- Developing media strategies, restaurant and grocery store campaigns, faith-based educational materials, worksite pilot projects, and pharmacy education.

These programs have resulted in increased access to needed services, leading to lower rates of diabetes-related complications, improving quality of life and decreasing long term costs.[21] Nevertheless, diabetes prevalence, hospitalizations and death rates continue to rise—and disparities persist.

Better Access to Health Care is Necessary but Not Sufficient to Eliminate Disparities

The programs described above use strategies to address health disparities in Washington that are effective and necessary. But better access to health services is not by itself sufficient to eliminate inequalities in diabetes prevalence, complications, hospitalizations and deaths. For example, federally funded programs that reduce financial barriers to health care for the poor (such as Medicaid) have made it easier to get preventive and treatment medical care, yet these programs have not been successful in eliminating disparities.[22] Further, for certain racial groups in the U.S., disparities exist even at the highest levels of income and education—where members of those

[21] For information on the impact and outcomes of REACH programs in Washington and the nation, please visit http://www.cdc.gov/reach2010/evaluation.htm

[22] Washington State Department of Health. (2002). Social Determinants of Health. In: *The Health of Washington State*, Olympia, WA: Washington State Department of Health. Downloadable from: www.doh.wa.gov/HWS/2002.

groups presumably would have access to insurance and a regular source of care.[23] Finally, even in countries with universal health care, people with low SEP have worse health; just like their counterparts living in the U.S.[24] Improved access to care does not by itself eliminate health disparities, any more than advances in preventive and medical treatment services can stem the tide of increasing diabetes prevalence. The reason for this is that underlying factors that lead to the development of diabetes are often not addressed by the health care system.[25] The factors that contribute to poor diabetes management and associated health outcomes for people with diabetes occur outside the provider's office.

What are these factors? *Family history* (genetic make-up) plays a part in the onset of many chronic diseases; this factor is largely beyond the control of public health programs. *Health behaviors* such as diet, level of physical activity, abuse of alcohol and drugs, sexual behavior and smoking also exert a strong influence over biological processes that lead to chronic diseases. So influential are these health behaviors, they have been called the *actual causes* underlying deaths in the United States.[26]

Over the past four decades, much of public health has been devoted to finding effective ways to communicate, motivate, and help individuals change risky behaviors. Scientists have found that behavioral change is most effective when physical, social, political, and economic environments are supportive of healthy ways of living.[27] For example, many Americans find it hard to eat a healthy diet when tasty, high-fat, high-calorie options are cheaper, easier, and readily available. For low-income people, the problem is compounded by limited budgets and higher density of neighborhood fast-food restaurants.[28] The automobile-orientation of our society, with fewer sidewalks in new subdivisions and with shops, grocery stores and restaurants located far away from residential areas, has made it difficult for most Americans to build physical activity into the daily routine. The problem is compounded by deterioration of public safety in some areas, which has made it unsafe for adults and children to walk, bike, run or play

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[23] Adler, N.E., Boyce, W.T., Chesney, M.A., Folkman, S., Syme, S.L. (1993). Socioeconomic inequalities in health: No easy solution. *Journal of the American Medical Association*, 269(24): 3140-3145.

[24] Pincus, T. (2004). *Will racial and ethnic disparities in health be resolved primarily outside of standard medical care?* Annals of Internal Medicine, 141(3): 224-225.

[25] Kieffer, E.C., Willis, S.K., Odoms-Young, A.M., Guzman, J.R., Allen, A.J., Two Feathers, J., Loveluck, J. (2003). Reducing disparities in diabetes among African-American and Latino residents of Detroit: the essential role of community planning focus groups. *Ethnicity and Disease*, 14 (3 Supplement 1): S27-37.

[26] McGinnis, J.M., Foege, W.H. (1993). Actual causes of death in the United States. *Journal of the American Medical Association*, 270:2207-2212.

[27] O'Donnell, M.P. (1989). Definition of health promotion: Part III: Expanding the definition. *American Journal of Health Promotion*, 3(3):5.

[28] Baker, E.A., Kelly, C., Barnidge, E., Strayhorn, J., Schootman, M., Struthers, J., Griffith, D. (2006). The Garden of Eden: acknowledging the impact of race and class in efforts to decrease obesity rates. *American Journal of Public Health*, 96(7):1170-4.

outside.[29] The increase in time spent in sedentary activities, such as computer, television, and video games, along with increasingly long commute times, cuts into the time that people have available to be physically active. These environmental barriers have contributed to the sharp increase in obesity and consequently, diabetes. These environmental barriers tend to be more prevalent among certain population subgroups. Thus, there is a third category of risk—*the social and economic conditions of life*—that interacts with genetic and behavioral factors in the development of disease. It is within this third category we find clues to what drives disparities in health.

Health is Socially Determined

We have already noted that health follows a socioeconomic gradient, with each increase in social rank corresponding to an incremental increase in health status. This in itself is an indication that health is determined by the social and economic conditions of life. As explained in *The Health of Washington State*, "social forces acting at a collective level shape individual biology, individual risk behaviors, environmental exposures and access to resources that promote health."[30] Socioeconomic position (SEP) is often measured by personal characteristics (income, educational attainment and occupation); these are good indicators of SEP because they reflect access to material social resources within the social hierarchy.

By its very nature, a social hierarchy is unequal—some are at the top, some are at the bottom, and the rest are somewhere in between. Position in the social hierarchy governs access to material resources such as safe and affordable housing, education, health care, jobs, and healthy neighborhoods.[31, 32] In addition to these material resources, there are social resources, such as knowledge, prestige, influence, money and social connections, whose access is governed by SEP.[33]

Higher SEP not only implies access to social and material resources—some of which are necessary for good health—but also protects against things that are detrimental to health, such as exposure to environmental toxins and pollutants in air, soil and water; increased risk of crime/homicide; increased likelihood of working in a job with higher

[29] Molnar, B.E., Gortmaker, S.L., Bull, F.C., Buka, S.L. (2004). Unsafe to play? Neighborhood disorder and lack of safety predict reduced physical activity among urban children and adolescents. *American Journal of Health Promotion*, 18(5):378-86.
[30] Washington State Department of Health. (2002). Social Determinants of Health. In: *The Health of Washington State*, Olympia, WA: Washington State Department of Health. Accessed 5/28/2006 from: www.doh.wa.gov/HWS/2002.
[31] Healthy neighborhoods have built environments that are conducive to walking, biking and public transportation; access to affordable, high quality healthy foods; low crime rates; clean air, water and soil; and access to other goods and services.
[32] Ellaway, A., Macintyre, S. (1996). Does where you live predict health related behaviors? A case study in Glasgow. *Health Bulletin* 54:443–446.
[33] Marmot, M. (2002). The influence of income on health: views of an epidemiologist. *Health Affairs*, 21(2):31-46.

risk of occupational injury and death, or exposure to industrial toxic substances. As Gabriele Amersbach notes in the *Harvard Public Health Review*,

> *Studies document that poor people have greater exposure to environmental toxins, from lead paint to proximity to chemical plants and waste incinerators that are consistently built in poor neighborhoods. The high-fat, high-salt, and low-vegetable/fruit diets found in disadvantaged populations are often less the result of bad choices than the unfortunate consequence of the shrinking number of good, affordable supermarkets in inner-city neighborhoods, the explosion of fast food restaurants in urban areas, and food traditions originating in deprivation. Similarly… higher rates of smoking and alcohol use…are more a response to the pressures of poverty and lack of employment opportunities than "lifestyle choice."*[34]

The health impacts of lower SEP accumulate and persist throughout the lifespan. Critical life events, such as transitions from school to job to marriage and childrearing to retirement, require material and emotional resources that may be missing for people living in lower SEP households; lack of resources at these critical junctures may push people onto less-advantaged paths throughout one's life.[35] The relationship between material deprivation and early onset of diabetes in childhood has been demonstrated,[36] but the impact of long-standing deprivation on development of diabetes in adulthood has also been shown.[37]

Poverty and Relative Deprivation

It is easy to see how poverty causes poor health. The World Health Organization describes the collateral damage of poverty as follows:

> *"disadvantage has many forms…it can include having few family assets, having a poorer education during adolescence, having insecure employment, becoming stuck in a hazardous or dead-end job, living in poor housing, trying to bring up a family in difficult circumstances and living on an inadequate retirement pension."*[38]

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[34] Amersbach,G. Through the lens of race: Unequal health care in America. *Harvard Public Health Review*, Winter 2002. Viewed 3/5/2006. http://www.hsph.harvard.edu/review/review_winter_02

[35] Sing-Manoux, A., Ferrie, J.E., Chandola, T., Marmot, M. (2004). Socioeconomic trajectories across the life course and health outcomes in midlife: evidence for the accumulation hyspothesis? *International Journal of Epidemiology*, 33:1072-1079.

[36] Crow, Y.J., Alberti, K.G.M.M., Parkin, J.M. (1991). Insulin dependant diabetes in childhood and material deprivation in northern England, 1977-1986. British Medical Journal, 303(6795): 158-160.

[37] Connolly, V., Unwin, N., Sherriff, P., Bilous, R., Kelly, W. (2000). Diabetes prevalence and socioeconomic status: a population based study showing increased prevalence of type 2 diabetes mellitus in deprived areas. *Jounal of Epidemiology and Community Health*, 54(3):173-7.

[38] Wilkinson, R., Marmot, M. (2003). *Social Determinants of Health: The Solid Facts, 2nd Edition*. Geneva: World Health Organization.

Recent research suggests that it is not only being poor that causes poor health; it is how poor you are compared to others. An indicator of relative poverty is *income distribution*, measured as how much of the aggregate income earned in a community in one year has been received by each fifth of the households, arranged by increasing income.[39] Data from the 2000 Census indicate that the richest 20 percent of Washington households received 47 percent of the total income that year (Figure 2), while the poorest 20 percent earned only 4 percent of the total income.

If income were evenly distributed across all households in an area, we would expect that if each income group represented one-fifth of all households, it would receive one-fifth of the total income. This is the basic assumption behind the calculation of the *Income Inequality Index.* The Index ranges from 0 percent to 100 percent, and approximates the share of total income that would have to be transferred from above-average income households to below-average income households in order to achieve perfect equity in the distribution of income. A higher index score means more disparity exists. The 2000 Income Inequality Index in Washington was 43 percent, slightly less than the U.S. Index of 46 percent.

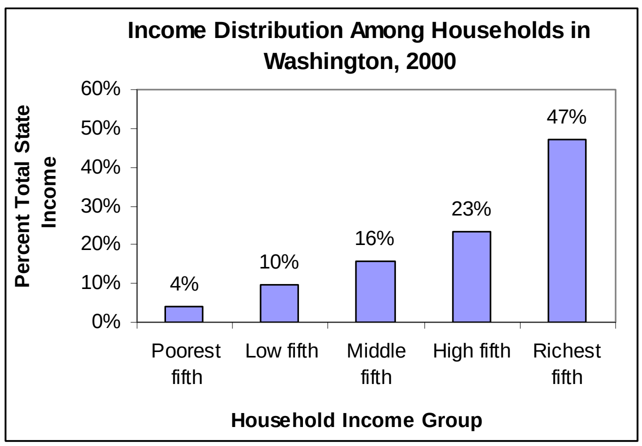

Figure 2. Source: 2000 Census, US Census Bureau

There is an apparent dose-response relationship associated with deprivation; in other words, the longer people live in disadvantaged circumstances, the more likely they are to suffer ill health—this is especially true in the case of cardiovascular disease.[40] In addition, some research suggests that a widening gap between rich and poor adversely affects all members of society.[41] The financial and human costs associated with health

[39] For this indicator, each income group has an equal number of households. For more information, please see the Technical Appendix.

[40] Washington State Department of Health. (2002). Social Determinants of Health. In: *The Health of Washington State*, Olympia, WA: Washington State Department of Health. Downloadable from: www.doh.wa.gov/HWS/2002.

[41] Lochner, K., Pamuk, E., Makuc, D., Kennedy, B.P., Kawachi, I. (2001). State-level income inequality and individual mortality risk: a prospective, multilevel study. *American Journal of Public Health*, 91:285-391.

disparities not only impact those with lower SEP; all members of society have worse health of when income is unevenly distributed in society.

The impact of poverty goes beyond mere material deprivation. In a society that places great value on acquisition of material goods, the poverty is equivalent to failure and personal inadequacy. Those living in poverty may feel socially inadequate compared to others with more money. Researchers hypothesize that lower health among the disadvantaged is a result of higher levels of chronic stress; the negative influence of psychosocial factors on health behaviors; reduced control over one's work and personal life; and the stress of feeling devalued and inferior."[42]

Chronic Stress

There is a well-established link between higher levels of stress and decreased physical and mental health.[43] Stress affects health through both psychological and physiological processes. In emergencies, our nervous systems and hormones prepare us to respond to threats by raising the heart rate, increasing alertness, diverting blood to muscles, and mobilizing stored energy, preparing us to either fight or flee. The biological system that helped our ancestors survive an attack by a wild animal is more likely nowadays to be invoked in response to a last-minute work assignment, an unexpected bill from a creditor, or being cut off in traffic during rush hour. The physiological changes associated with stress cause great wear and tear on the immune and cardiovascular systems. The negative effects of chronic stress on health mount up in a cumulative fashion and tend to persist over time.

Stress can result from acute, major events, such as divorce or job loss, though these events are rare.[44] More commonly, stress results from ongoing, daily struggles, such as work overload, competing demands of work and family responsibilities, less money than is needed to meet monthly expenses, or exposure to noise, pollution and crime in the daily environment. While everyone experiences stress as part of daily life, individuals with low SEP shoulder a disproportionate amount of both acute and chronic stressful events. The stresses that appear to be most damaging to health are 1) a pervasive feeling of social inferiority and 2) exposure to situations in work and personal life over which one has little control. For example, a Swedish study found a relationship between work-related stress, insulin resistance, and type 2 diabetes in a sample of middle-aged women.[45] Similarly, a Japanese study found higher A1c levels among men

[42] Wilkinson, R. G., Pickett. K.E. (2006). Income inequality and population health: A review and explanation of the evidence. *Social Science and Medicine*, 62(7): 1768-1784.
[43] Kelly, S., Hertzman, C., Daniels, M. (1997). Searching for the biological pathways between stress and health. *Annual Review of Public Health*, 18:437-462.
[44] Wheaton, B. (1997). Stress, personal coping resources and psychiatric symptoms: An investigation of interactive models. *Journal of Health and Social Behavior*, 24:208-229.
[45] Agardh, E.E., Ahbom, Andersson, T., Efendic, S., Valdemar, G., Hallqvist, J., Norman, A., Ostenson, C. (2003). Work stress and low sense of coherence is associated with type 2 diabetes in middle-aged Swedish women. *Diabetes Care*, 26: 719-724.

who reported high levels of stress on the job and low levels of social support from coworkers.[46]

While no one is immune from the negative health impacts of chronic life stressors, disadvantaged individuals may be more vulnerable than more advantaged individuals, due to fewer or less effective coping strategies and resources,[47] or because their stressors are qualitatively more potent.[48]

Racism and Discrimination

> "... I suggest that we look at what race is very precisely measuring. Race is a precise measure of the social classification of people in our race-conscious society where that social classification results in differences in life experience, life chances, life opportunities...Another way of saying what I'm saying is that race is precisely measuring exposure to the effects of racism...when people ask me, Are you talking about socioeconomic status really, or is it racism? I say, institutionalized racism explains the fact that there is an association between socioeconomic status and race in this country."
>
> *Camara Jones, M.D., M.P.H.*[50]

Worse health status and health outcomes among non-white racial and ethnic groups have been documented for a number of health conditions.[49] Although non-white racial and ethnic groups have higher rates of poverty, lower education and unemployment, even those with high incomes, college degrees, and good jobs have worse health than whites of similar SEP. Persistent disparities among racial and ethnic groups cannot be explained by genes alone; for example, the high rates of hypertension seen among African Americans in the US, long thought to be driven by genetic factors, is much lower among blacks in the Caribbean and nearly non-existent in rural African communities, indicating that other factors are at work.

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[46] Kawakami, N., Akachi, K., Shimizu, H., Haratani, T., Kobayashi, F., Ishizaki, M., Hayashi, T., Fujita, O., Aizawa, Y., Miyazaki, S., Hiro, H., Hashimoto, S., Araki, S. (2000). Job strain, social support in the workplace, and hemoglobin A1c in Japanese men. *Journal of Occupational and Environmental Medicine*. 57(12): 805-809.

[47] Kessler, R.C., Cleary, P.D. (1980). Social class and psychological distress. *American Sociological Review*, 45:463-478.

[48] Grzywacz, J.G., Almeida, D.M., Neupert, S.D., Ettner, S.L. (2004). Socioeconomic Status and Health: A Micro-level Analysis of Exposure and Vulnerability to Daily Stressors. *Journal of Health & Social Behavior,* 45, (1):1-16.

[49] US Department of Health and Human Services, Office of Minority Health. (2000) Assessment of state minority health infrastructure and capacity to address issues of health disparity. Washington DC. Viewed 3/1/2006 from:http://www.omhrc.gov/omh/sidebar/cossmo/toc.htm.

[50] Jones, C**.,** *Addressing the underlying causes of health disparities: What is the role of public health?* Electronic Health Promotion Conference: Plan for Success: Strengthening the Public's Health through Health Promotion. Viewed 3/2/2006 from: http://www.dhpe.org/PlanforSuccess/files/003.htm

In reviewing twenty studies that actually measured the impact of self-reported discrimination, one researcher found higher levels of discrimination were linked to psychological stress, depression, and hypertension.[51] This was explained by saying: "the accumulated insults arising from everyday and at times violent experiences of being treated as a second class citizen, at each and every economic level, are a constant source of stress, with a devastating impact on health." Another study found that African-Caribbean women in the West Indies with high levels of internalized racism were more likely than those with low levels to have higher levels of stress, larger waist circumference and abnormal levels of fasting blood glucose, indicating a possible link between perceived racism, stress, obesity and diabetes.[52]

These perspectives are important to keep in mind as we consider differences in diabetes statistics by race that are presented in this report. For more discussion on how racism impacts health, please see page 56 in Technical Appendix C.

Inequality Hurts Us All

Humans are social creatures. We need the sense of belonging that comes from frequent interaction with a network of friends, family and others. S*ocial support* is the term used to describe the reciprocal sense of caring for and valuing one another. Social support has important psychological as well as practical benefits; with social support, people recover from illnesses more quickly and are less likely to die from specific diseases.[53] The term *social capital* refers to the degree of collaboration and cooperation members of the larger community develop to achieve mutual benefits, through such mechanisms as networks, shared trust, norms and values.[54] Communities with high levels of social capital have a high degree of trust and involvement; people in these communities come together readily to work for a common goal. The trust, reciprocity and cohesion associated with high levels of social capital have a positive impact on the health of all members of a community, regardless of their individual social rank.

Social capital is related to the degree of inequality in society; in those societies that are more unequal, social capital is lower because inequality and mutual cooperation are at odds with one another: "Friendship includes the concepts of trust, appreciation and reciprocity, while social hierarchy involves dominance and subordination, competition

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[51] Amersbach,G. Through the lens of race: Unequal health care in America. *Harvard Public Health Review*, Winter 2002. Viewed 3/5/2006 from: http://www.hsph.harvard.edu/review/review_winter_02

[52] Butler, C., Tull, E.S., Chambers, E.C., Taylor, J. (2002). Internalized racism, body fat distribution and abnormal fasting glucose among African Caribbean women in Dominica, West Indies. Journal of the National Medical Association, 94(3): 143-148.

[53] Taylor, S.E. (1990). Health psychology: the science and the field. *American Psychologist*, 45:40-50.

[54] Putnam, R.D. (2000). Bowling Alone: The Collapse and Revival of American Community. Simon & Schuster Publishing, 2000.

and social comparison."[55] When social capital is low, people at all levels of the social hierarchy are mistrustful and insecure about maintaining their position. This may explain why people at all levels of SEP in societies with large gaps between rich and poor have worse health compared to societies with lower levels of income inequality.[56]

What's Next?

A summary of key points from this chapter include:

- Disparities exist in diabetes prevalence, in the utilization of medical services, and in the rate of complications and diabetes deaths for low-income and racial/ethnic groups. These disparities are costly; yet they are not inevitable.
- While genetic factors play a role in an individual's risk of disease, disparities in the health of populations are driven by inequalities in the social and economic conditions that are experienced by various subgroups.
- Lower social and economic position affects health through material deprivation, through stress, and through discriminatory policies and practices that exclude certain groups from access to social resources
- Social inequality not only leads to higher morbidity and mortality among those with lower SEP; people at all levels of the social hierarchy are adversely affected when resources are unevenly distributed in society.

Given what we know about the impact of social and economic conditions on health, how can we use this information to reduce health disparities?

In 1998, President Clinton made eliminating health disparities a national priority as part of his Initiative on Race. Elimination of health disparities is also one of the two overarching goals of *Healthy People 2010*.[57] *Healthy People 2010* states that health disparities are driven by inequalities in income and education. In order to reduce or eliminate disparities, organizations at the local, state, tribal and national level will need to take a multidisciplinary approach that encompasses health, education, housing, labor, justice, transportation, agriculture and the environment.

In the remaining five chapters of this report, we address the relationship between diabetes prevalence and socioeconomic factors operating at the personal, community, and county level (Chapter 2). Next, we examine the effect of an individual's socioeconomic position on factors that affect health status: health behaviors, access to

[55] Washington State Department of Health. (2002). Social Determinants of Health. In: *The Health of Washington State*, Olympia, WA: Washington State Department of Health. Viewed 3/1/2006 from: www.doh.wa.gov/HWS/2002.
[56] Wilkinson, R.G. (1992). Income distribution and life expectancy. *British Medical Journal*, 304:165-168.
[57] the other overarching goal of *Healthy People 2010* is to increase the quantity and quality of healthy life.

care, and diabetes services (Chapter 3). Chapter 4 examines diabetes hospitalizations by rural-urban geography and insurance status, and Chapter 5 examines diabetes deaths by race/ethnicity, rural/urban geography, and by the socioeconomic environment of the neighborhood. Finally, Chapter 6 provides a summary and recommendations for action, along with examples of policy and programmatic strategies for addressing disparities in diabetes prevalence, control, and outcomes in a more upstream fashion.

In this report, we aim to go beyond documentation of the disparities that exist in diabetes, and draw a connection between health inequalities and social forces that shape them. We place more emphasis on the relationship of socioeconomic position to diabetes prevalence and health status rather than on hospitalizations and deaths. We do this because our current programs already focus on improving systems of care for people with diabetes, including disparate populations. Our aim in this report is to better understand how socioeconomic factors influence diabetes prevalence and progression of the disease, so that we may move towards addressing these underlying factors in new and creative ways.

Detailed information about the data sources used in this report can be found in Appendix A, Data Sources.

Notes on methods and terms used throughout this report can be found in Appendix C, Technical Notes.

Chapter 2: Socioeconomic Position, Risk Factors and Diabetes Prevalence

In this chapter, we examine personal characteristics and lifestyle behaviors that increase the risk of developing diabetes, and look at how socioeconomic position and community context exacerbates these risks. Most of the information presented in this chapter is derived from analysis of the Washington State Behavioral Risk Factor Surveillance System, and US Census data.[58]

Conceptual Framework

Certain factors increase the risk of diabetes. Figure 3 (see next page) describes various categories of these risk factors. *Non-modifiable risk factors* associated with diabetes are comprised of personal characteristics that cannot be changed, such as race/ethnicity, sex, age and family history (genetic make-up). *Modifiable risk factors* can include health behaviors (such as insufficient physical activity, obesity and cigarette smoking), health conditions (such as hypertension and high blood cholesterol), and access to preventive medical care (measured in this report as being without insurance, not having a regular source of care, and inability to obtain care due to cost). If one or more of these *modifiable* factors are present, alterations in lifestyle, control of health conditions, use of prescription medication, and/or access to medical care can prevent the onset of diabetes. The effect of these factors on diabetes risk is cumulative[42] therefore, if an individual has multiple modifiable risk factors, all of them should be addressed in order to decrease the risk of developing diabetes as much as possible.

Each one of the non-modifiable and modifiable factors is affected by an individual's socioeconomic position (SEP). For example, a person with low educational attainment who is obese will be at higher risk of developing diabetes compared to a person of high educational attainment who is obese.[59] In this report, SEP is described in terms of household income, educational attainment, and employment status. In addition, the socioeconomic environment, or context, of the surrounding community modifies the impact of both individual risk factors and SEP. For example, a person with a higher income may have increased diabetes risk if he lives in a neighborhood where there are many people living in poverty.[60] In this report, we examine contextual influences on

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[58] Please see "At a Glance—Data Sources, Methods and Technical Terms" on page 14 for a brief explanation of the data and methods used for analysis in this chapter. For further information on data quality and limitations, refer to Appendix A.

[59] Maty, S.C., Everson-Rose, S.A., Haan, M.N., Raghunathan, T.E., Kaplan, G.A. (2005). Education, income, occupation, and the 34-year incidence (1965-99) of Type 2 diabetes in the Alameda County Study. *International Journal Epidemiology*, 34(6):1274-81.

[60] Cubbin, C., Hadden, W.C., Winkleby, M.A. (2001). Neighborhood context and cardiovascular disease risk factors: the contribution of material deprivation. Ethnicity and Disease, 11(4): 687-700.

diabetes prevalence, using percent living in poverty, percent with a college education at the neighborhood level, and use percent unemployed, percent uninsured, and an index measure of income inequality at the county level.

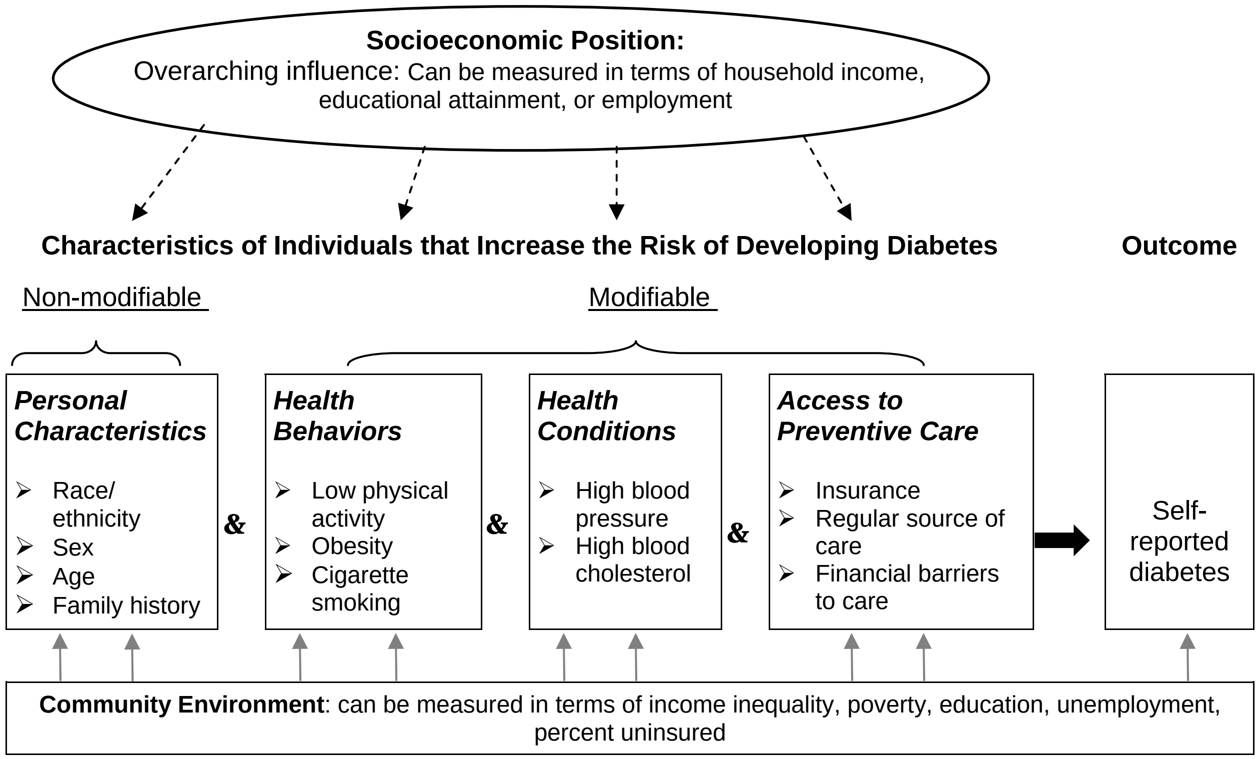

Figure 3

In sections that follow, we begin by examining variations in diabetes prevalence using the three indicators of SEP described above, and consider variations in diabetes prevalence according to our chosen measures of community socioeconomic environment. Next, we show how the risk of developing diabetes is affected by characteristics within each risk factor category, showing the impact of each risk factor on diabetes one at a time. We will see that some factors, such as age and obesity, affect the risk of developing diabetes more than others. We used data from the 2003 BRFSS, the most recent year that physical activity questions were asked, in order to provide consistent risk factor data for the regression analysis described below.

We then turn our attention to describing how risk factors acting in combination impact diabetes risk, using race and age (two non-modifiable personal characteristics), and race and household income (a non-modifiable personal characteristic and an indicator of SEP) as examples.

Finally, we combine data on significant individual characteristics and risk factors, along with measures of individual SEP, to examine the risk of developing diabetes when multiple influences are taken into account. When we do this, we will begin to obtain a clearer picture of the independent contribution of SEP to the development of diabetes while controlling for the effect of other critical factors known to impact diabetes prevalence.

Socioeconomic Position

A number of studies have demonstrated a link between socioeconomic position (SEP) and increased diabetes prevalence, particularly for women.[61,62] This may be because groups with lower socioeconomic position have a higher prevalence of diabetes risk factors, such as obesity, physical inactivity and smoking.[63]

The development of diabetes has also been linked to increased stress resulting from poor working conditions and stressful life events, exacerbated by lack of social support and poor coping style.[64] Stress is thought to increase diabetes risk by raising cortisol levels, which leads to insulin resistance.[65] A number of studies have identified stress to be more prevalent among low SEP populations.[66] Thus, poor health behaviors and increased stress among low-SEP populations may explain increased prevalence of diabetes.

Education

A gradient effect was observed between diabetes prevalence and education; prevalence increased as level of education decreased (Figure 4). Adults with less than a high school education had about twice the prevalence of diabetes as those who were college graduates.

Employment

Diabetes was much less common among people who were homemakers, employed, or in school compared to those who were retired or unable to work. Diabetes prevalence among those who were unable to work was significantly higher compared to other employment groups. However, because data on disease and employment status were

[61] Robbins, J.M., Vaccarino, V., Zhang, H., Kasl, S.V. (2001). Socioeconomic status and type 2 diabetes in African American and non-Hispanic white women and men: evidence from the Third National Health and Nutrition Examination Survey. *American Journal of Public Health*, 91:76–83.
[62] Robbins, J.M., Vaccarino, V., Zhang, H., Kasl, S.V. (2005). Socioeconomic status and diagnosed diabetes incidence. *Diabetes Research and Clinical Practice*, 68(3):230-6.
[63] Lantz, P.M., House, J.S., Lepowski, J.M., Williams, D.R., Mero, R.P., Chen, J. (1998). Socioeconomic factors, health behaviors, and mortality. *Journal of the American Medical Association,* 279:1703–1708.

[64] Agardh, E.E., Ahlbom, A., Andersson, T., Efendic, S., Grill, V., Hallqvist, H., Östenson, C. (2004). Explanations of Socioeconomic Differences in Excess Risk of Type 2 Diabetes in Swedish Men and Women. *Diabetes Care*, 27:716-721.

[65] Björntorp, P., Holm, G., Rosmond, R. (1999). Hypothalamic arousal, insulin resistance and type 2 diabetes mellitus. *Diabetes Medicine,* 16:373–383.
[66] Marmot, M.G., Smith, G.D., Stansfeld, S., Patel, C., North, F., Head, J., White, I., Brunner, E., Feeney, A. (1991). Health inequalities among British civil servants: the Whitehall II study. *Lancet*, 337:1387–1393.

collected at the same time, it is unknown whether employment status was a cause of diabetes, or a consequence of poor health (Figure 5). Two things should be kept in mind with regard to our findings. Compared to the general population, a larger proportion of people with diabetes are of post-retirement age. Also, since diabetes is a degenerative, potentially debilitating disease, more adults with diabetes may be unable to work.

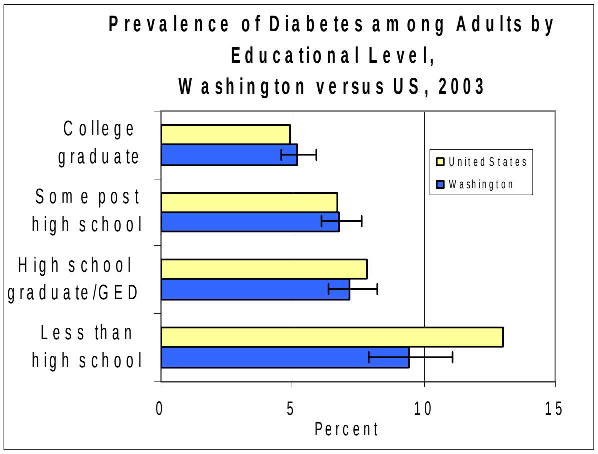

Figure 4. Source: 2003 Washington BRFSS

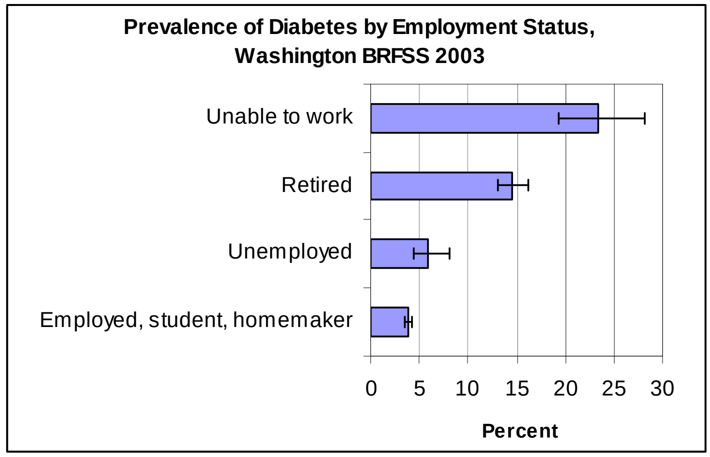

Figure 5. Source: 2003 Washington BRFSS

Household Income

Diabetes prevalence showed a significant gradient effect with household income; prevalence increased with each incremental decrease in income. In this regard,

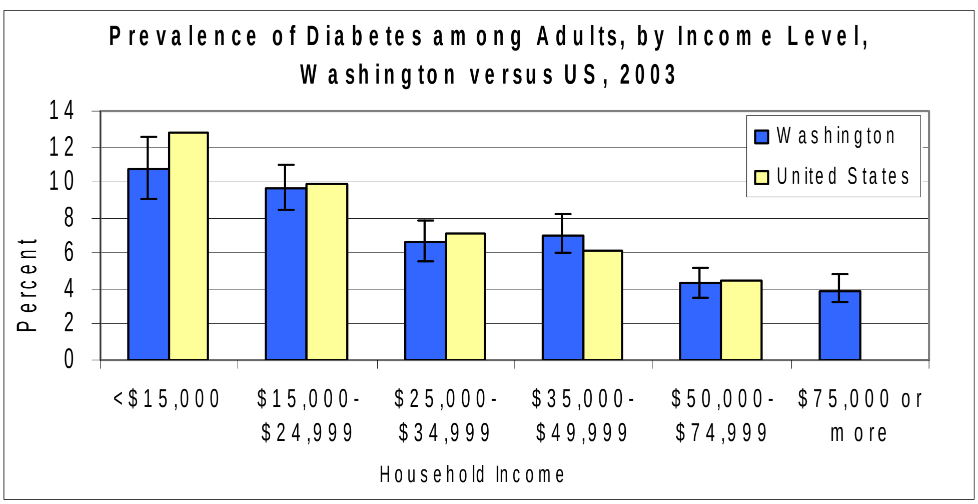

Figure 6. Source: 2003 Washington BRFSS and 2003 US BRFSS

Washington State has a similar pattern as that of the US (Figure 6). The prevalence of diabetes among those with incomes below $15,000 per year was 1.7 times higher than the prevalence among those whose household incomes were $75,000 or more. Other studies have shown that growing up in lower income households increases the risk of diabetes.[67] Since our data are cross-sectional (taken at one point in time) we had no information regarding the childhood socioeconomic status of our respondents. Thus, we were unable to look beyond simple associations between current income and diabetes to determine whether having low household income led to the onset of diabetes, or whether diabetes interfered with the ability to earn a higher income in adulthood.

Socioeconomic Environment

In addition to characteristics associated with an individual such as family history, age, race and behaviors, there are factors that operated in the physical, social, and economic environment that affected diabetes risk. While certain individual characteristics, such as behavior, are under the control of the individual, characteristics at the neighborhood or community level are beyond the individual's control. In the following section we consider factors that operate at the neighborhood level, such as area poverty and educational level, and at the county level in using an indicator of income inequality.

Percent of Neighborhood in Poverty

To study the link between area poverty and diabetes in neighborhoods, we used Census 2000 data to determine the percent of residents who lived at or below the federal poverty level for the zip code in which each BRFSS respondent with diabetes lived. We grouped zip codes into four categories of neighborhood poverty, and calculated the rate of self-reported diabetes for each category (Figure 7). An association was observed

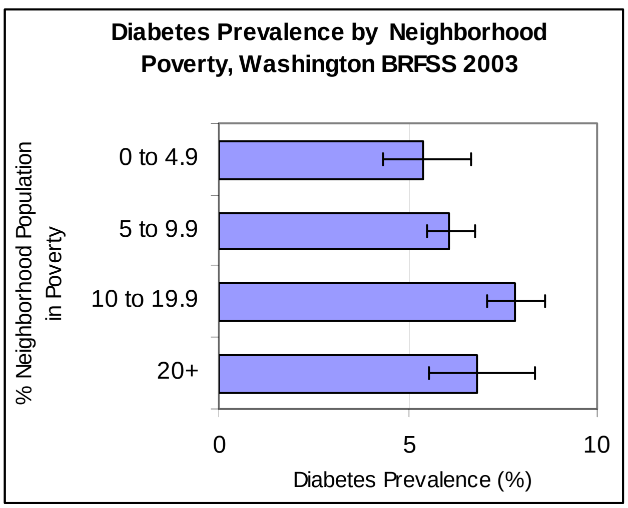

Figure 7. Source: 2003 Washington BRFSS

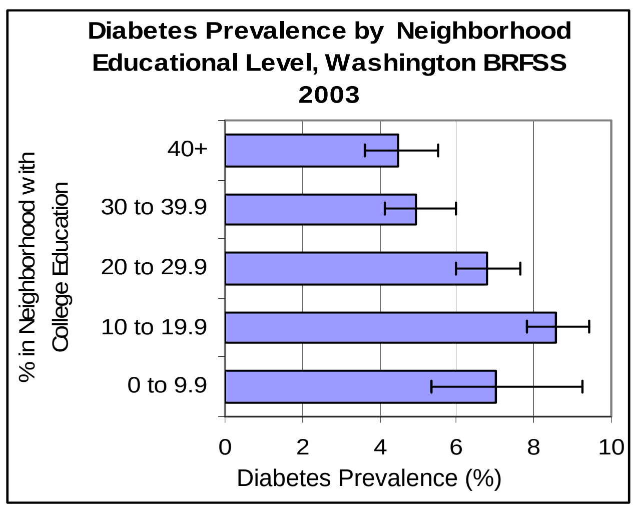

Figure 8. Source: 2003 Washington BRFSS

[67] James, S.A., Fowler-Brown, A., Raghunathan, T.E., Van Hoewyk , J. (2006). Life-course Socioeconomic Position and Obesity in African American Women: The Pitt County Study. *American Journal of Public Health*. 2006 Jan 31; [Electronic publication ahead of print]

between diabetes prevalence and area poverty. The prevalence of diabetes among adults in neighborhoods where 10-19.9 percent of the residents lived at or below the poverty line was 1.5 times higher than the prevalence among adults living in neighborhoods with less than 5 percent poverty.

Percent of Neighborhood With College Education

To assess the association between diabetes and education, we assigned a neighborhood educational level to each BRFSS respondent with diabetes based on the percent of people age 25 and older with a college education in each respondent's zip code of residence. There was a significant gradient effect in prevalence of diabetes by neighborhood education level; prevalence increased as the percentage in neighborhood with a college education decreased (Figure 8). The prevalence of diabetes among adults living in neighborhoods where less than 30 percent were college graduates was 1.5 to 2 times higher than the prevalence among adults in neighborhoods with 40 percent college graduates.

County-level Income Inequality

As mentioned in Chapter 1, increased morbidity and mortality is associated not only with individual poverty or neighborhood socioeconomic environment, but also with relative deprivation, or *income inequality*. The indicator we used to measure county-level income inequality is the GINI index. The GINI index is a summary of the dispersion of income across the entire income distribution, constructed from 2000 U.S. Census data on household income (see Technical Appendix for a detailed description of calculating the GINI index.) The GINI index ranges from 0, which indicates perfect equality (everyone receives an equal share) and 1, which indicates that all income is received by one group of recipients. Thus, the higher the GINI index, the greater the gap between rich and poor. In 2000, GINI indices for Washington counties ranged from 0.38 in Snohomish and Wahkiakum counties to 0.52 in San Juan County. The GINI index for the state was 0.43, and for the nation, 0.46.

We used data from the 2003 BRFSS to examine the relationship between diabetes prevalence and county-level income inequality but found no significant association between the two. A recent review of literature on income inequality and health suggests that studies of income inequality between relatively small areas are more likely to show either no significant associations with health compared to studies using a larger geographic scale. [68] The authors explain that studies of income inequality are more supportive in large areas because in that context income inequality serves as a measure of how hierarchical a society is. They go on to suggest that studies showing no significant association measured inequality in areas too small to reflect the scale of social class differences in a society.

[68] Wilkinson, R. G., Pickett. K.E. (2006). Income inequality and population health: A review and explanation of the evidence. *Social Science and Medicine*,62(7): 1768-1784.

Personal Characteristics and Diabetes Prevalence

Age, sex, and race/ethnicity are *non-modifiable* personal characteristics that put people at greater risk for developing diabetes.

Age

Age is a strong risk factor for diabetes; with each successive age group having an increasing risk of developing diabetes (Figure 9). In Washington State, diabetes prevalence in 2003 was 16 percent among people aged 65 years and older, about 8 times higher than the average diabetes prevalence for adults aged 18-44 years (2 percent diabetes prevalence). Diabetes prevalence in Washington for each age group was nearly identical to the corresponding national prevalence.

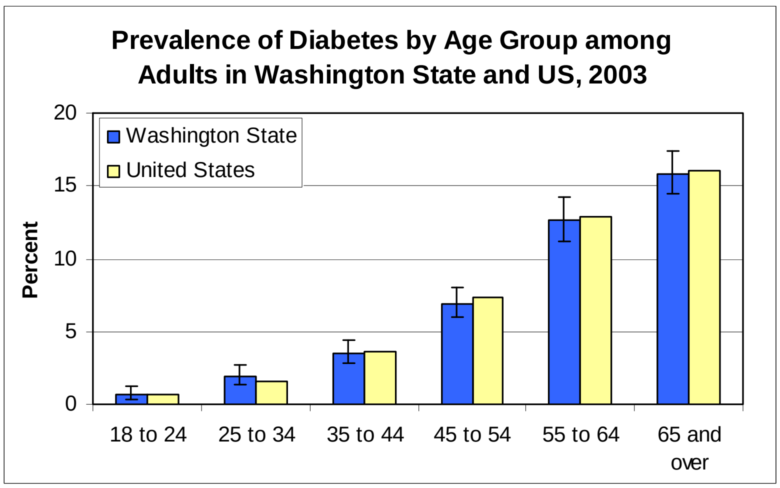

Figure 9. Source: 2003 Washington BRFSS and 2003 US BRFSS

Sex

In 2003, diabetes prevalence was significantly higher among men (7 percent) than women (6 percent) after adjusting for age. National age-adjusted rates were not available, but crude rates for men were similar for Washington and the U.S. (both were 7 percent). Adult women in Washington had a slightly lower crude diabetes prevalence compared to women nation-wide (6 percent and 7 percent, respectively).

Race and Ethnicity

Non-Hispanic American Indians and Alaska Natives and non-Hispanic blacks had the highest age-adjusted[69] prevalence of diabetes in Washington for 2003-2004 combined

[69] Age is a strong risk factor in the development of diabetes, and the age distribution of various racial and ethnic groups varies dramatically. Age-adjusting re-calculates the rate of diabetes prevalence for each racial and ethnic group to a standard population age distribution, thereby accounting for differences in population distributions of age.

(14 percent and 12 percent respectively, Figure 10).[70] Both groups had about twice the diabetes prevalence of non-Hispanic whites (6 percent). Hispanics also had higher diabetes prevalence (9 percent) than non-Hispanic whites. Diabetes prevalence among non-Hispanic Asians and Pacific Islanders (8 percent) was not significantly different than that of non-Hispanic whites.

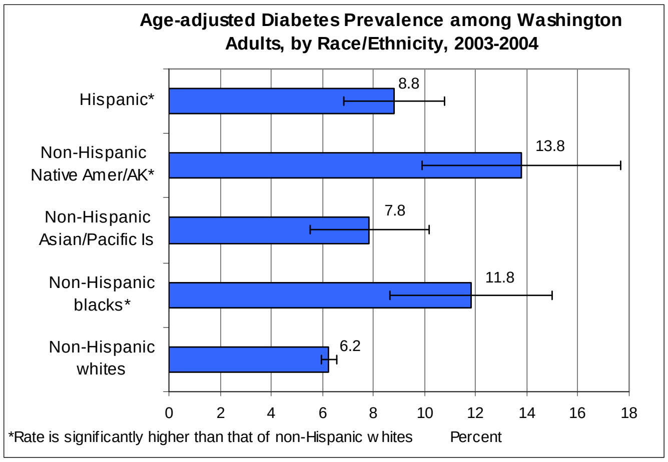

Figure 10. Source: 2003-2004 Washington BRFSS

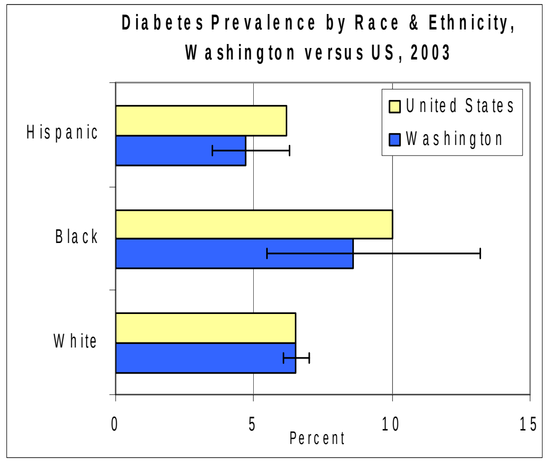

Figure 11. Source: 2003 Washington & US BRFSS

For 2003, crude diabetes prevalence for non-Hispanic white (7 percent) and non-Hispanic black (9 percent) adults in Washington was on par with national rates for those groups (7 percent and 10 percent respectively, Figure 11). Unadjusted diabetes prevalence in Washington Hispanics appeared to be lower compared to their national counterparts (4 percent and 6 percent, respectively), but this difference was not statistically significant.[71]

Several studies have found variations in diabetes prevalence among Hispanics living in the U.S. A recent examination of BRFSS data from 6 states (California, Florida, Illinois, New York/New Jersey, and Texas) found noted regional variations in diabetes prevalence among Hispanics, although diabetes prevalence was consistently higher in Hispanic compared to non-Hispanic white adults after rates were age-adjusted.[72] Regional variations were also present in national data from the 1982-1984 Hispanic Health and Nutrition Examination Survey (HNHANES)[73] that further found differences in diabetes prevalence by Hispanic subgroup. Type 2 diabetes prevalence was highest among those living in the southwest and among those of Puerto Rican descent, and lowest among those of Cuban descent. Further, migration studies show that diabetes is more common among Hispanics of Mexican and Puerto Rican descent living in the US

[70] Two years' worth of data were combined in order to provide sufficient sample size to detect significant differences.
[71] http://apps.nccd.www.cdc.gov/brfss/ viewed 1-20-2006.
[72] Morbidity and Mortality Weekly Report. (2004). 53(40): 941-944.
[73] Carter, J.S., Pugh, J.A., and Monterrosa, A. (1996). Non-insulin dependent diabetes mellitus in minorities in the United States. *Annals of Internal Medicine*, 125(3):221-232.

compared with residents in their country of origin, due to "westernization" of diet and lifestyle.[74] While our data did not allow us to identify ethnic sub-groups or migrant status, we did find that when a small subset of Spanish-speaking Hispanics were excluded from the analysis, crude diabetes prevalence among Hispanics increased from 4 percent to 6 percent. One interpretation is that English-speaking Hispanics are more acculturated to mainstream American habits that increase the risk of diabetes. An alternative explanation is that Spanish-speaking Hispanics with access to a telephone may be younger and therefore healthier, than English-speaking Hispanics.

There are variations in diabetes prevalence among other racial subgroups. For example, analysis of BRFSS data for 2001 showed age-adjusted diabetes prevalence in the U.S. was lower for Asians and Pacific Islanders than that of whites (5.9 percent and 6.9 percent, respectively).[75] However, when prevalences were calculated separately for Asians and Pacific Islanders, the rates were quite different from one another. At 5 percent, diabetes prevalence for Asians was still lower than that of whites, but that of Pacific Islanders was considerably higher (13 percent). Researchers attributed the differences in diabetes prevalence to differences in mean BMI for Asian subgroups compared to Pacific Islander subgroups.[76]

Similar variations are apparent in diabetes prevalence among American Indians and Alaska Natives by tribal affiliation. A 2001 tribal-specific BRFSS conducted by the Northwest Portland Indian Health Board found self-reported unadjusted diabetes prevalence ranged from 6 percent to 15 percent among 6 tribes living in Idaho, Oregon and Washington.[77]

Health Behaviors and Diabetes Prevalence

Obesity, insufficient physical activity, and cigarette smoking are all *modifiable risk factors* for diabetes. In Washington, people who do not meet the recommended level of physical activity[78] (insufficient physical activity) were twice as likely to have diabetes as those with sufficient levels of physical activity. People whose body mass index put them in the obese category[79] were even more likely to have diabetes compared to people in the non-overweight category.

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[74] Ibid.

[75] McNeely, M.J., Boyko, E.J. (2004). Type 2 Diabetes prevalence in Asian Americans: Results of a national health survey. *Diabetes Care*, 27(1): 66-69.

[76] We were unable to perform similar subgroup analysis using Washington BRFSS data due to small sample sizes.

[77] Northwest Indian Health Board, (2004).

[78] The Centers for Disease Control recommends that adults get 30 minutes of moderate physical activity daily at least five times per week or 20 minutes of vigorous activity daily at least three days per week.

[79] Body mass index measured in terms of weight in kilograms divided by height in meters squared. A body mass index (BMI) of 30 kg/m^2 is considered to be obese.

Obesity and Overweight

Obesity is a particularly strong risk factor for developing diabetes. Obesity is believed to lead to insulin resistance, a condition in which the body cannot use insulin properly, and increased concentration of insulin circulating in the blood over time.[80] At some point, a loss of control of blood glucose may emerge, resulting in dietary glucose intolerance, which then leads to type 2 diabetes. In Washington, the diabetes prevalence increased with increasing BMI. For adults who were obese, the prevalence of diabetes was about 7 times greater than for adults who were in the non-overweight category (Figure 12).

Findings from a recent randomly controlled trial[81] showed that people at high risk for type 2 diabetes could lower their chances of developing the disease by 58 percent through diet, weight loss of 5-7 percent of body weight, and physical activity (30 minutes of moderate intensity exercise per day). Treatment with the oral diabetes drug metformin also reduced diabetes risk, though less dramatically.

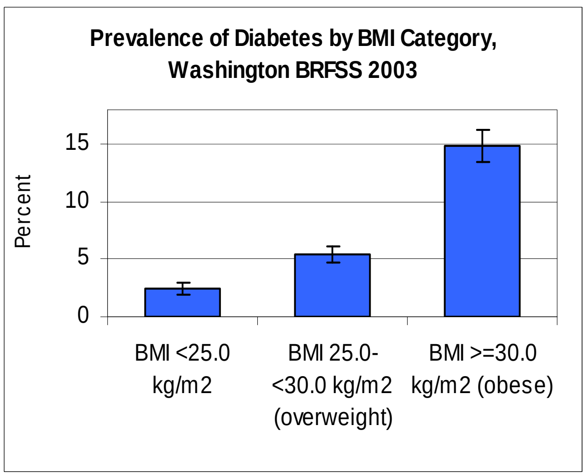

Figure 12. Source: 2003 Washington BRFSS

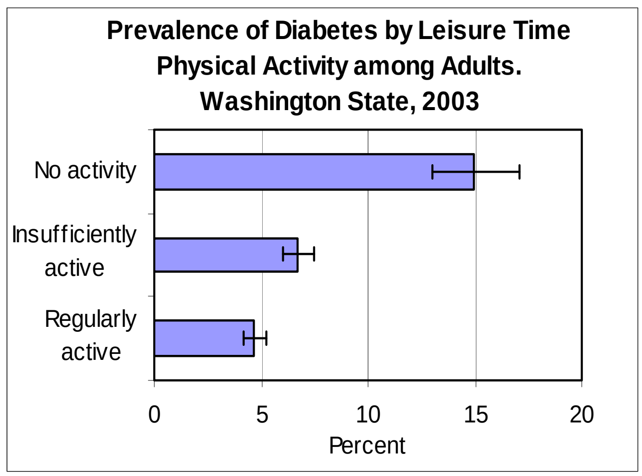

Figure 13. Source: 2003 Washington BRFSS

Prevalence of Diabetes Among Adults by Level of Physical Activity

Lack of physical activity at recommended levels [82] also increases the risk of diabetes. In addition, it is associated with poor health outcomes for those who already have diabetes. The prevalence of diabetes among Washington adults increased as level of physical activity dropped (Figure 13). Diabetes prevalence was more than 3 times higher among those who were physically inactive compared to those who achieved the recommended level of physical activity.

[80] Steinberger, J., Daniels, S. (2003). Obesity, insulin resistance, diabetes and cardiovascular risk in children. *Circulation*, 107:1448-1463.
[81] Diabetes Prevention Program Research Group. (2002). Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin, *New England Journal of Medicine*, 346: 393-403.
[82] The level of physical activity recommended for adults is 30 minutes of moderate activity at least 5 times per week, or less than 20 minutes of vigorous activity at least 3 times per week.

Smoking

Smoking is a well-documented risk factor for diabetes.[83, 84] Smoking has been identified as a risk factor for insulin resistance.[85] It is believed that the hormones catecholamines, are produced in greater quantity in smokers and act as an antagonist to insulin action.[86] In Washington, adults who were current or former smokers were more likely to have diabetes than adults who had never smoked (Figure 14). Due to the cross-sectional nature of the data, we are unable to conclude that smoking was one of the factors that caused these adults to develop diabetes—we don't know whether they were smokers prior to developing diabetes, or whether they developed diabetes prior to beginning to smoke.

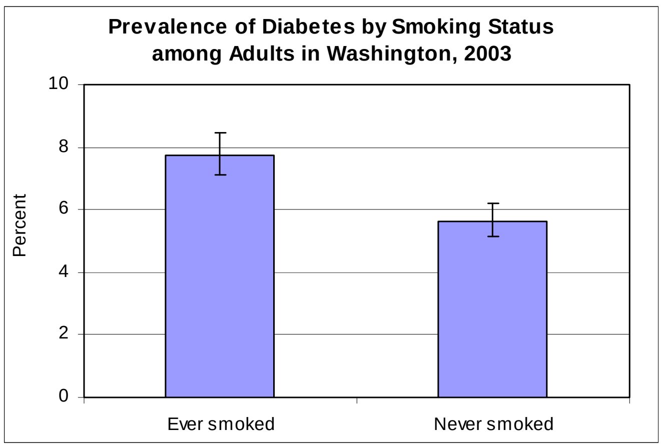

Figure 14. Source: 2003 Washington BRFSS

Access to Care and Diabetes Prevalence

Having access to preventive medical care provides those at risk for diabetes with routine screenings for pre-diabetes and diabetes, as well as professional advice on smoking cessation, healthy diet, exercise programs, weight management, and control of health conditions such as hypertension and dyslipidemia.

Access to care was measured in the BRFSS by asking respondents whether they had health care coverage (either as part of employer-based insurance or state-sponsored programs such as Medicare or Medicaid), whether they had a regular health care

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[83] Rimm, E.B., Manson, J.E., Stampfer, M.J., Colditz, G.A., Willett, W.C., Rosner, B., Hennekens, C.H., Speizer, F.E. (1993). Cigarette smoking and the risk of diabetes in women. *American Journal of Public Health*, 83 :(2) 211-214.
[84] Rimm, E.B., Chen, J., Stampfer, M.J. (1995). Prospective study of cigarette smoking, alcohol use, and the risk of diabetes in men. *British Medical Journal*, 310 (6979): 555-559.
[85] Targher, G., Alberiche, M., Zenere, M.B., Bonadonna, R.C., Muggeo, M., Bonora, E. (1997). Cigarette smoking and insulin resistance in patients with non-insulin resistance in patients with non-insulin-dependent diabetes mellitus. *Journal of Clinical Endocrinology Metabolism*, 82: 3619-3624.
[86] Cigarettes: What the warning label doesn't tell you. The American Council on Science and Health. 1996.

provider, and whether there were times they could not get medical care due to cost. In 2003, 14 percent of Washington residents were without health care coverage. About 21 percent of Washington residents in 2003 said they did not have their own health care provider, and 13 percent said they were unable to get medical care when they needed it due to cost. People who have already been diagnosed with diabetes are more likely to have access to care than those without diabetes (see next chapter). There may be many among those who do not have access to health care who are at risk for diabetes. Without routine health check ups, monitoring of risk factors, and advice on lifestyle choices, these vulnerable individuals are less likely to get the help they need in order to prevent diabetes.

Combined Effects of Risk Factors on Diabetes

No single personal characteristic or measure of socioeconomic status is by itself responsible for increased risk of diabetes; rather, they act in combination. In some cases, the prevalence of diabetes by one risk factor may vary when a second factor is taken into account. Similarly, the independent effect of one factor on diabetes may be influenced when multiple factors are taken into account. In this section, we examine diabetes prevalence when two risk factors are taken into account, and then we examine diabetes prevalence when multiple factors are taken into account. First, we discuss variations in diabetes prevalence by race/ethnicity (a non-modifiable risk factor) for various age groups (age is another non-modifiable risk factor). Next, we discuss variations in diabetes prevalence by race/ethnicity (a non-modifiable risk factor) for various levels of household income (an indicator of SEP). Finally we examine variations in diabetes prevalence by individual SEP after adjusting for other critical factors associated with diabetes.

Diabetes Prevalence by Race/Ethnicity and Age

When variations in diabetes prevalence were examined by race/ethnicity and by age group, we found significantly higher prevalence of diabetes among older adults (aged 45 years and older) compared to younger adults (aged 18-44 years) for non-Hispanic whites, non-Hispanic blacks, and Hispanics. For non-Hispanic American Indians/ Alaska Natives only older adults aged 65 years and older had a significantly higher prevalence of diabetes than younger adults aged 18-44 years. Due to the small number of responses among non-Hispanic Asian/Pacific Islanders under age 55, we were unable to investigate differences in diabetes prevalence by age.

Figure 15 shows that compared to non-Hispanic whites, diabetes prevalence was significantly higher among non-Hispanic Native American/Alaska Natives than non-Hispanic whites for those aged 18-44 years (7 percent compared to 2 percent), 45-54 years (17 percent compared to 6 percent), and 65 years and older (32 percent compared to 15 percent). Age-specific diabetes prevalence was also significantly higher among

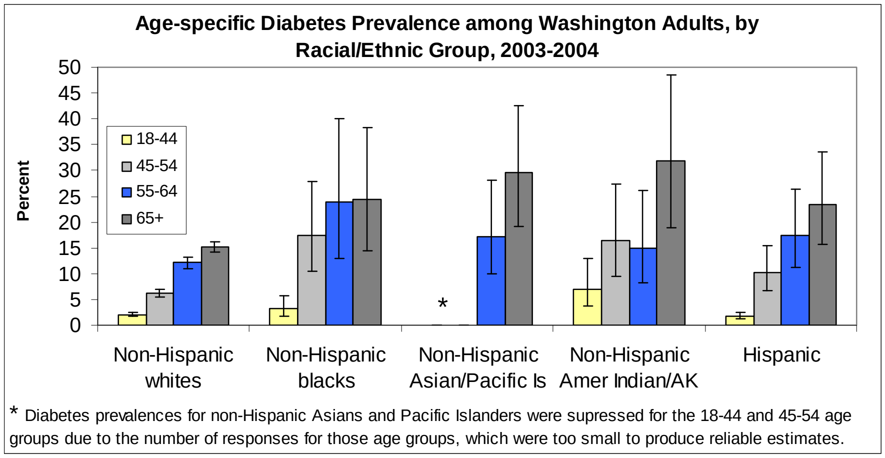

Figure 15. Source: 2003-2004 Washington BRFSS

non-Hispanic blacks compared to non-Hispanic whites for those aged 45-54 years (18 percent compared to 6 percent). Although diabetes prevalence appeared to be higher among Hispanics compared to non-Hispanic whites in older age groups (45 years and older), we were unable to detect differences that were statistically significant.

Diabetes Prevalence by Race/Ethnicity and Income

When both race/ethnicity (a non-modifiable risk factor), and household income (an indicator of socioeconomic position) are taken into account, an interesting pattern emerges (Table 1). When examining diabetes prevalence within racial/ethnic groups,

Table 1. Diabetes Prevalence among Washington Adults, by Race/Ethnicity and Income, 2003-2004

Racial/ethnic group	**Annual Household Income**	**Percent** (95% Confidence Interval)		**Percent difference in prevalence** (p-value)	
Non-Hispanic White	<$25,000	11.0	(10.2, 12.0)	*Ref*	
	$25,000 to <$50,000	6.9	(6.4, 7.6)	*Ref*	
	$50,000 or more	4.0	(3.6, 4.4)	*Ref*	
Non-Hispanic Black	<$25,000	10.1	(6.5, 15.4)	-1.0	(0.68)
	$25,000 to <$50,000	9.3	(5.5, 15.5)	2.4	(0.34)
	$50,000 or more	8.6	(4.4, 16.1)	4.6	(0.11)
Non-Hispanic Asian/Pacific Islander	<$25,000	6.2	(3.2, 11.6)	-4.8	(0.02)
	$25,000 to <$50,000	5.0	(2.7, 8.9)	-2.0	(0.20)
	$50,000 or more	--	--	--	--
Non-Hispanic American Indian/Alaska Native	<$25,000	15.0	(9.2, 23.3)	3.9	(0.27)
	$25,000 to <$50,000	12.7	(7.8, 19.9)	5.7	(0.06)
	$50,000 or more	--	--	--	--
Hispanic	<$25,000	4.3	(3.1, 5.8)	-6.8	(0.00)
	$25,000 to <$50,000	4.6	(3.0, 7.1)	-2.3	(0.03)
	$50,000 or more	5.0	(2.7, 8.9)	1.0	(0.50)

Source: 2003-2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent. *Ref* indicates reference category for comparison of differences in prevalence. Persons of Hispanic origin may be of any race.

non-Hispanic whites with household incomes under $25,000 have significantly higher diabetes prevalence compared to those in higher income categories. But this decrease in diabetes prevalence with increasing income was not observed for other racial/ethnic groups. Between racial and ethnic groups, the following variations by income were observed: among adults with incomes below $25,000, diabetes prevalence was significantly lower for non-Hispanic Asian/Pacific Islanders and Hispanics compared to non-Hispanic whites. Among adults with incomes from $25,000 to $50,000, diabetes prevalence was significantly lower among Hispanics than non-Hispanic whites.

Combined Influence of Socioeconomic Position, Individual Characteristics, and Risk Factors on Diabetes Prevalence

In this final section we examine the joint effects of individual-level socioeconomic position on diabetes, while taking other individual-level factors associated with diabetes into account. A multivariate analysis was performed to reveal the cross-sectional association between measures of SEP (i.e., income, education, and employment status) and self-reported diabetes, independent of the effect of other critical factors such as age, sex, race/ethnicity, BMI, physical activity level and access to health care.[87] Table 2 displays the adjusted odds ratio calculated to approximate how much more likely (or unlikely) it was for diabetes to be present among the different SEP groups.[88]

We previously described that the prevalence of diabetes increased as income and educational attainment decreased and was higher among adults who were unemployed, retired, or unable to work. These associations persisted after adjusting for age, sex, race/ethnicity, overweight/obese, level of physical activity, and having regular source of care.

Major risk factors like age and obesity still had the strongest independent influence on self-reported diabetes, but measures of SEP continued to have independent effects on diabetes prevalence after taking the contributions of other factors into account, such as sex, race/ethnicity, physical activity, and access to care. For example, the adjusted odds of self-reported diabetes was two times greater for adults with an annual household income <$25,000 and 1.4 times greater for adults with incomes from $25,000 to <$50,000, compared to adults with an income of at least $50,000. Self-reported diabetes was

[87] We did not include rural/urban geographic measures because we plan to conduct more sophisticated analysis to demonstrate the combined influences of both individual- and community-level socioeconomic position on diabetes where we will account for geographic variation at the county level.
[88] Since our analysis was based on self-reported data collected at one point in time, we are unable to estimate the cumulative effect of these risk factors over time, or determine whether any of these factors were responsible for the development of diabetes in any one individual. The adjusted odds ratios therefore represent the odds of having diabetes in the presence of a specific factor vs. the odds of diabetes with that factor absent while adjusting for all other remaining factors.

reported 2.5 times as likely by adults who were unable to work and 1.5 times as likely among retirees, compared to adults who were currently employed.

In this analysis, the overall effect of education on diabetes was no longer significant after adjusting for other factors. However, adults with less than a high school education were still significantly more likely to have diabetes (at least 1.5 times greater) than adults who graduated from college. Additional factors such as smoking and other measures of health care coverage were evaluated, but excluded from further analysis because they did not have a significant effect on diabetes prevalence when multiple factors were taken into account. [89]

The multivariable regression analysis described above only addresses the combined effects of *individual-level* characteristics on diabetes. We have plans to conduct more sophisticated analyses to investigate the combined influences of both individual- and neighborhood-level socioeconomic characteristics on diabetes prevalence in Washington. A better understanding of the combined effects of individual factors and community context on diabetes prevalence is needed to develop effective interventions at both levels, to help ameliorate the generally negative effects of SEP on diabetes.

Table 2 Relationship Between Self-Reported Diabetes and Socioeconomic Postion among Washington Adults, Multivariate Logistic Regression Analysis, 2003

Factors	**Odds Ratio** (OR) **prior to adjusting for other critical factors**		**Odds Ratio** (OR) **after adjusting for other critical factors**	
Socioeconomic position measures	OR (95% CI)		OR (95% CI)	
Household income				
<$25,000	2.7*	(2.3, 3.4)	2.0*	(1.6, 2.7)
$25,000-$49,999	1.8*	(1.5, 2.2)	1.4*	(1.1, 1.8)
$50,000 or more	*Ref*		*Ref*	
Education level				
Less than high school	2.2*	(1.7, 2.9)	1.5*	(1.1, 2.0)
High school graduate/GED	1.4*	(1.2, 1.8)	1.0	(0.8, 1.3)
Some post high school	1.4*	(1.1, 1.7)	1.1	(0.9, 1.4)
College graduate	*Ref*		*Ref*	
Employment status				
Employed, student, homemaker	*Ref*		*Ref*	
Unemployed	1.7*	(1.2, 2.4)	1.4	(1.0, 2.0)
Retired	4.3*	(3.6, 5.2)	1.5*	(1.2, 1.9)
Unable to work	7.7*	(5.9, 10.1)	2.5*	(1.8, 3.6)

*P<.05, meaning the odds ratio of this category is significantly greater than the reference category based on an adjusted Wald test. Data Source: 2003-2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the odds ratio. *Ref* indicates reference category for comparison of differences in odds ratios. Odds ratios adjusted for other critical factors including: age, sex, race/ethnicity, overweight/obese, level of physical activity, and having regular source of care. A more extensive version of Table 2 with corresponding odds ratios for each of the critical factors can be found in the Multivariate Analysis and Odds Ratio section of Appendix C: Technical Notes (pg. 53).

[89] A description of the modeling strategy used for this multivariate analysis can be found in the *Multivariate Analysis and Odds Ratio* section of Appendix C: Technical Notes (pg. 58).

Chapter 3: SEP, Health Behaviors and Diabetes Outcomes

In this chapter we use an evidence-based model developed by Brown and colleagues (2004) to describe the pathways by which socioeconomic position (SEP) may influence health outcomes for people with diabetes. This model has similarities to the model presented in the last chapter, but focuses on morbidity and mortality associated with diabetes rather than diabetes prevalence.

In this model, SEP reflects both the current influence of an individual's location within the social hierarchy as well as the cumulative effects of social position over time. SEP is described by characteristics at the individual, household, or community level. Also, personal characteristics (race, ethnicity, sex and age) constitute critical covariates that affect the impact of SEP on health outcomes. The avenues through which SEP affects health outcomes include: 1) self-management behaviors (including blood glucose monitoring, taking prescribed medications, and adherence to recommended diet and physical activity regimes); 2) access to care (in terms of primary care provider visits, specialty care visits, and waiting times); and 3) patient-provider adherence to recommended processes of care (measures include testing A1c and lipids, annual foot and dilated eye examinations, nephropathy assessments, aspirin use, pneumococcal and influenza immunizations, and smoking cessation.)

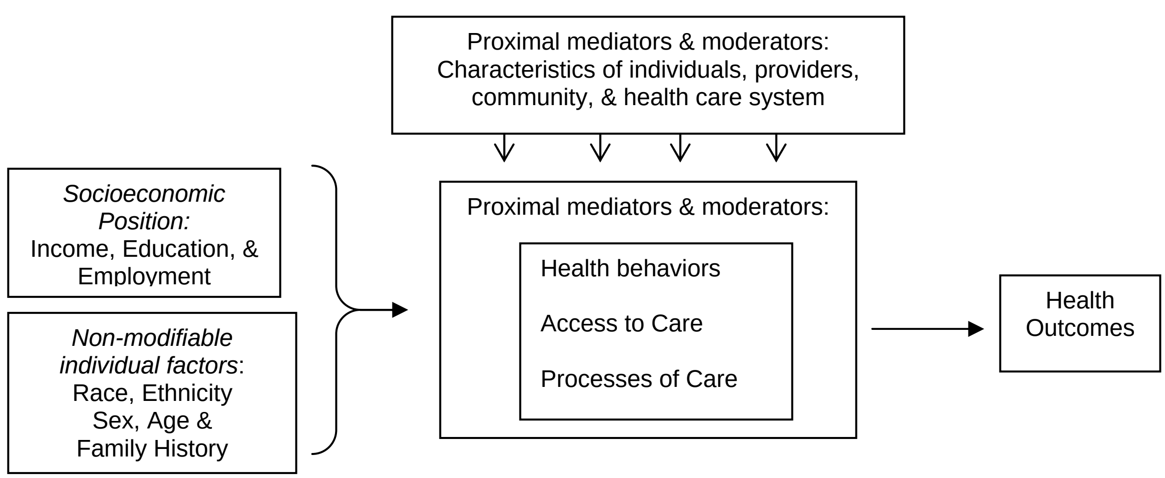

Figure 16. Model for the relationship between SEP and health among persons with diabetes. Adapted from Brown, et. al, *Epidemiology Rev* (2003); 26:63-77.

Health outcomes include deaths, co-morbid conditions (such as obesity and cardiovascular disease), preventable hospitalizations and emergency room visits, health status and quality of life, and measures of diabetes control: lipid levels, glycemic control, blood pressure management and medications. The model also acknowlegdes proximal factors that may mediate or moderate[90] the impact of SEP on outcomes: barriers that operate within the health care system, the community, and the provider or within the individuals themselves.

In the following sections, we use data combined from the 2003-2004 Washington BRFSS to describe variations in self-management behaviors, access to care, and recommended processes of care for people with diabetes according to individual-level SEP indicators (income and education) and covariates (race, age and sex).[91] We also analyze self-reported physical and mental health and disability for people with diabetes according to SEP. We did not have information that allowed us to explore the effect of proximal barriers that may mediate or moderate the effect of SEP, or examine what effect variations in access, behaviors and processes have on deaths and hospitalizations.

Diabetes Self-Management

Certain personal health care behaviors have been found to be critical to disease management for people with diabetes. These include daily self-monitoring of blood glucose concentrations, adjustment of insulin and oral anti-diabetic agents in response to blood glucose readings, adherence to dietary and physical activity regimens, weight control, and abstinence from smoking. Among people with diabetes, lower income and educational attainment have been associated with lower rates of blood glucose self-monitoring, lower levels of physical activity and higher rates of smoking.[92]

This section includes information from the Washington BRFSS on blood glucose self-monitoring, physical activity, smoking status, and obesity. For each section, we include a table listing demographic characteristics (age, sex, income and education) and measures of SEP and checking which characteristics are significantly associated with the variable of interest. The accompanying text details the magnitude and direction of the association. For example, among people with diabetes, the prevalence of obesity decreases with increasing income; the text tells how much higher obesity is among lower income compared to high-income group. On the summary table, we omitted race/ethnicity except in cases where there was sufficient sample to create stable estimates and to detect differences between groups.

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[90] A factor is a *mediator* if it is the means through which SEP influences health outcomes, and is a *moderator* if the effect of SEP differs according to levels of the factor,

[91] Please see “At a Glance—Data Sources, Methods and Technical Terms” on page 14 for a brief explanation of the data and methods used for analysis in this chapter. For further information on data quality and limitations, refer to Appendix A.

[92] Brown, A.F., et. al. (2004). Socioeconomic position and health among people with diabetes mellitus: A conceptual framework and review of the literature. *Epidemiology Review*, 26, 63-77.

Daily blood glucose monitoring

Significantly associated with	
age	
sex	
income	
education	

People with diabetes need to monitor their blood glucose level daily in order to make appropriate adjustments to their diet, physical activity level or medications to improve it. When blood glucose levels fall too low, a person with diabetes can become nervous, shaky, and confused. Judgment may become impaired and fainting may occur. A person with diabetes can also become ill if blood glucose levels rise too high. In addition, keeping blood glucose levels close to normal reduces the risk of developing major complications of diabetes.[93] About 65 percent of Washington adults with diabetes said they monitored their blood glucose on a daily basis in 2004, slightly above the national average of 60 percent. No differences were detected in glucose self-monitoring by age, sex, income or education.

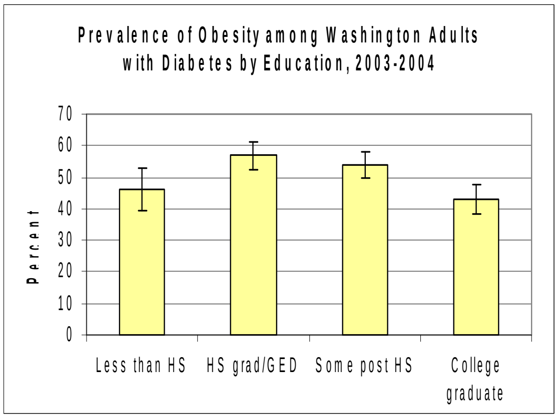
Obesity and Overweight

Significantly associated with...	
age	✓
sex	✓
income	
education	✓

Obesity is associated with poor health status and increased risk of complications in people with diabetes. While the mechanisms by which obesity leads to worse outcomes is poorly understood, some researchers hypothesize that the insulin resistance associated with obesity, and subsequent development of type 2 diabetes, also leads to development of hypertension, higher triglyceride levels, and lower levels of HDL (the "good" cholesterol).[94]

People with diabetes were more likely than those without the disease to be obese[95] in 2003-2004 (51 percent and 20 percent, respectively). The rate of obesity among adults with diabetes in Washington was on par with the US prevalence. Obesity was more prevalent among women and among those with a high school or post-high school education, compared to other educational groups (Figure 17). Obesity was about two times more prevalent among adults less than 65 years (54 percent aged 18-44 and 61 percent aged 45-64) and 1.6 times more prevalent among adults 65-74 years (46 percent), compared to adults aged 75 years and older (29 percent). When obesity was considered alone in this analysis, no significant differences were detected by race/ethnicity. However, when both overweight and obese BMI categories were considered, non-Hispanic Asians and Pacific Islanders had lower prevalence compared to non-Hispanic whites (Figure 18)

[93] Diabetes Control and Complications Trial (DCCT), sponsored by the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK).
[94] Cherian, M.A., Santoro, T.J. (2006). The role of saturation of fat depots in the pathogenesis of insulin resistance. *Medical Hypotheses*, 66(4):763-8. (Electronic publication 2005 Dec 19.)
[95] Obesity refers to having a body mass index (BMI) greater than or equal to 30, where BMI is calculated as a ratio of weight to height (kg/m^2). Data from the BRFSS is based on self-reported height and weight.



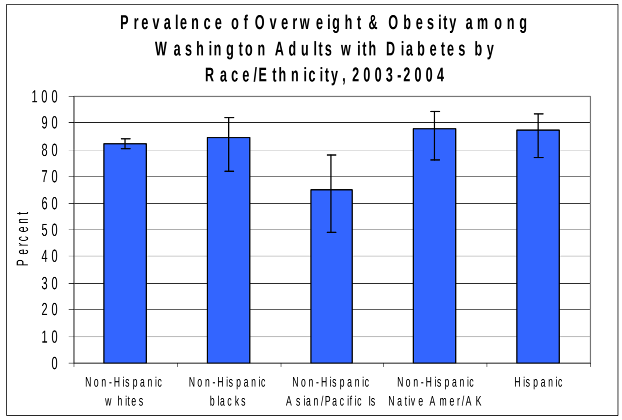


Figure 17. Source: 2003-2004 Washington BRFSS Figure 18. Source: 2003-2004 Washington BRFSS

Physical Activity[96]

Significantly associated with	
Age	✓
Sex	
Income	✓
Education	✓

Daily physical activity at recommended levels[97] is important for weight control, and confers additional benefits for those with diabetes including control of risk factors for heart disease and stroke, improved bone strength and management of depression[98]. Compared to people without diabetes, those with diabetes are less likely to achieve recommended levels of physical activity (44 percent and 64 percent, respectively).

Fewer adults with diabetes who had annual incomes under $15,000 and from $25,000-$49,999 achieved recommended levels of physical activity compared to those whose incomes were $50,000-$74,999 (Figure 19). A gradient effect was observed between physical activity and education among adults with diabetes; where achieving recommended levels of physical activity decreased as level of education decreased (Figure 20). Similar to trends in the general population, older adults with diabetes were significantly less likely to meet recommendations for physical activity (31 percent age 75 years and older), compared to younger adults (51 percent aged 18-44 years, 47 percent aged 45-64, and 44 percent aged 65-74). No differences in physical activity prevalence were observed by sex.

[96] Washington BRFSS included questions about moderate and vigorous physical activity in leisure time in 2003, but not in 2004.
[97] *Surgeon General's Report on Physical Activity and Health*, 1996
[98] Ibid.

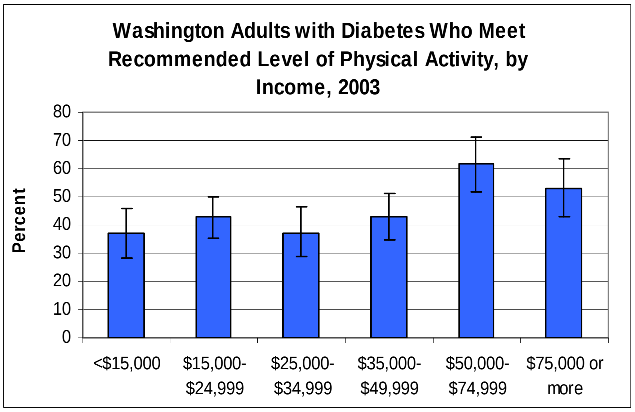


Figure 19. Source: 2003 Washington State BRFSS

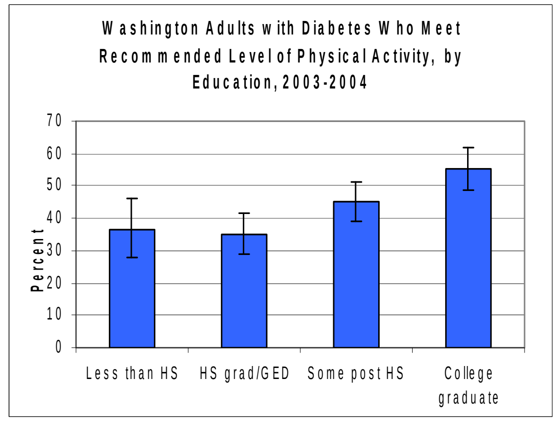


Figure 20. Source: 2003 Washington State BRFSS

Current Cigarette Smoking

Significantly associated with	
age	✓
sex	
income	✓
education	✓

Smoking puts people with diabetes at greater risk for diabetes-related complications, including cardiovascular disease. Compared to people without diabetes, those with diabetes were significantly less likely to smoke cigarettes (16 percent and 20 percent, BRFSS, 2003). Among adults with diabetes, Washington smoking rates were on par with 2003 US prevalence. As with the general population, current smoking among adults with diabetes significantly increased with each incremental decrease in age.

Prevalence of current smoking also increased with decreasing income level (Figure 21) and decreasing educational attainment (Figure 22). No differences were observed in prevalence by sex.

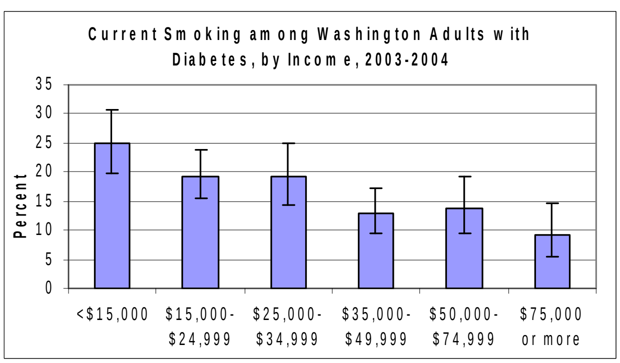


Figure 21. Source: 2003 Washington BRFSS

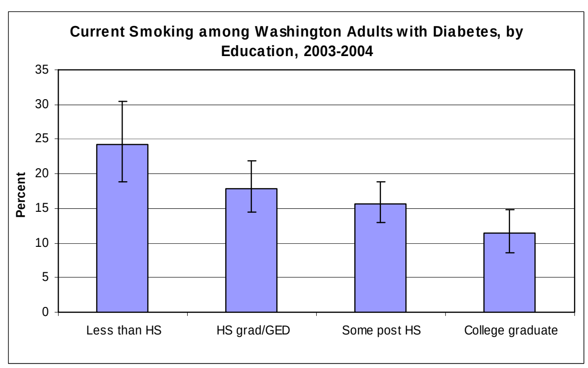


Figure 22. Source: 2003 Washington BRFSS

Access to Care

Access to health care refers to both the availability of health care services and the use of those services. Use of services may be affected by administrative barriers such as co-payments, restrictions on specialty referrals and lack of proximity to a health care facility. Differences in culture and language between patient and provider may present additional barriers to access. Observational studies have shown that an increase in the quality of care or in the number of primary care providers in a region can mitigate the negative association between income inequality and poor health status.[99] In the United States, access to health care is closely related to insurance coverage and whether persons have a regular source of care.[100] Thus, we examine disparities in health care access using those indicators, which are readily available in the BRFSS dataset, and also examine the ratio of population to primary care providers in each county. We found that most of these indicators of access to health care varied by geographic location, age, education and race/ethnicity in the general population, but the differences were more dramatic for adults who had diabetes.

Health Care Coverage

Significantly associated with...	
Age	✓
Sex	
Income	✓
Education	✓
race/ ethnicity	✓

Most adults with diabetes say they have some kind of health care coverage, either insurance, prepaid plans such as HMOs, or government plans such as Medicare. In fact, adults with diabetes were more likely than those without the disease to have health care coverage (91 percent and 85 percent, respectively). The difference in health care coverage could be affected by differences in the age distribution of diabetes population-(there could be more Medicare-eligible adults among the diabetes population). In addition, those with a chronic, degenerative disease have a high need for ongoing and comprehensive medical care—and may therefore be more likely to secure coverage.

Health insurance coverage varied significantly by age, income, education, and race/ethnicity. A lower percentage of younger adults with diabetes (82 percent aged 18-44 years) reported having health insurance coverage, than older adults with diabetes (89 percent aged 45-64 years, 99 percent aged 65-74, and 98 percent aged 75 and older). A significant gradient effect was also observed between health insurance coverage among adults with diabetes and both income and education; where coverage decreased with each incremental decrease in income and education (Figures 23 and 24).

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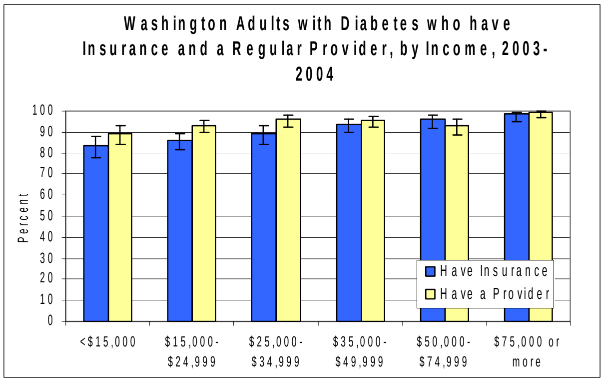
[99] Brown, A.F., et. al. (2004). Socioeconomic position and health among people with diabetes mellitus: A conceptual framework and review of the literature. *Epidemiology Review*, 26, 63-77.
[100] Sambamoorthi, U., McAlpine, D.D. (2003). Racial, ethnic, socioeconomic and access disparities in the use of preventive services among women. *Preventive Medicine*, 37:475-484.



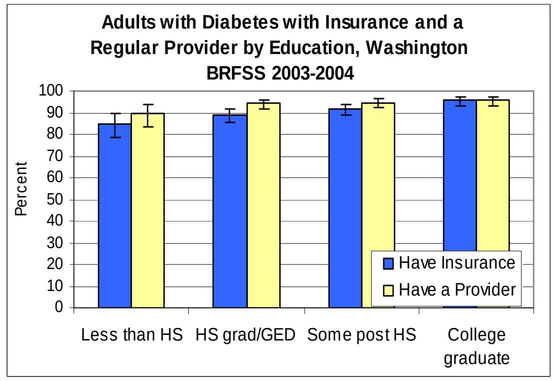


Figure 23. Source: 2003-2004 Washington BRFSS Figure 24. Source: 2003-2004 Washington BRFSS
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Further, significantly fewer Hispanic adults with diabetes said they had health care coverage compared to non-Hispanic whites (Figure 25). Unlike the general population, in which women are more likely than men to have health care coverage, there were no significant differences by sex among adults with diabetes.

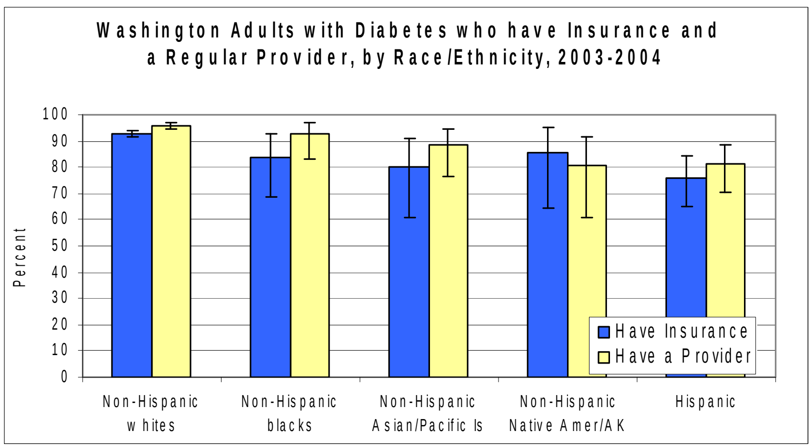

Figure 25. Source: 2003-2004 Washington BRFSS

Regular Provider

Significantly associated with	
age	✓
sex	
income	✓
education	✓
Race/ ethnicity	✓

In 2003-2004 combined, the majority of adults with diabetes said they had at least one person who they considered to be their personal doctor or health care provider. For people with diabetes, having a regular health care provider may facilitate meeting the goal to have at least two diabetes care visits per year. Adults with diabetes were more likely to have a regular health care provider than those without diabetes (94 percent and 78 percent, respectively). As with health insurance, these differences may be due to more Medicare-eligible adults among the diabetes population, or the tendency of people with chronic disease to secure a regular provider because they need one. While a high percentage of adults with diabetes in all population subgroups said they had a regular health care provider, there were some significant variations by age, income, education, and race/ethnicity.

While regular source of care was fairly high among adults with diabetes across all age groups, fewer adults aged 18-44 years (87 percent) reported having a personal health care provider compared to adults 45 years and older (97 percent). A significant gradient effect was also observed between having a personal health care provider and income; where having a regular source of care decreased with each incremental decrease in income (Figure 23). A lower percentage of adults with diabetes who had less than a high school education (90 percent) reported having a regular health care provider than college graduates with diabetes (96 percent), (Figure 24). Significantly fewer non-Hispanic Asians and Pacific Islanders, non-Hispanic Native Americans and Alaska Natives, and Hispanics with diabetes had a regular health care provider compared to non-Hispanic whites (Figure 25). Unlike the general population, in which women are more likely than men to have a regular provider, there were no significant differences by sex among adults with diabetes

Number of Primary Care Providers

The Washington State Office of Rural Health routinely surveys counties to ascertain how many primary care physicians are available for the population being served. Counties with a population over 2000 per primary care physician are considered to be high-need areas, while 1500 to 2000 people per physician are considered medium need and less than 1500 people per physician are low need. Figure 26 displays the average county-level diabetes prevalence for 2003-2004, overlaid onto the ratio of population to physicians. While living in a region with a lower level of medical services is an issue for all people with diabetes, it is of particular concern for those counties with high prevalence of diabetes. Three counties with diabetes prevalence significantly higher than the state's average rate of 6.5 percent (i.e., Garfield, Mason, and Pend Oreille) are in areas where the ratio of population to physicians is greater than 2000 to 1, indicating that these are high-need areas. The county-level provider data can mask major differences in availability of care within smaller geographic areas, or counties with a rural-urban mix. For example, while Pierce County is largely urban and considered a county with medium physician need, high need areas have been identified among rural portions of the county.

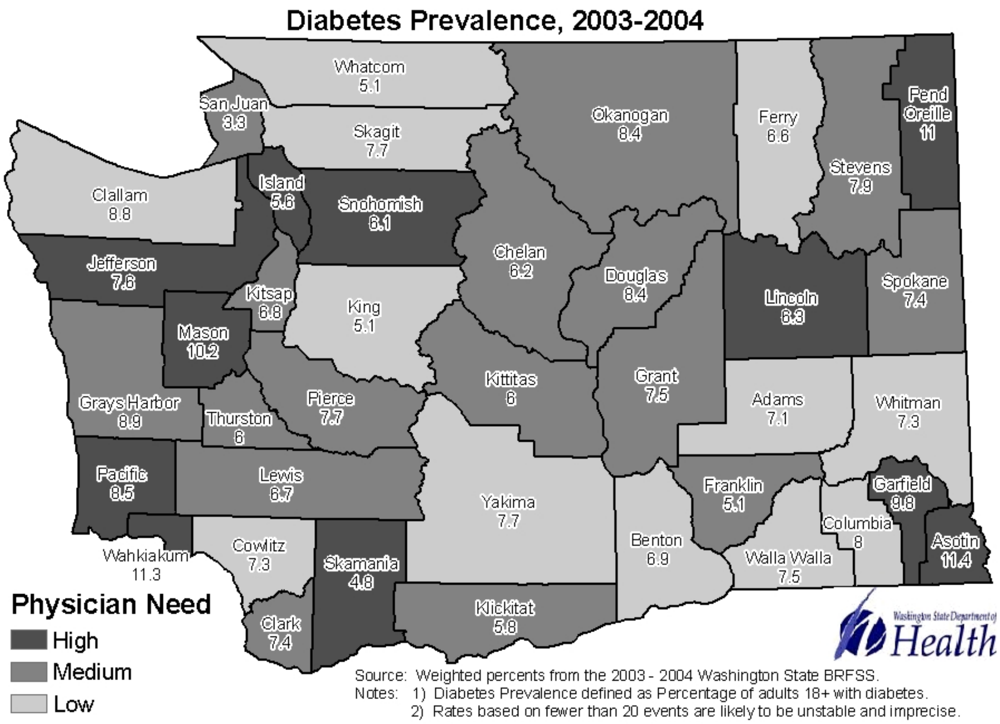

Figure 26. Source: Washington State Primary Care Clinic Inventory, Washington BRFSS

Process Measures

The process of care refers to technical and interpersonal care provided to patients within the health care setting.[101] These processes include measurement of hemoglobin A1c (an indicator of long-term control of blood sugar), annual dilated eye exams and foot examinations; immunization for pneumonia and influenza; regular screening for hypertension and high blood cholesterol, and counseling for smoking cessation for those who currently smoke. The first five of these services were among the standard set of performance measures for diabetes quality care improvement and accountability in the US, established in 1998 as part of the Diabetes Quality Improvement Project (DQIP) through a partnership between the national Committee for Quality Assurance, the American Diabetes Association and the Center for Medicare and Medicaid Services.[102]

A number of studies have shown an association between low socioeconomic status and poor glycemic control, high cholesterol, neuropathy, retinopathy, nephropathy and high blood pressure. A recent French study showed poorer diabetes outcomes among people who scored lowest on a combination index of 11 measures of social and

[101] Brown, A.F., et. al. (2004). Socioeconomic position and health among people with diabetes mellitus: A conceptual framework and review of the literature. *Epidemiology Review*, 26, 63-77.
[102] McLaughlin, S. (2000). The Diabetes Quality Improvement Project. *Diabetes Spectrum*, 13(1):5-11.

economic deprivation.[103] An American study showed that among those who needed treatment for diabetes, hyperlipidemia, hypertension and coronary artery disease, there were no differences in receipt of services between racial and ethnic groups. There were variations in outcome of care measures, however. Both non-Hispanic black African American and Hispanic study participants were less likely than non-Hispanic whites to have A1c, blood pressure and LDL at acceptable levels[104].

A1c Measurement

Significantly associated with	
age	
sex	
income	✓
education	

Hemoglobin A1c reflects average blood glucose over a 2- to 3-month period. The Diabetes Control and Complications Trial demonstrated that good control of blood glucose, as reflected in A1c values consistently close to normal (6 percent), resulted in lower rates of eye, kidney and nerve complications for those with intensive management of type 1 diabetes as compared to those with standard care.[105]

In addition, a British study[106] showed that consistent control of blood glucose and blood pressure decreased the risk of blindness, kidney disease, stroke, and heart attack for people with diabetes. One of the Healthy People 2010 Objectives for the nation is to increase the proportion of people with diabetes who have two A1c measures per year to 50 percent among those with diabetes. The American Diabetes Association also recommends that the A1c test be performed twice yearly.[107]

About 76 percent of people with diabetes say they have had at least two A1c tests in the past year, on par with the national prevalence of 72 percent, above the level needed to meet the Healthy People 2010 Objectives. No significant differences were detected by age, sex, or education. However, a higher percentage of adults with diabetes who had incomes of $75,000 and over (84 percent) had a biannual A1c test, than those with incomes $25,000-$34,999 (66 percent) and $50,000-$74,999 (72 percent), (Figure 27).

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[103] Bihan, H., et al. (2005). Association among individual deprivation, glycemic control and diabetes complications: the EPICES score. *Diabetes Care*, 28(11), 2680-2686.
[104] Bonds, D.E., et. al, (2004). Ethnic and Racial Differences in Diabetes Care. *Diabetes Care*, 26:1040-1046.
[105] The Diabetes Control and Complications Trial Research Group. (1993).The Effect of Intensive Treatment of Diabetes on the Development and Progression of Long-Term Complications in Insulin-Dependent Diabetes Mellitus. *New England Journal of Medicine*, 329(14): 977-986.
[106] United Kingdom Diabetes Prospective Study Group. (1998). Intensive blood-glucose control with sulphonylureas or insulin compared with conventional treatment and risk of complications in patients with type 2 diabetes. *The Lancet*, 352(9131): 837-853
[107] American Diabetes Association 2006 Clinical Practice Recommendations, viewed 3.30.2006 from: http://care.diabetesjournals.org/content/vol29/suppl_1/.

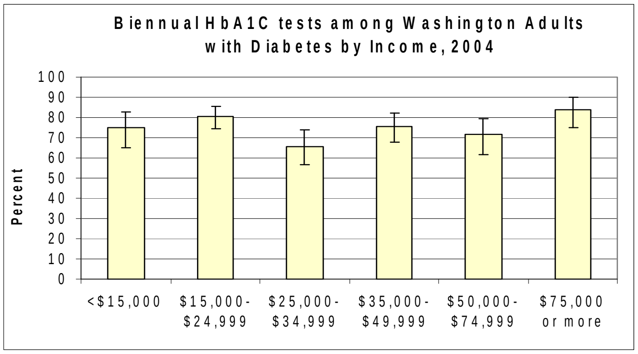

Figure 27. Source: 2004 Washington BRFSS

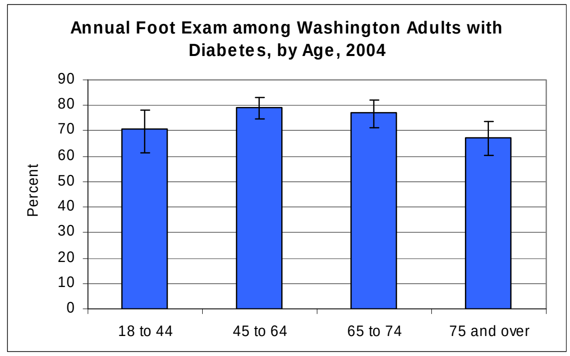

Figure 28. Source: 2004 Washington BRFSS

Annual Foot Examination by a Health Care Provider

Significantly associated with	
age	✓
sex	
income	
education	

It is recommended that people with diabetes have a complete foot exam yearly to check for poor circulation, loss of feeling, sores, or changes in foot shape. The Healthy People 2010 Objective for the nation is to increase to 74 percent the proportion of people with diabetes who have an annual foot exam. In 2004, 75 percent of people with diabetes said that in the past year, a health professional examined their feet for sores or irritations. This was higher than the national prevalence of 68 percent.

Fewer adults with diabetes aged 75 years and older (67 percent) had an annual foot exam, compared to adults 45-64 years (79 percent) and 65-74 years (77 percent) (Figure 28).

Annual Dilated Examination by a Health Care Provider

Significantly associated with	
age	✓
sex	
income	
education	✓

People with diabetes should have an annual dilated eye examination performed by a health care provider to check for onset of retinopathy. The Healthy People 2010 Objective for the nation is to increase the proportion of people with diabetes who have an annual dilated eye exam to 75 percent. In 2004, 71 percent of people with diabetes in Washington said they had a dilated eye examination in the past year. This is similar to the national prevalence of 69 percent. Fewer adults with diabetes aged 18-44 years (62 percent) had an annual eye exam compared to those 65 years and older (77 percent). A lower percentage of adults with diabetes who had less than a high school education (57 percent) or were high school graduates (63 percent) reported having an annual eye exam, compared to adults with some post high school education (76 percent) and college graduates (78 percent), (Figure 29.)

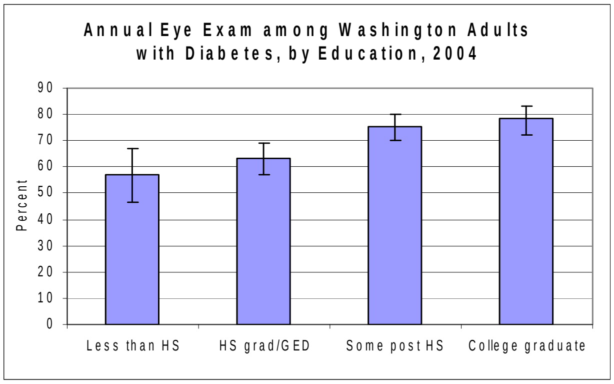

Figure 29. Source: 2004 Washington BRFSS

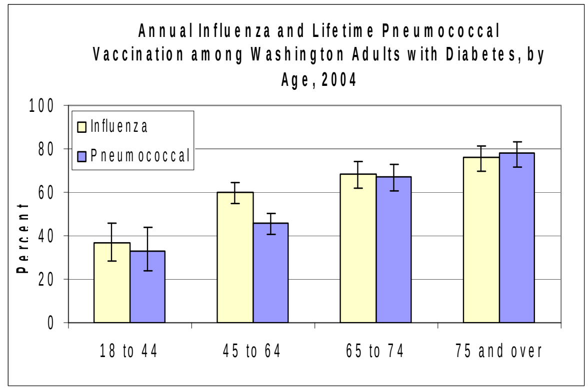

Figure 30. Source: 2004 Washington BRFSS

Influenza and Pneumococcal Vaccinations

Significantly associated with	
age	both
sex	pneumococcal only
income	
education	

Annual influenza vaccination is recommended for people with diabetes, as is one lifetime pneumococcal vaccination. In 2004, 61 percent of adults with diabetes reported a vaccination for influenza in the past year. Fewer adults with diabetes aged 18-44 (only about 2 out of 5) received a flu shot in the past year, compared to all other age groups (Figure 30).

In 2004, 55 percent of adults with diabetes reported having had a pneumococcal vaccination. Women were more likely than men to have had a lifetime vaccination (57 percent and 50 percent, respectively). Pneumococcal immunization rates increased with each incremental increase in age; only 33 percent adults aged 18-44 with diabetes had ever received a pneumococcal vaccination.

Receipt of Multiple Preventive Services

Significantly associated with	
age	✓
sex	
income	✓
education	✓

This indicator reflects the number of people with diabetes who received all five of the recommended preventive services: biannual A1c test, annual foot exam, annual eye exam, annual flu shot, and previous pneumococcal vaccination. While the percentage that receives any single recommended service is fairly high (in most cases, more than 75 percent), fewer than 25 percent of adults with diabetes received all five services. Fifty-three percent said they had received three or four services, and 25 percent received less than three.

The receipt of all five recommended diabetes-related preventive care services varied significantly by age, income, and education. Fewer adults with diabetes aged 18-44 (10 percent) received all 5 services compared to all other age groups (21 percent aged 45-64 years, 35 percent aged 65-74, and 26 percent aged 75 and older). A lower percentage of adults with diabetes who had a high school education or less also reported receiving all 5 services compared to those with more than a high school education (Figure 32).

The receipt of services varied by income in an inverted U- shaped curve, with lower prevalence of receipt of all five services reported among adults in income groups less than $25,000 and $50,000-$74,999, compared to adults in the $35,000-$49,999 income group (Figure 31).The lower percentages observed in the higher income groups may be influenced by the complex interactions between age, income, and receipt of influenza and pneumococcal vaccinations. Younger adults, who are more likely to have higher incomes than older adults, are also significantly less likely to receive influenza and pneumococcal vaccinations than older adults.

These results were similar to a recent analysis of national BRFSS data. This study examined receipt of three recommended services (annual foot exam, annual dilated eye exam and two A1c tests per year), and showed that between 2002-2004, only 25 percent of adults with diabetes received all three.[108] Further, receipt of all three services was lower among those aged 18-44, among current smokers and among Hispanics; and higher among those with higher education and income, those with health insurance coverage, and those who had received diabetes-management education.

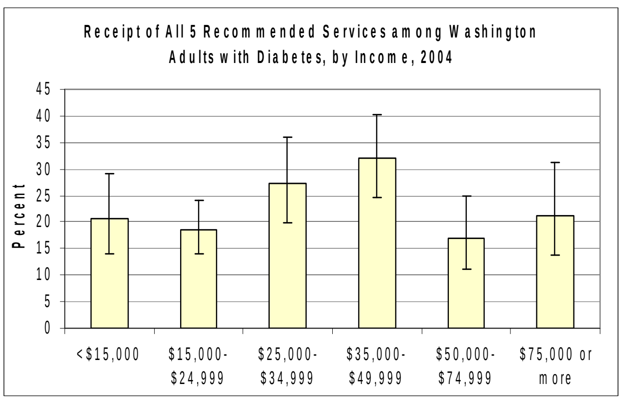

Figure 31. Source: 2004 Washington BRFSS

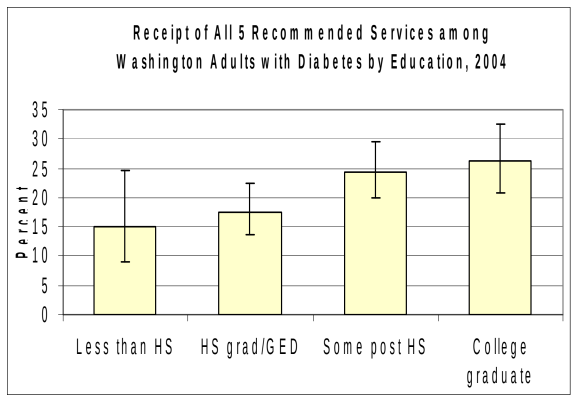

Figure 32. Source: 2004 Washington BRFSS

Hypertension and High Blood Cholesterol

Hypertension significantly associated with	
age	✓
sex	
income	✓
education	

Because people with diabetes are at increased risk for heart disease and stroke, it is important that people with diabetes are monitored routinely for cardiovascular risk factors, hypertension and high blood cholesterol. In Washington, 88 percent of people with diabetes had their blood cholesterol tested in the past year. Fewer adults with diabetes aged 18-44 (73 percent) had their cholesterol checked in the past year, compared to older adults with diabetes (90 percent aged 45-64 years, 94 percent aged 65-74, and 87 percent aged 75 and older). Men were more likely than women to have had annual cholesterol tests for (91 percent and 84 percent, respectively, 2003 BRFSS

[108] Mukhhtar, Q., Pan, L., Jack, L., and Murphy, D.L. (2005). Prevalence of receiving multiple preventive-care services among adults with diabetes: United States 2002-2004. Morbidity and Mortality Weekly Report, 54(44); 1130-1133.

data). The BRFSS survey does not contain a similar question about hypertension screening.

Hypertension was more prevalent among people with diabetes compared to those without the disease (66 percent compared to 21 percent, 2003 BRFSS data). High cholesterol was also more common among people with diabetes than those without the disease (58 percent compared to 32 percent, 2003 BRFSS data). Prevalence of hypertension and high blood cholesterol among people with diabetes in Washington is on par with national levels. Fewer adults with diabetes aged 18-44 (46 percent) had hypertension, compared to older adults with diabetes (67 percent aged 45-64 years, 75 percent aged 65-74, and 74 percent aged 75 and older), (Figure 33). Those with incomes between $15,000 and $24,000 were more likely to have hypertension than those with incomes over $75,000 (Figure 34).

To decrease risk of cardiovascular disease, people with diabetes must control their hypertension and hyperlipidemia. The majority of hypertensive adults with diabetes were taking medication to control their blood pressure (82 percent). Fewer hypertensive adults with diabetes aged 18-44 years (72 percent) took prescribed medication for high blood pressure, compared to older adults with diabetes (87 percent aged 45-64 years, 95 percent aged 65-74, and 94 percent aged 75 and older). Data on the control of high cholesterol was not available from the BRFSS.

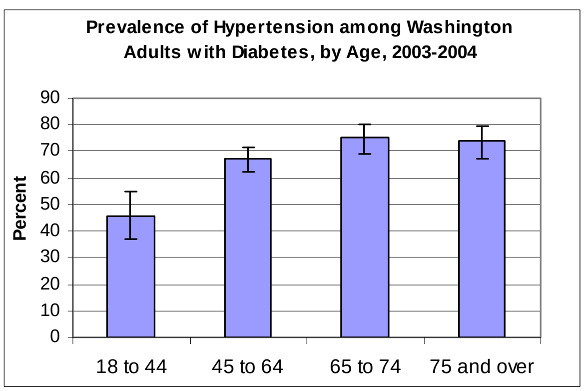

Figure 33. Source: 2003-2004 Washington BRFSS

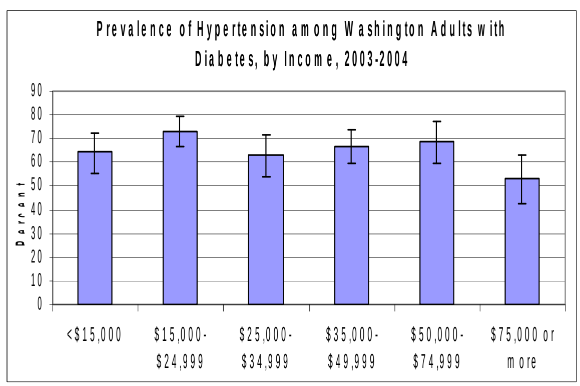

Figure 34. Source: 2003-2004 Washington BRFSS

Aspirin Use

Significantly associated with	
age	✓
sex	✓
income	
education	

Aspirin therapy is recommended for people with diabetes to help lower their risk of heart disease. About 62 percent of Washington adults with diabetes age 35 and over said they take aspirin regularly to prevent heart disease. Men were more likely than women to adhere to a regimen of daily aspirin use (70 percent and 53 percent, respectively). Lower rates of adherence were seen among people aged 35-44 years compared to older age groups. However, while we know how many people use aspirin on a daily basis, we do not know how many were advised by a health care provider to do so.

Smoking Cessation

Significantly associated with	
age	✓
sex	
income	?
education	?

As mentioned above, adults with diabetes are at risk for earlier onset of severe diabetes-related complications if they smoke. Therefore, it is especially important that smokers receive advice and help to stop smoking. In 2003-2004 combined, 53 percent of adult smokers with diabetes were advised by a doctor or other health professional to quit smoking. Among those given advice to quit, only 52 percent were offered help or referred to a source of help to quit. Adult smokers with diabetes were no more likely to get advice to quit or offered help compared to smokers without diabetes. Only 28 percent of older adult smokers with diabetes (aged 65 years and older) were advised to quit smoking by a health care provider; significantly lower than adults aged 45-64 years (62 percent). Sample sizes were too small to assess differences in receipt of advice to quit smoking by income, education, and race/ethnicity, despite combining two years of data.

Diabetes Education

Significantly associated with	
age	
sex	
income	✓
education	✓

About 67 percent of people with diabetes had ever received diabetes self-management education. No differences were detected by age or sex. However, a significant gradient effect between diabetes education and income was observed; where receipt of diabetes self-management education decreased with each incremental decrease in income (Figure 35). Self-management education was also more likely among adults with more than a high school education compared to those with a high school education or less (Figure 36).

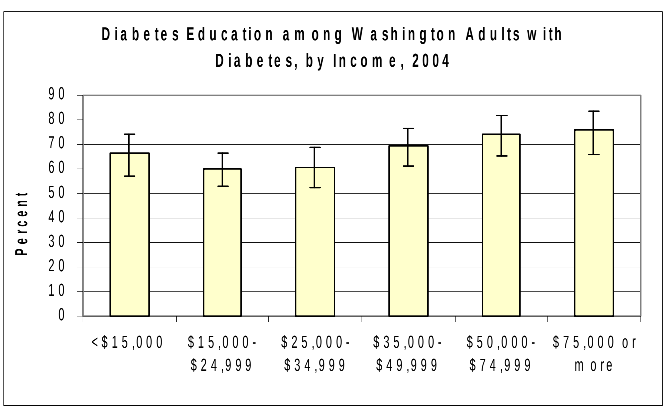

Figure 35. Source: 2004 Washington BRFSS

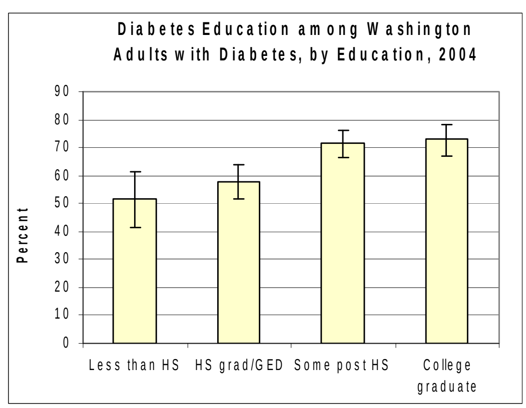

Figure 36. Source: 2004 Washington BRFSS

Overall Self-Reported Health Status

Poor Physical and Mental Health in Past Month

Significantly associated with	
age	✓
sex	✓
income	✓
education	✓

Adults with diabetes were significantly more likely than those without diabetes to report poor physical health. They were also more likely than adults without diabetes to report having poor mental health for 14 days or more in the past month (Figure 37). More than half of those with diabetes said they had one or more days of poor physical health in the past month, and nearly 30 percent reported two or more weeks of poor physical health. The prevalence of reporting one or more days of poor physical health in the past month was higher than the prevalence of having one or more days of poor mental health among adults with diabetes (53 percent and 38 percent respectively).

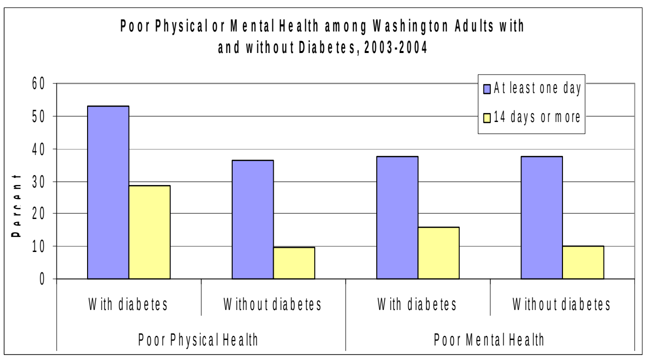

Figure 37. Source: 2003-2004 Washington BRFSS

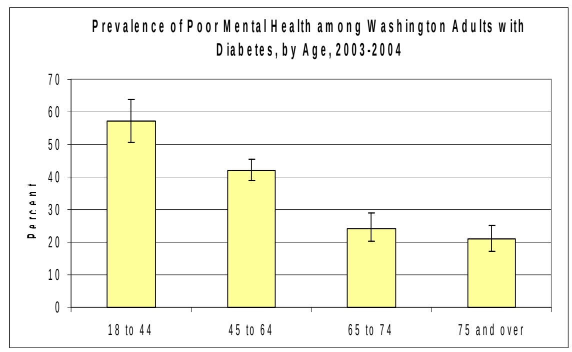

Figure 38. Source: 2003-2004 Washington BRFSS

Women were more likely than men to report one or more days of poor physical health in the past month (60 percent and 47 percent, respectively) and one or more days of poor mental health in the past month (42 percent and 34 percent, respectively). People in successively younger age groups were increasingly likely to report at least one day of poor mental health in the past 30 days (Figure 38). More than half of adults with diabetes under age 45 reported poor mental health in the past month.

A gradient effect was observed in the relationship between poor health and income among adults with diabetes. For example, those with incomes less than $15,000 were twice as likely to have one or more poor physical or mental health days in the past month compared to those with incomes over $75,000 (Figure 39). Compared to college graduates with diabetes, those with less than a high school education and those with some post high school education were around 1.5 times more likely to report having one or more days in past month of poor physical or mental health (Figure 40).[109]

[109] Brown, D.W., Balluzm, L.S., Giles, W.H., Beckles, G.L., Moriarty, D.G., Ford, E.S., Mokdad, A.H. (2004). Diabetes mellitus and health-related quality of life among older adults. Findings from the

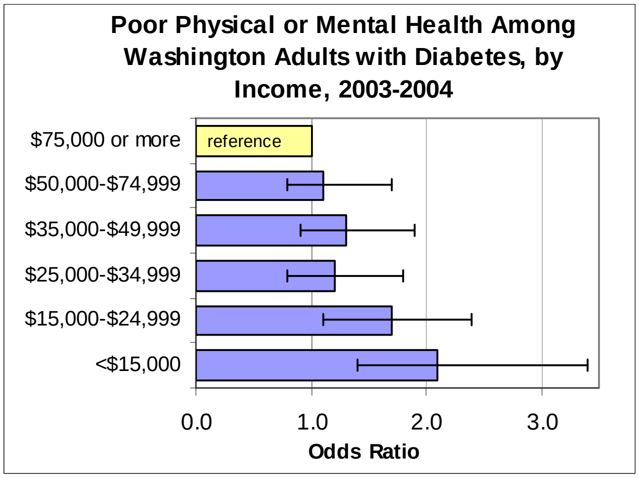

Figure 39. Source: 2003-2004 Washington BRFSS

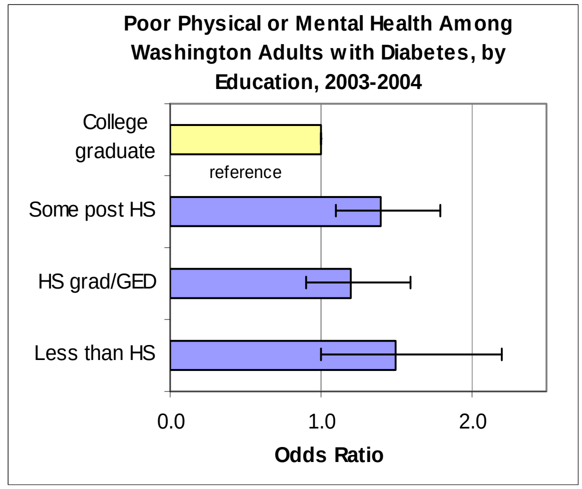

Figure 40. Source: 2003-2004 Washington BRFSS

Inability to Perform Usual Activities Due to Poor Health

Significantly associated with	
age	✓
sex	✓
income	✓
education	✓

In 2003-2004 combined, a higher percentage of adults with diabetes, compared to adults without diabetes, reported having at least one day in the past month in which they were unable to perform their usual activities due to poor physical or mental health (34 percent and 22 percent, respectively). This difference was even more pronounced when considering those who reported 14 or more days of impaired function: adults with diabetes were 3 times more likely to report impaired function than adults without diabetes (18 percent and 6 percent, respectively).

Among people with diabetes, more adults aged 18-44 (37 percent) and 45-64 years (39 percent) reported an inability to perform usual activities due to poor health for at least one day in the past month, compared to older adults aged 65-74 (29 percent) and 75 years and older (27 percent). Women were more likely than men to report impaired abilities. A gradient effect was observed by income and education, with increasing reports of 14 or more impaired days as both income levels and educational attainment decreased (Figures 41 and 42).

Behavioral Risk Factor Surveillance System (BRFSS). *Diabetes Research and Clinical Practice*, 65(2):105–115.

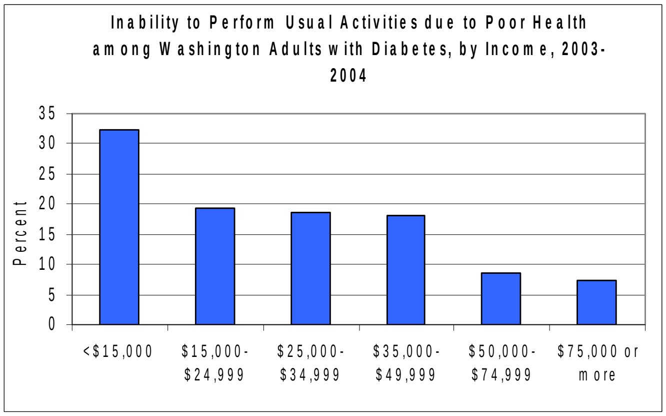

Figure 41. Source: 2003-2004 Washington BRFSS

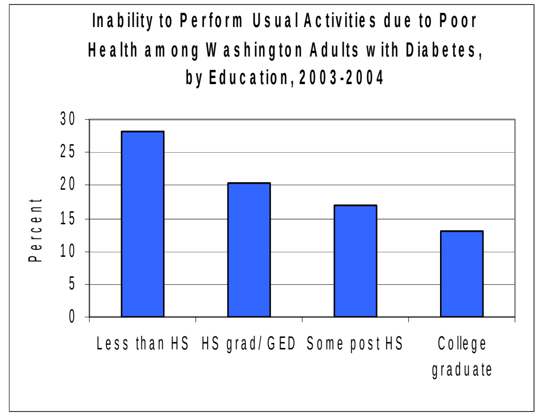

Figure 42. Source: 2003-2004 Washington BRFSS

Diabetes-Related Retinopathy

Significantly associated with	
age	
sex	
income	✓
education	
race/ ethnicity	

Diabetic retinopathy is a serious complication of diabetes that can eventually lead to blindness. Retinopathy refers to the damage to tiny blood vessels inside the retina, and is caused by poor diabetes management. In 2004, 22 percent of adults with diabetes said they had retinopathy. Prevalence of retinopathy increased with each incremental decrease in income. Adults with incomes less than $15,000 had twice the prevalence of diabetes-related retinopathy than those with an annual income of $75,000 and above (34 percent and 17 percent, respectively, Figure 43).

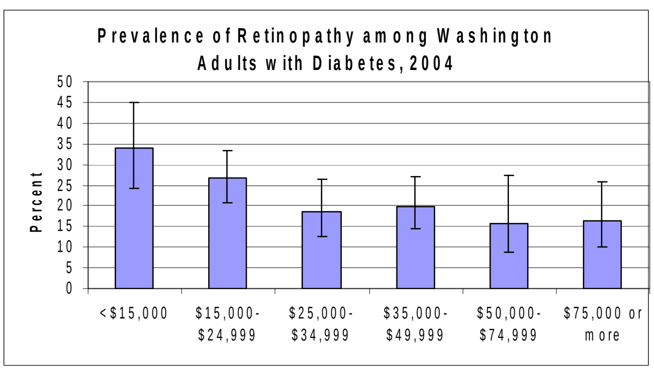

Figure 43. Source: 2004 Washington BRFSS

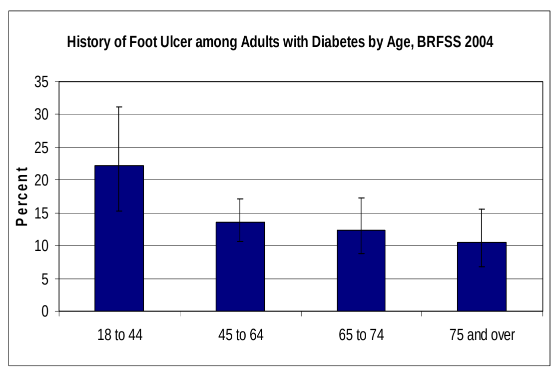

Figure 44. Source: 2004 Washington BRFSS

Foot Ulcers

Significantly associated with	
age	✓
sex	
income	
education	
race/ ethnicity	

Foot ulcers are another serious complication of diabetes that can increase a person's risk for more adverse outcomes such as lower extremity disease and amputation. In 2004, 14 percent of adults with diabetes had a history of foot ulcer. As shown in Figure 44, the percentage was significantly higher among younger adults less than 45 years (22 percent) compared to older adults aged 45 years or older. The percentage did not differ significantly by sex or education level. These observed differences were similar to national BRFSS findings for 2000-2002.[110] While national data also indicate that the percentage is lower among non-Hispanic blacks, than among non-Hispanic whites or Hispanics, the number of respondents from Washington's BRFSS was not sufficient to assess statewide differences by race/ethnicity. The sample size was too small to adequately assess differences by income, as well.

[110] Aguiar, M.E., Burrows, N.R., Wang, J., Boyle, J.P., Geiss, L.S., Engelgau, M.M. (2003). History of foot ulcer among persons with diabetes: United States, 2000-2002. *MMWR*, 52(45):1098-1102.

Chapter 4: Diabetes-Related Hospitalizations, Complications, Procedures and Costs

> *Begin on the sixth floor, third room from the end, swathed in fluorescence: a 60-year old woman was having two toes sawed off. One floor up, corner room: a middle-aged man sprawled, recuperating from a kidney transplant. Next door: nerve damage. Eighth floor, first room to the left: Stroke. Two doors down: more toes being removed. Next room: a flawed heart. As always the beds at the Montefiore Medical Center in the Bronx were filled with a universe of afflictions. In truth these assorted burdens were all the work of a single illness: diabetes. Room after room, floor after floor, diabetes. On any given day, hospital officials say, nearly half the patients are there for some trouble precipitated by the disease.*
>
> *Kleinfield, N.R. (2006). Diabetes and its awful toll quietly emerge as a crisis. New York Times January 9, 2006.*

In the previous chapter we examined the effect of SEP on access to health care, using an overlay of diabetes prevalence by county onto a map of provider shortage areas/medically underserved areas. However, diabetes hospitalizations for certain conditions are in themselves an indicator of lack of access to ambulatory care, because these conditions are preventable when appropriate primary care is received in a routine and timely manner.[111] In this chapter, we examine hospitalization data keeping in mind that the data reflect not only the magnitude of diabetes burden, but also the consequence of disparities in access to primary care.

The statewide data source for this chapter, *Comprehensive Hospital Abstract Reporting Systems* (CHARS), has several limitations. Because we are using a de-identified dataset, the unit of analysis is *hospitalizations*, not patients.[112] Thus, if a person was hospitalized twice in a year, that person would count as two hospitalizations. Further, the data do not contain information on individual-level SEP factors such as income, employment, education or race/ethnicity. Thus, to examine patterns of inequality we focus our analysis on geographic patterns in diabetes hospitalizations by county and by community type, and use payer source as a proxy measure for SEP.

In the CHARS data, up to 9 diagnoses can be listed for a single hospitalization. The first-listed diagnosis is considered the principle reason the patient was admitted to the

---

[111] Other conditions for which hospitalizations are preventable include: immunization preventable conditions, convulsions, severe ENT infections (suppurative and unspecified otitis media, pharyngitis, tonsilitis, URI), tuberculosis, COPD, bacterial pneumonia, asthma, diabetes, hypoglycemia, gastroenteritis, kidney/urinary infection, dehydration, iron deficiency anemia, nutritional deficiencies, pelvic inflammatory disease, and dental conditions. These conditions are also known as ambulatory care sensitive conditions.

[112] Please see “At a Glance—Data Sources, Methods and Technical Terms” on page 14 for a brief explanation of the data and methods used for analysis in this chapter. For further information on data quality and limitations, refer to Appendix A.

hospital. In our analysis of *diabetes-related complications* we presented information on hospitalizations that had any listed diagnosis of diabetes, except where indicated (i.e., Figure 45).

In 2003, 70,009 Washington hospitalizations included a diagnosis of diabetes at discharge, constituting 12 percent of all hospitalizations and with charges amounting to more than $1.27 billion dollars. For 5,838 of these hospitalizations, diabetes was the first listed diagnosis, amounting to $84 million in hospitalization costs.

Among diabetes-related hospitalizations, cardiovascular diseases were the most frequent first-listed diagnosis, comprising 14 percent of diabetes-related hospitalizations (10 percent due to coronary heart disease and 4 percent due to stroke, Figure 45). Among diabetes- related hospitalizations, 8 percent named diabetes as the first-listed reason for the visit and 5 percent cited pneumonia or influenza. Lower extremity conditions, which include peripheral arterial disease; ulcer, inflammation or infection; and neuropathy, comprised 5 percent of diabetes-related hospitalizations. Severe and potentially life-threatening complications, such as diabetic ketoacidosis and lower extremity amputations, comprised 4 percent of all diabetes-related hospitalizations (3 percent and 1 percent, respectively). A large portion (64 percent) of diabetes related hospitalizations had a first-listed diagnosis of other conditions, such as certain infectious or parasitic diseases; cancers; unintentional injuries; and diseases involving other organ systems. Note that this category could include complications of diabetes, such as retinopathy and end-stage renal disease.

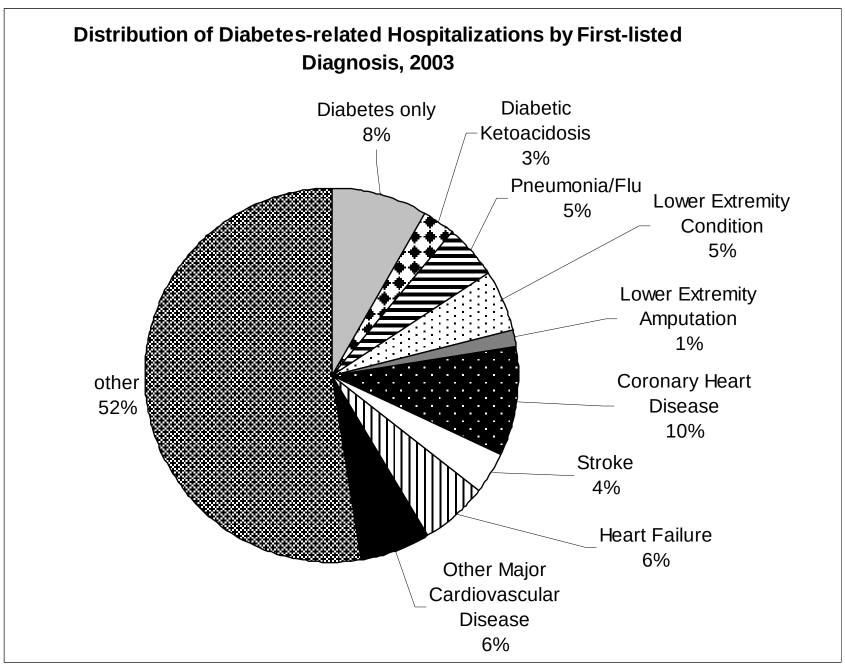

Figure 45. Source: Washington State Comprehensive Hospital Abstract Reporting System (CHARS), 2003

Hospitalizations by County

For 2001-2003 combined, the rate of age-adjusted hospitalizations with diabetes as the first-listed diagnosis ranged from 5.3 per 10,000 in San Juan County to 20.5 per 10,000 in Stevens County. Eleven counties had diabetes hospitalization rates that were significantly higher than the state rate of 9.6 per 10,000. Ranked from highest to lowest, there were: Stevens, Grays Harbor, Adams, Yakima, Lewis, Clallam, Franklin, Skagit, Whatcom, Pierce and Spokane counties. Twelve counties had hospitalization rates significantly below the state rate. Ranked from lowest to highest, these included: San Juan, Skamania, Kittitas, Clark, Island, Asotin, Douglas, Walla Walla, Cowlitz, Thurston, Kitsap, and King counties.

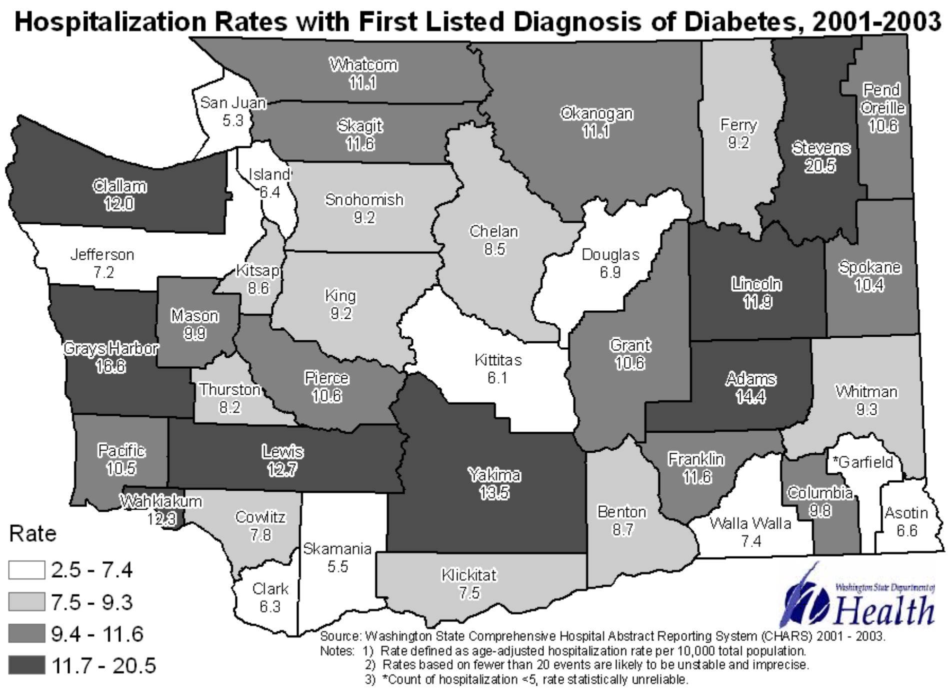

Figure 46. Source: Washington CHARS

Hospitalizations by Age and Sex

Young adults under age 45 years were responsible for the greatest number of hospitalizations with diabetes as the first-listed diagnosis (2,413 hospitalizations in 2003), followed by adults aged 45-64 years (1,926), adults aged 65-74 (709) and adults age 75 and over (791). The rate of hospital discharges with diabetes as the first-listed diagnosis increased with age, from 6.2 percent among those under 45 years, to 23 percent among those over age 75. Males had a higher age-adjusted rate of diabetes hospitalizations than females (10.5 and 8.9 hospitalizations per 10,000, respectively). However, some variation was observed by age group: in each successive age group over 45 years of age, men were progressively more likely than women to have a diabetes-related hospitalization (Figure 47).

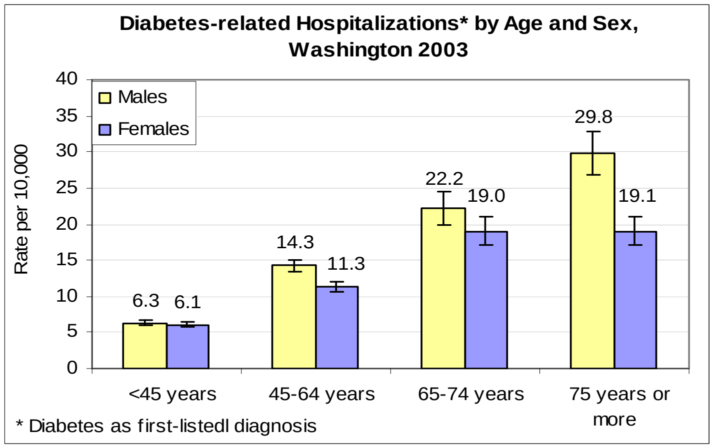

Figure 47. Source: Washington State CHARS, 2003

The rate of diabetes-related hospitalizations for coronary heart disease, stroke, pneumonia and influenza, lower extremity conditions and lower extremity amputations increased with increasing age (Table 3). The hospitalization rate for diabetic ketoacidosis was highest in young adults under age 45.

Table 3. Age-Specific Diabetes-Related Hospitalization Rates for Select Conditions as Any Listed Diagnosis by Age, Washington, 2003

Age in years	Diabetic Ketoacidosis	Coronary Heart Disease	Stroke	Pneumonia or Influenza	Lower Extremity Conditions	Lower Extremity Amputations
Less than 45	4.2 *(4.0, 4.4)*	1.3 *(1.2, 1.5)*	0.3 *(0.3, 0.4)*	1.0 *(0.9, 1.1)*	4.6 *(4.4, 4.8)*	1.1* *(1.0, 1.2)*
45 to 64	3.6 *(3.3, 3.9)*	45.2 *(44.1, 46.2)*	9.6 *(9.1, 10.1)*	9.9 *(9.4, 10.4)*	38.0 *(37.0, 38.9)*	
65 to 74	3.7 *(3.1, 4.3)*	169.4 *(165.1, 173.7)*	47.3 *(45.0, 49.6)*	40.4 *(38.3, 42.6)*	101.7 *(98.3,105.0)*	7.3 *(6.4, 8.2)*
75 and over	2.9 *(2.3, 3.5)*	234.1 *(228.9, 239.2)*	77.1 *(74.1, 80.0)*	73.6 *(70.8, 76.5)*	116.8 *(113.2, 120.4)*	8.2 *(7.2, 9.1)*

Source: 2003 Washington State Comprehensive Hospital Abstract Reporting System (CHARS). Data are presented as rates per 10,000 total population. Lower CI and Upper CI are in parenthesis and show the 95% confidence interval around the rate. Age groups are based on categorization used by Centers for Disease Control and Prevention. National Diabetes Surveillance System. Atlanta, GA, last review 2006 Mar. [cited 2004 April 21]. Available from http://www.cdc.gov/diabetes/statistics/index.htm. Lower extremity conditions include peripheral arterial disease, ulcer, inflammation, infection, and neuropathy.

Hospitalizations by Community Type[113]

Seventy five percent of all hospitalizations with diabetes as the first-listed diagnosis occurred in highly populated urban areas (Table 4). The average length of stay for all community types was 3 days. Hospital charges, which amounted to $84 million dollars statewide, followed the distribution of hospitalizations (i.e., 77 percent were in the urban core). The median charge per discharge was slightly higher in the urban core and suburban areas; the lowest median charge was in rural areas.

Table 4. Hospitalizations with Diabetes as First-Listed Diagnosis by Community Type, Washington, 2003

Community Type	Number of hospital discharges	Total days of hospitalization	Median length of stay in days	Total hospital charges	Median charge per discharge
Urban Core	4,387	18,770	3	$64,720,419	$8,542
Suburban	500	2,030	3	$6,640,658	$8,743
Large town	489	2,124	3	$6,360,437	$7,606
Rural	462	2,103	3	$5,929,014	$6,949

Source: 2003 Washington State Comprehensive Hospital Abstract Reporting System (CHARS).

When the rates of diabetes hospitalizations were examined, the less densely populated rural communities and large towns had significantly higher rates than urban or suburban communities (Figure 48). This was true whether diabetes as the first-listed diagnosis was considered, or whether all hospital discharges related to diabetes were considered.

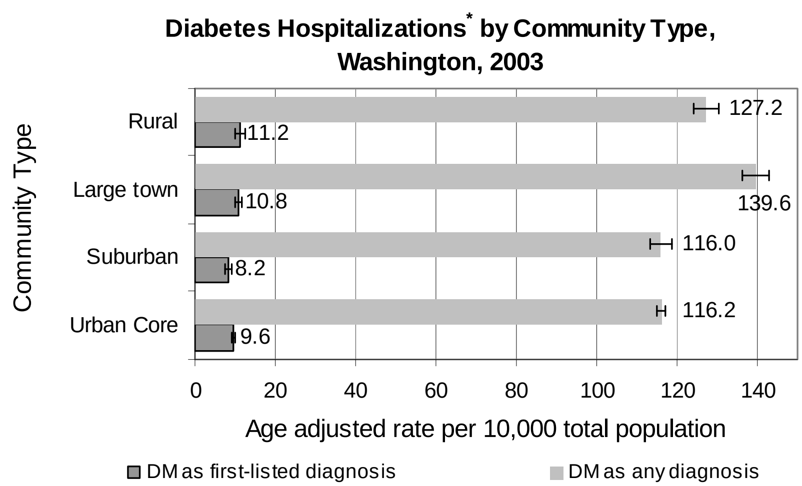

Figure 48. Source: Washington State CHARS, 2003

Compared to urban, suburban and rural areas, large towns had higher hospitalization rates for diabetes-related hospitalizations with first-listed diagnosis of coronary heart

[113] For definition of community type, please see "At A Glance: Data Sources, Methods and Technical Terms on page 16, or refer to Appendix C p.59.

disease, lower extremity conditions, and stroke (Table 5).[114] Rates of diabetes-related hospitalizations for pneumonia and influenza were greater in rural areas and large towns compared to urban and suburban areas (Table 5). In contrast, the hospitalization rate for diabetic ketoacidosis was significantly higher in urban communities, significantly above hospitalization rate for suburban communities. Ketoacidosis is an acute marker of poorly controlled diabetes, and is more prevalent among the young and the poor.[115] Thus, it is not surprising to see this in urban areas. There were no differences in the hospitalization rates for lower extremity amputations by community type.

Table 5. Age-Adjusted Diabetes-Related Hospitalization Rates for Select Conditions as Any Listed Diagnosis by Community Type, Washington, 2003

Community Type	Diabetic Ketoacidosis	Coronary Heart Disease	Stroke	Pneumonia or Influenza	Lower Extremity Conditions	Lower Extremity Amputations
Urban Core	4.1 (3.9, 4.3)	35.5 (34.9, 36.1)	10.0 (9.7, 10.3)	9.4 (9.1, 9.7)	25.2 (24.8, 25.7)	1.9 (1.7, 2.0)
Suburban	3.4 (3.0, 3.9)	37.0 (35.4, 38.7)	10.3 (9.4, 11.2)	10.0 (9.2, 10.9)	22.2 (21.0, 23.5)	1.9 (1.6, 2.3)
Large town	3.7 (3.2, 4.3)	43.7 (41.9, 45.6)	11.6 (10.6, 12.6)	12.6 (11.6, 13.7)	29.4 (27.8, 31.0)	1.9 (1.5, 2.3)
Rural	3.7 (3.1, 4.4)	37.1 (35.4, 38.9)	9.6 (8.8, 10.6)	12.9 (11.9, 14.0)	26.8 (25.4, 28.4)	2.2 (1.7, 2.6)

Source: 2003 Washington State Comprehensive Hospital Abstract Reporting System (CHARS). Data are presented as rates per 10,000 total population, age-adjusted to 2000 US population. Lower CI and Upper CI are in parenthesis and show the 95% confidence interval around the rate. Lower extremity conditions include peripheral arterial disease, ulcer, inflammation, infection, and neuropathy.

Hospitalizations by Payer Source[116]

In 2003, over half (56 percent) of all diabetes-related hospitalization claims were paid by Medicare, most likely because most diabetes related hospitalizations occur among older people with diabetes. About 28 percent of claims were reimbursed by employer- based insurance (including commercial insurance, health services contractors, and HMO's) and 12 percent were paid by Medicaid. Medicare was the predominant payer source for

[114] When assessing differences between groups for hospitalization rates, as in this instance, we only visually compared confidence intervals to identify differences and did not perform formal statistical testing. Refer to *Statistically Significant Differences* section in Appendix C: Technical Notes (pp. 57-58) for further details.

[115] Maniatis, A.K., Goehrig, S.H., Gao, D., Rewers, A., Walravens, P., Klingensmith, G.J. (2005.) Increased incidence and severity of diabetic ketoacidosis among uninsured children with newly diagnosed type 1 diabetes mellitus. Pediatric Diabetes, 6(2): 79-83.

[116] Payer sources include Medicare, Medicaid (Washington State Department of Social and Health Services- DSHS, Healthy Options), HMO (Health Maintenance Organization, e.g. Kaiser, Group Health, Molina, Basic Health Plan), Commercial Insurance (e.g. Mutual of Omaha, Safeco), Health Care Service Contractors (private companies hired by private industry or governments, like a county, to deliver and run health care such as Premera Blue Cross, KPS), Worker's Compensation (includes state fund, self-insured employers, and Labor & Industries crime victim's claims), Self Pay, Other government sponsored patients (e.g. TRICARE, Indian Health), Charity Care (as defined in WAC 246-453-010; includes those which cannot pay and whose bills are excused; to fall into this category the patient has to have no resources and not qualify for Medicaid)

most hospitalization subcategories related to diabetes. For example, of all coronary heart disease hospitalizations related to diabetes, Medicare reimbursed 64 percent, other employer-sponsored insurance provided 26 percent, and Medicaid covered only 8 percent (Figure 49).

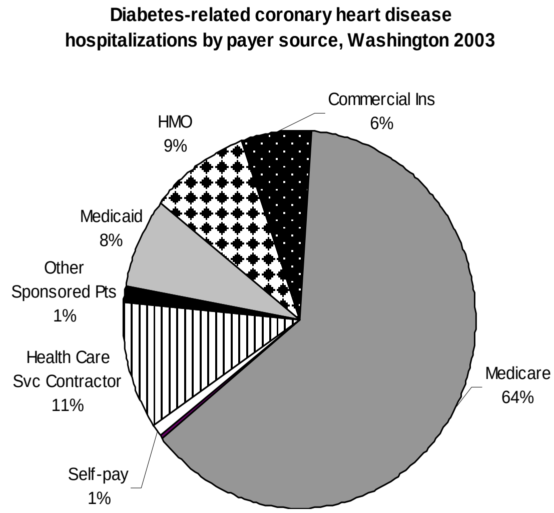

Figure 49. Source: National Hospital Discharge Survey, Washington State CHARS, 2003
Hospitalizations with diabetes as any-listed diagnosis and coronary heart disease as any-listed diagnosis.

A similar pattern was observed for diabetes-related hospitalizations for stroke, pneumonia/influenza, lower extremity amputations and lower extremity conditions (Table 6), with Medicare comprising 59-69 percent of all reimbursed charges.

Table 6. Distribution of Diabetes-Related Hospitalizations for Select Conditions as Any Listed Diagnosis by Payer Source, Washington, 2003

Primary Payer Source	Diabetic Ketoacidosis	Coronary Heart Disease	Stroke	Influenza or Pneumonia	Lower extremity amputations	Lower extremity conditions
Medicare	18.3% (440)	63.1% (13,351)	68.5% (3,994)	68.5% (3,963)	59.6% (671)	58.9% (8,836)
Medicaid	34.0% (819)	7.8% (1,654)	8.0% (465)	10.0% (579)	12.5% (141)	13.1% (1,971)
Health Maintenance Organization (HMO)	7.2% (173)	9.2% (1,939)	8.1% (474)	6.9% (399)	7.2% (81)	8.0% (1,197)
Commercial Insurance/Health Care Service Contractor	28.1% (676)	17.2% (3,640)	12.8% (748)	11.9% (687)	17.7% (199)	16.8% (2,527)
Worker's Compensation	*	0.2% (45)	0.1% (8)	0.1% (5)	0.5% (6)	0.3% (47)
Self-pay	10.4% (250)	1.1% (228)	1.2% (71)	1.5% (88)	1.4% (16)	1.6% (244)
Other Government Sponsored Patients	0.9% (21)	1.3% (283)	1.1% (62)	1.0% (60)	0.8% (9)	1.1% (158)
Charity Care	1.0% (25)	0.1% (15)	0.1% (6)	0.1% (7)	*	0.2% (23)

*Percentages based on fewer than 5 hospitalizations are suppressed. Percentages based on less than 20 hospitalizations are likely to be unstable and imprecise.
Source: 2003 Washington State Comprehensive Hospital Abstract Reporting System (CHARS). Data are presented as percent and number of hospitalizations in parenthesis. Source of payment is collected in CHARS to identify each payer group from which the hospital may expect some payment for the bill. Priority of payer is indicated in CHARS as primary or secondary payer. Lower extremity conditions include peripheral arterial disease, ulcer, inflammation, infection, and neuropathy.

An exception to this pattern was seen for hospitalizations for diabetic ketoacidosis (Figure 50). About 45 percent of reimbursements for hospital charges were Medicaid, self-pay or charity care. An additional 35 percent were reimbursed by a health care services contractor, commercial insurance, or HMO. Only 18 percent of charges were reimbursed by Medicare, most likely because the majority of diabetic ketoacidosis hospitalizations occur among people who are under 45 years of age.

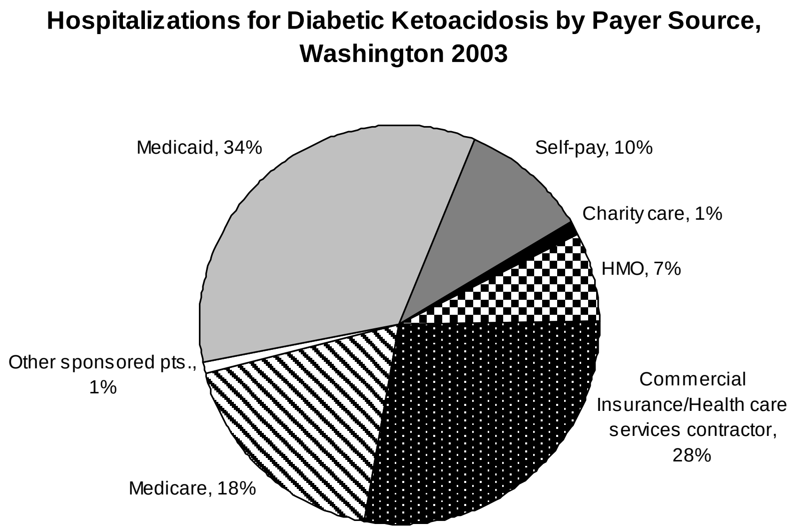

Figure 50. Source: Washington State CHARS, 2003
Hospitalizations with diabetes as any-listed diagnosis and diabetic ketoacidosis as any-listed diagnosis.

By Payer Source and Age

Among those age 65 years and older, Medicare was the primary payer on the majority of diabetes-related hospitalizations (Figure 51). HMO's and commercial insurance paid for nearly half of these hospitalizations among adults aged 45-64 years, followed by Medicare and Medicaid. For adults under age 45, most diabetes-related hospitalization charges were covered by HMO's and commercial insurance (38 percent) or Medicaid (36 percent). However, compared to other age groups, a high proportion of these hospitalizations were listed as self-pay (7 percent).

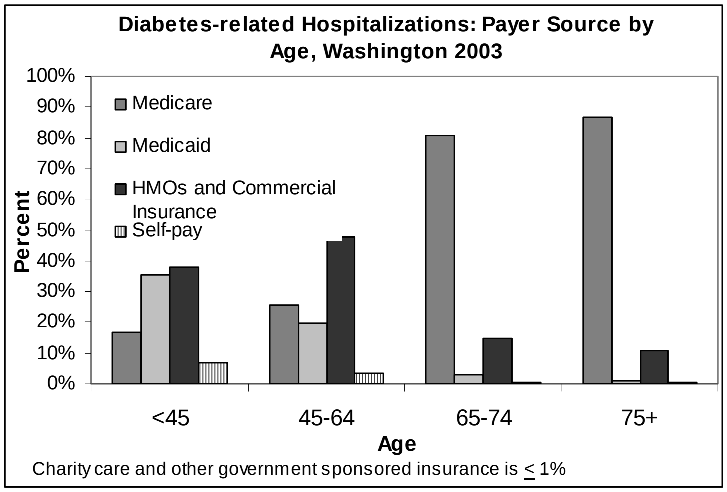

Figure 51. Source: Washington State CHARS, 2003
Hospitalizations with diabetes as first-listed diagnosis.

Medicare paid for the majority of hospitalizations for various complications of diabetes (diabetes ketoacidosis, cardiovascular disease, pneumonia and influenza, lower extremity amputations or lower extremity conditions) that occurred among adults aged 65 years or older. HMO's and commercial insurance and Medicaid were more likely to be the primary payer for hospitalizations in the younger age groups.

By Payer Source and Community Type

Medicare paid for the largest portion of diabetes-related hospitalizations in all areas, particularly large towns and small town/isolated rural areas, most likely because people with diabetes living in those areas tend to be older (Figure 52). HMO's and commercial insurance covered a higher proportion of diabetes-related hospitalizations in urban core (29 percent) and suburbs (35 percent) compared to more rural areas (16-22 percent). The proportion of diabetes-related hospitalizations paid by Medicaid did not vary by community type.

Medicare paid for the majority of diabetes-related discharges with cardiovascular disease, pneumonia or influenza, and lower extremity conditions in small town/isolated rural areas, while HMO's and commercial insurance covered more of these hospitalizations in the urban core and suburbs. Medicaid paid for a larger proportion of hospitalizations for diabetic ketoacidosis in small town/isolated rural areas (47 percent), compared to urban core (33 percent). In addition, 15 percent of these hospitalizations were self-pay.

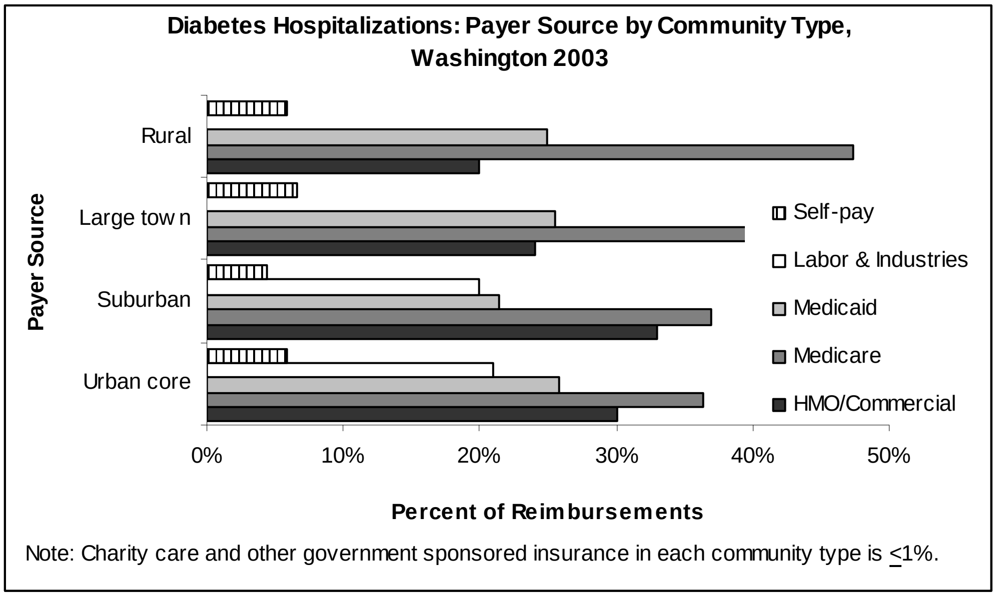

Figure 52. Source: Washington State CHARS, 2003
Hospitalizations with diabetes as first-listed diagnosis.

Chapter 5: Socioeconomic Position and Diabetes Deaths

In 2003, diabetes was the 7th leading cause of death in Washington. There were 4,459 diabetes-related deaths; 1,509 of these listed diabetes as the first-listed cause of death. Diabetes death rates appear to have increased slowly over the past 13 years, from 18.1 deaths per 100,000 in 1990 to 26 deaths per 100,000 in 2003, though we did not test this trend for significance since diabetes death rates trend is beyond the scope of this report (Figure 53).

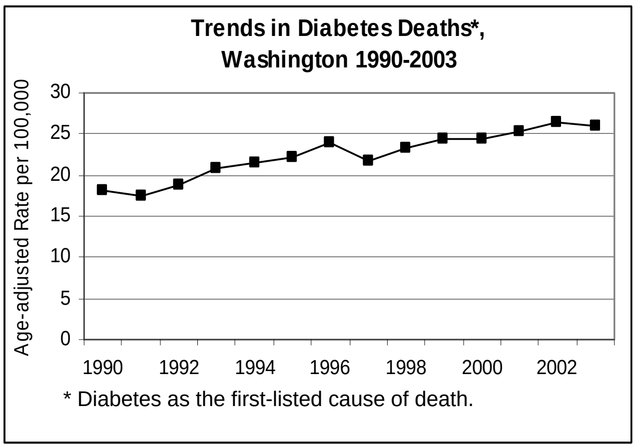

Figure 53. Source: 1990-2003 WA Vital Statistics

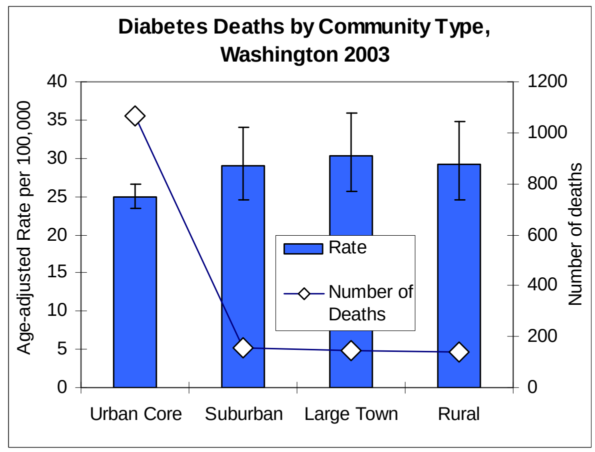

Figure 54. Source: 2003 WA Vital Statistics

Diabetes Deaths by Community Type[117]

As shown in Figure 54, urban areas had a lower rate of diabetes deaths than other community types, when diabetes as the first-listed cause of death was considered. No other statistically significant differences were observed in the rate of diabetes deaths by location.

Figure 54 also shows that the largest *number* of diabetes deaths occurred in the urban core. The geographic distribution of deaths matches the geographic distribution of the population: about 70 percent of diabetes deaths occur in the urban core, which is where 76 percent of Washington's population resides.

Diabetes Deaths by County

For 2001-2003 combined, the rate of age-adjusted deaths with diabetes as the first-listed cause ranged from 11 per 100,000 in Kittitas County to 58 per 100,000 in Klickitat

[117] For definition of community type, please see "At A Glance: Data Sources, Methods and Technical Terms on page 16, or refer to Appendix C, page 59.

County (Figure 55). Only a few counties had significantly higher diabetes mortality than the state rate of 26.0 deaths per 100,000: these were Yakima (35.0 deaths per 100,000), Lewis, (53.2 deaths per 100,000) and Klickitat (57.5 deaths per 100,000). Only King County (21.7 deaths per 100,000) had a rate of diabetes deaths that was significantly lower than the state rate.

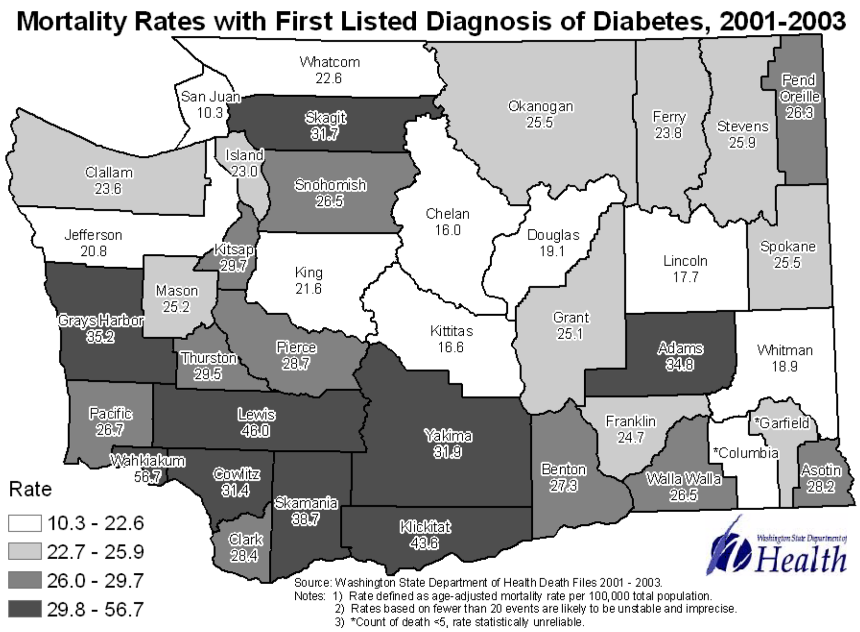

Figure 55. Source: 2003 Washington Vital Statistics

Race and Ethnicity

In Washington State, age-adjusted mortality rates for 2001-2003 combined due to diabetes as the first-listed cause of death were significantly lower for whites than other racial groups (Figure 56). For example, the rate of diabetes deaths among non -Hispanic Blacks was nearly three times that of non-Hispanic whites (67 deaths per 100,000 compared to 24 deaths per 100,000, respectively). The diabetes death rate for non-Hispanic American Indians and Alaska Natives was a little more than twice the rate among whites (55 deaths per 100,000). Among Hispanics, the diabetes death rate was also significantly higher than the rate among whites (42 deaths per 100,000).

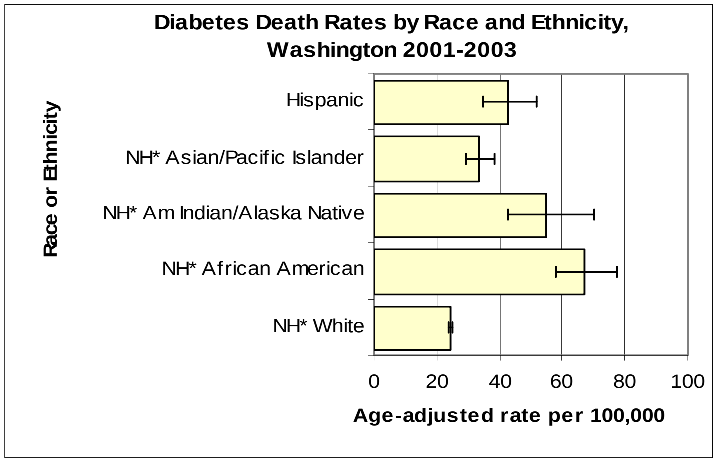

Figure 56. Source: 2001-2003 National Death Certificates, Washington State Death Certificates.

Figure 57 compares age-adjusted Washington diabetes death rates by race and ethnicity for 2001-2003 combined to those of the U.S. for 2002 (the most recent year for which these data are available). In general, Washington follows the national pattern for diabetes death rates, with most racial and ethnic groups having higher diabetes mortality compared to whites. However, Washington's diabetes death rates for African Americans, American Indians and Alaska Natives, Hispanics, and Asians and Pacific Islanders is higher than their national counterparts. Comparable US data were not available for non-Hispanic American Indians and Alaska Natives and for non-Hispanic Asians and Pacific Islanders. Therefore caution should be used in comparing rates between the state and the nation for these two racial groups. Further investigation is needed to determine reasons why diabetes mortality in some racial/ethnic groups is higher in Washington compared to the nation.

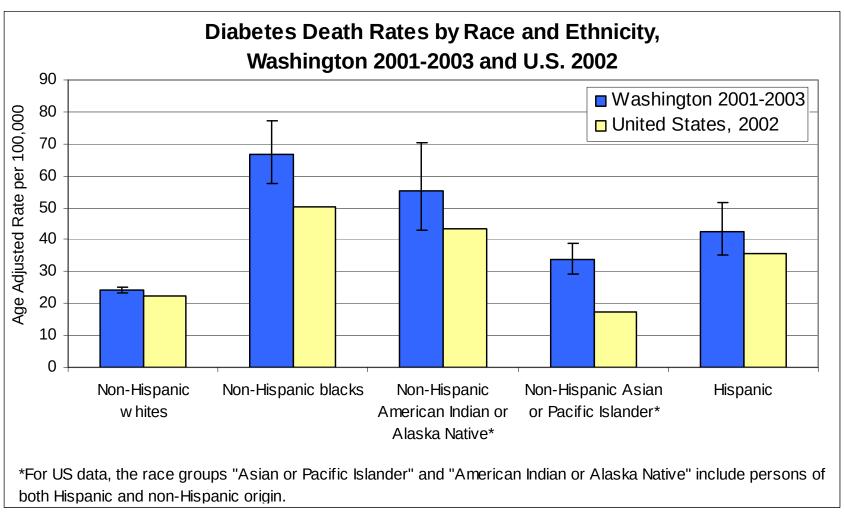

Figure 57. Source: 2001-2003 Washington Vital Statistics, 2002 National Vital Statistics

Neighborhood Education and Poverty

Previous chapters have discussed the association between lower socioeconomic position and higher diabetes prevalence. The link between lower socioeconomic position and poorer health status has been reported in the literature for a number of chronic diseases, including diabetes.[118] In explaining the relationship observed between poverty and deaths due to chronic diseases, Marmot has suggested that material deprivation results in health inequality through two mechanisms: 1) an increase of general susceptibility to ill health, and 2) an increase in those behavioral risk factors that are associated with disease prevalence, morbidity and mortality.[119] As mentioned in Chapter 2, poor living conditions and increased stress associated with lower SEP fuel the greater susceptibility to ill health. Poor health behaviors are fueled by environments that do not provide access to safe opportunities for physical activity or access to affordable healthy foods. Repeated exposure to increase stress and poor health behaviors can lead to higher obesity rates among residents of low-SEP neighborhoods, thereby increasing their risk of developing diabetes. As discussed in Chapter 3, worse access to care among those with low SEP decreases the likelihood that people with diabetes receive recommended services and processes of care, leading to poor management of diabetes and higher rates of complications. All of these factors drive disparities in diabetes mortality discussed in this chapter.

In this section, we examine differences in diabetes mortality by poverty and education. Because our data does not contain information on measures of socioeconomic position such as individual income or educational attainment, we examined the influence of neighborhood-level measures on risk of death. To assess the association between diabetes deaths and education, we assigned a neighborhood educational level to each person who died of diabetes, based on the percent of people aged 25 years and older with a college education in the census tract where the decedent resided at the time of death (see Technical Appendix for more information). In Washington for 2001 – 2003 combined, the age-adjusted rate of diabetes mortality decreased as the percent of college graduates in the decedent's neighborhood increased (Figure 58). This is consistent with findings that people with higher levels of education have lower prevalences of diabetes risk factors, lower rates of diabetes complications and fewer hospitalizations for diabetes, all of which lowers their risk of death due to diabetes.[120]

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[118] Everson, S.A., Maty, S.C., Lynch, J.W., Kaplan, G.A. (2002) Epidemiologic evidence for the relation between socioeconomic status and depression, obesity, and diabetes. *Journal of Psychosomatic Research*. 53(4):891-895.
[119] Marmot, M., Bobak, M., Davey, Smith, D. Explanations for Social Inequalities in Health. (1995). Pages 172-210 in: Amick, B.C. III, Levine, S., Tarlov, A.R., *et al*, (editors). *Society and Health*. New York: Oxford University Press.
[120] Winkleby, M.A., Jatulis, D.E., Frank, E., Fortmann, S.P. (1992). Socioeconomic status and health: how education, income, and occupation contribute to risk factors for cardiovascular disease. *American Journal of Public Health,* 82:816-820.

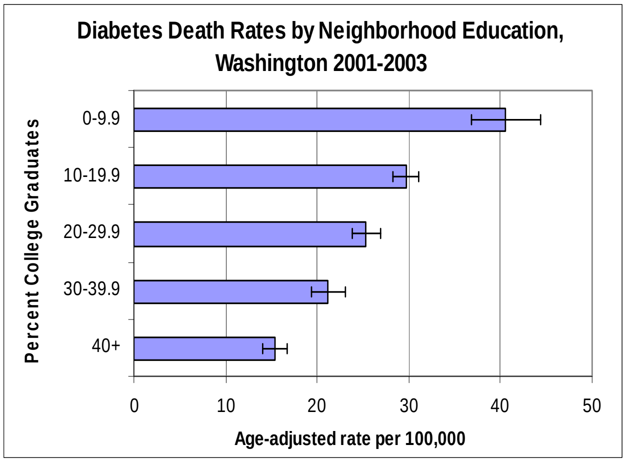


Figure 58. Source: 2001-2003 WA Vital Statistics

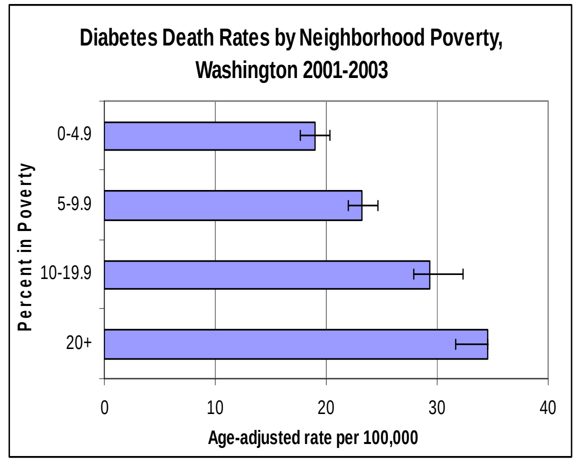


Figure 59. Source: 2001-2003 WA Vital Statistics

To examine the link between poverty and diabetes, we measured poverty as the percent of the population that lived at or below the federal poverty level in the census tract in which the decedent resided at death (see Technical Appendix for more information). In Washington for 2001–2003 combined, the age-adjusted death rate for diabetes increased as neighborhood poverty increased (Figure 59). Both poverty and neighborhood poverty are associated with higher rates of obesity,[121] which is a major risk factor for Type 2 diabetes. In addition, healthy diet and recommended physical activity at recommended levels have a dramatic impact on the prevention and control of diabetes, as well as on the risk of premature death from diabetes.[122] Yet as we have mentioned in Chapter 1, access to healthy foods and opportunities for physical activity are often limited for people living in poverty.[123]

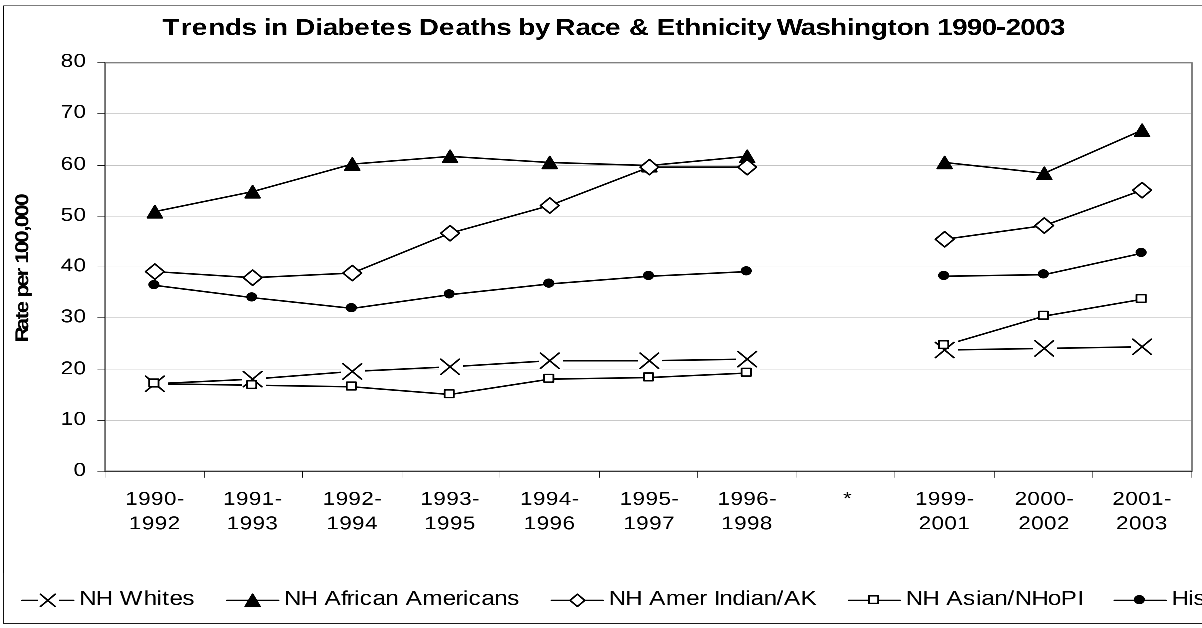
Trends by Race/Ethnicity[124]

In Washington, non-Hispanic African Americans, non-Hispanic American Indians and Alaska Natives and Hispanics experienced higher diabetes mortality than whites throughout the period from 1990 until 2003 (Figure 60).

The overall death rate from diabetes in the United States remained fairly constant during this period, although diabetes mortality for African Americans and American

[121] Shoenborn, C.A., et. al. (2002). Body weight status of adults: United States, 1997-98. *Journal of the American Medical Association*, 288:1723-1727.
[122] Knowler, W.C., Barrett-Connor, E., Fowler, S.E., et al. (2002).Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *New England Journal of Medicine*, 346(6):393-403.
[123] Drewnowski, A., Specter, S.E. (2004). Poverty and Obesity: the role of energy density and energy costs. *American Journal of Clinical Nutrition*, 79:6-16.
[124] Three year rolling averages were used to minimize year to year variations in death rates. In Figure 60, the break in the trend line between 1998 and 1999 reflects a change in coding for cause of death from ICD-9 to ICD-10 coding system.

Indians and Alaska Natives increased.[125] In Washington, the rate of diabetes deaths among non-Hispanic whites increased by about 7 percent per year between 1991 and 1994; rates continued to increase thereafter but at a slower pace (about 2 percent per year). Diabetes mortality among non-Hispanic American Indians and Alaska Natives increased by 10 percent per year from 1991 to 1996; there were no significant increases thereafter. Diabetes mortality among non-Hispanic Asians, Native Hawaiians and other Pacific Islanders did not change from 1991 to 1994, but rates increased by about 10 percent per year between 1994 and 2002. The rate of diabetes deaths among Hispanics increased slowly but steadily from 1991 to 2002, by about 2 percent per year.



*This gap is due to coding changes which might affect comparisons between death rates through 1998 and rates after 1998.

Figure 60. Source: 1990-2003 Washington State Death Certificates.

Although it appears in Figure 60 that diabetes mortality for non-Hispanic African Americans increased between 1991 and 2002, we were unable to detect any significant increases or decreases across this time period. This may be due to an inability to detect differences due to the small number diabetes deaths among non-Hispanic African Americans in any given three-year period, relative to diabetes mortality among whites.

125 Health, United States, 2003 Chartbook on Trends in the Health of Americans. Viewed 3/21/2006 from: http://www.cdc.gov/nchs/data/hus/hus03.pdf

Chapter 6: How Data From This Report Can Be Used

This chapter provides suggestions for how data from the report can be used; and offers examples of general public health strategies to address socioeconomic factors that might be adapted to address health disparities in diabetes & other health conditions.

Ensuring the health of all should be thought of not only in terms of assurance of health care, but also in terms of the social and economic factors that affect health. Public health professionals have the expertise to educate policy makers who want to better understand the relationships between social position and health, and provide examples of workable policies they can endorse. Just as public health experts have provided scientific data to support the connection between the built environment and health, we can provide evidence that links economic and social policies to disparities in health. While this report was developed primarily as an assessment tool for the statewide Diabetes Leadership Team, anyone who is interested in health disparities in diabetes can use data and scientific information from the report in the following ways:[126]

- *Cite report data in grant applications.* For example, Federal grant applications submitted by the Diabetes Prevention and Control Program in the Washington Department of Health have included data on health disparities; county level data in this report may be used in a similar manner by public and private agencies at the local level.

- *Use scientific references cited in this report to educate people about root causes that drive health disparities.* For example, information cited in Chapter 1 formed the basis of a presentation to the 2006 meeting of the Diabetes State Network entitled *Washington State Disparities in Diabetes*

- *Cite report data in presentations to educate people about local health disparities.* For example, data from this report were presented at a 2006 statewide workshop on public policy related to health disparities sponsored by the Washington State Alliance for Healthy Communities of Color.

- *Use data in setting priorities and planning.* For example, data will be used by the Diabetes State Network Leadership Team to reduce inequalities by addressing social and economic barriers in access to care, quality of care, and assurance of services.

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126 These suggestions were adapted from: Colorado Department of Public Health and Environment, (2005). *Racial and Ethnic Health Disparities in Colorado, 2005*. Denver, CO: Colorado Department of Public Health and the Environment. Viewed 5/28/2006 from: www.cdphe.state.co.us/ohd/ethnicdisparitiesreport/REHD-05.pdf.

- *Use data to set measurable program objectives.* For example, 2003 data were used by the Diabetes Prevention and Control Program in the Washington Department of Health to set measurable objectives in developing program objectives related to health disparities for the 2006-2007 grant cycle.

Examples of Potential Strategies to Address Health Disparities in General

The information presented in this report implies that in order to eliminate diabetes disparities, underlying social and economic conditions must be addressed. Changing social, economic, and cultural determinants of health is complex -- but achievable.[127] As mentioned above, public health can educate policy makers and the public about the evidence linking social and economic conditions to health. With this knowledge, decision makers can consider effects of broader social and economic policies, such as those related to education, housing, and community development on health disparities related to diabetes. Public health can also partner and support the work of those who already are working to ensure greater social and economic equity.

For example, a number of scientists have identified innovative programs and policies where public health should play a role in addressing social determinants. Researchers have noted that investments in early childhood development, nutrition programs, improvements in the quality of the work environment, and reductions in income inequality are also investments in population health.[128] The following are examples of social policies that might improve health by reducing socioeconomic disparities:

- Programs that support early child development for low income families, including home-visitation programs during pregnancy through the first year of life, and early childhood development programs for three to five-year olds. Public health actively implements these types of programs, and partners with other public agencies and groups who work to support families and young children.

- Nutritional support for low income women and infants, to provide the best possible basis for early physical development and good health. Public health is already active in implementing programs of this type.

- Modifying the work environment to reduce the negative health impacts associated with stressful, low-control/high-demand job conditions, through increasing the variety of tasks in the production process, encouraging worker participation in

[127] Heymann, S. J. (2000). Health and social policy. In L. F. Berkman & I. Kawachi (Eds.), *Social Epidemiology* (pp.368-382). Oxford: Oxford University Press.
[128] Daniels, N., Kennedy, B., Kawchi, I. (2000). Justice is Good for Our Health. *Boston Review*, February/March, 2000. Viewed 3/6/2006 from: http://www.bostonreview.net/BR25.1/daniels.html.

decision-making, and allowing more flexible work arrangements. Public health could actively include these strategies as elements of worksite wellness programs..

- Income redistribution, which moves beyond anti-poverty programs to address income inequality through mobilizing low-SEP voters to participate more fully in voting, and revisions in the tax structure to redistribute wealth. This is an area where public health could participate as partners, providing scientific support for the link between income inequality and poor population health.

Several European nations have created and implemented national policies such as those described above to address social and economic factors driving health disparities among their populations. To see a summary of these policies, and suggestions for how similar policies might be developed in the United States, please refer to *Appendix D: Policies and Strategies to Address Health Disparities.*

Policy Development at the State Level

Several states in the US have published documents describing approaches that address social and economic factors underlying health disparities. For example, the Minnesota Department of Health issued *A Call to Action: Advancing Health for All through Social and Economic Change*[129] in 2001, which described health inequalities and measures of social determinants underlying health disparities in the state, as well as general recommendations for appropriate changes in policy. In 2002, *Minnesota Strategies for Public Health: A Compendium of Ideas, Experience and Research from Minnesota's Public Health Professionals*[130] proposed specific strategies to reduce health disparities by addressing issues of unequal access to affordable, nutritious foods; improving community environments that promote physical activity, mental well being and quality of life; providing quality, affordable housing; developing and promoting education, literacy and employment policies that contribute to employment status; and conducting multi-sectoral health impact assessments to identify ways to avoid inequities in health consequences of policies and programs.

The Colorado Department of Public Health and Environment recently published a comprehensive look at the epidemiology and underlying social and economic factors driving health disparities in their state.[131] Among the suggestions made for closing the gap in health status by race and ethnicity, the report recommends the development of

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[129] Minnesota Department of Health. (2001). *A Call to Action: Advancing Health for All through Social and Economic Change*. Minneapolis, MN: Minnesota Department of Health. Viewed 3/2/2006 from: http://www.health.state.mn.us/divs/chs/mhip/action.pdf.

[130] Minnesota Department of Health. (2002). *Minnesota Strategies for Public Health: A Compendium of Ideas, Experience and Research from Minnesota's Public Health Professionals.* Minneapolis, MN: Minnesota Department of Health Viewed 3/2/2006 from: www.health.state.mn.us/strategies/social.pdf.

[131] Colorado Department of Public Health and Environment, (2005). *Racial and Ethnic Health Disparities in Colorado, 2005*. Denver, CO: Colorado Department of Public Health and the Environment. Viewed 5/28/2006 from: www.cdphe.state.co.us/ohd/ethnicdisparitiesreport/REHD-05.pdf.

interventions that increase access to better housing, improved nutritional choices, health care, goods and services.

Recent passage of Substitute Senate Bill 6197 in Washington State represents our state's effort to address health disparities by examining the impact of policy on underlying social determinants of health. SB 6197 creates a governor's interagency council on health disparities, charged with conducting health impact reviews to determine the extent to which proposed legislative or budgetary actions improve or exacerbate disparities in health. Further, the interagency council is required to develop an action plan to develop policies and strategies that address social factors driving health disparities.

Examples of Strategies Within Local Public Health Agencies

In 2006, the National Association of City and County Health Officials (NACCHO) published *Tackling Health Inequities Through Public Health Practice.* The document is a compendium of essays and case studies that defines the role of Public Health in addressing the social determinants of health, and describes the experiences of local public health professionals in "transforming everyday public health practice, departmental structure, and organizational culture in ways that may advance the attack on the root causes of inequities in the distribution of disease and illness." For example, health officials in Ingham County Michigan describe a 9-month dialogue process that resulted in a strategic plan to address social determinants through policy reform, public education campaigns on issues of health equity, community empowerment and mobilization, partnerships for social justice and public work force mobilization. The Ingham County experience provides a roadmap that may be used by other local public health agencies who wish to explore new ways to address health disparities.

The Boston Public Health Commission recently participated in a multisectoral collaborative effort to eliminate health disparities, convened by the mayor of Boston. In addition to identifying goals for needed research, better data, improvements in the health care system and strengthening traditional public health services for people of color, the *Mayor's Task Force Blueprint* included a focus on jobs and economic security, and on neighborhood investments such as elimination of environmental health hazards, increasing opportunities for recreation and access to healthy foods, and elimination of racial discrimination. The Boston *Blueprint* demonstrates a potential role for public health departments as collaborators in a broader multi-sectoral coordinated effort to address social and economic factors driving health disparities.

Examples of Community Approaches

The strategies proposed in Minnesota's *Call to Action* and Colorado's *Racial and Ethnic Health Disparities* address those social and economic factors related to health disparities that are universally found in other states. These strategies serve as examples that could be adapted by communities across Washington to address diabetes disparities at the local level. The first two strategies are becoming more common in public health practice; the last two are more experimental.

- Address inequalities in access to affordable, nutritious food by creating community gardens or providing shuttles to transport people to supermarkets at convenient times.

- Promote physical activity, mental well being and quality of life by working with law enforcement officials to make neighborhoods safer or by offering free or low-cost fitness activities at community centers. If possible, offer health classes that include a parenting skill-building component.

- Coordinate programs that promote education, literacy, better housing and employment. The NACCHO document describes the roles that public health departments in Baltimore, Chicago, and San Francisco have played in collaborative efforts to support living wage campaigns.

- Provide access to quality, affordable housing, helping people to find affordable housing and navigate the complex application process or facilitating relationships between housing developers and residents, to ensure new housing meets community needs. Public Health Seattle-King County currently partners with the Seattle Housing Authority to improve the living conditions for Asthma sufferers living in public housing.

For other examples of health promotion programs that have incorporated these ideas into traditional prevention activities, please refer to page 63 of Appendix D.

Reducing Disparities Specific to Diabetes in Washington

In 2003, the Diabetes Prevention and Control Program (DPCP) within the Washington State Department of Health conducted a multi-sector assessment of the strengths and weaknesses of the current public health system in place to prevent and control diabetes in Washington, using the Ten Essential Public Health Services as benchmarking framework. Based on the findings of this assessment, the DPCP and its statewide partners developed a set of strategic objectives to strengthen the diabetes public health system in Washington State in 2004. *The Washington State Diabetes Plan*[132] was launched in March 2005 during the first annual meeting of the Washington State Diabetes Network, a 400 member multi-sector statewide group that works to address state plan goals in the private, public, tribal, community and academic/training sectors.

Reducing health disparities in diabetes was identified as a priority in *The Washington State Diabetes Plan*,[132] as stated in Goal 6: "The state supports evidence-based culturally and linguistically appropriate and sustainable strategies that affect social determinants of health and reduce disparities in health outcomes". The formation of a statewide diabetes partnership provides a unique opportunity to explore innovative strategies to address health disparities that includes a focus on relevant social and economic factors.

After the launch of the state plan, the Leadership Team for the Diabetes State Network requested background information on the disparities in diabetes prevalence, health care, and outcomes that exist in Washington. The data that comprise this report were presented at the second annual meeting of the Diabetes State Network held in March 2006. The meeting evaluation indicated a desire to learn more about how to address diabetes disparities at the subsequent meeting.

Concurrent session in the 2007 annual meeting of the Diabetes State Network focused on: 1) reducing barriers to quality care; 2) culturally and linguistically appropriate approaches to prevent diabetes and complications at the community level and 3) innovative strategies to foster health equity. This last session covers approaches to address social and economic factors driving diabetes disparities. It is expected to generate discussion that will inform the work of the Statewide Leadership Team, the Regional Coalitions, and local communities in reducing diabetes disparities

Much of the current interventions to reduce diabetes disparities focuses on ensuring that public health and health care services for all people with diabetes are accessible, of high quality, and linguistically appropriate and culturally competent. This work is essential and will continue. However, reducing health disparities in diabetes will also require that we explore ways to address the underlying social and economic factors driving disparities. For those working in diabetes prevention and control, addressing the underlying social and economic causes of health disparities may mean collaborating with public and private partners outside the traditional circle of public health or working with traditional public health partners in new ways.

[132] Washington State Department of Health (2005). *Washington State Diabetes Plan.* Olympia, WA: Washington State Department of Health. Viewed 6/16/2006 from : www.doh.wa.gov/cfh/diabetes/diabetes_plan.htm.

Appendix A: Data Sources

A variety of data sources were analyzed for this report from data systems maintained by the Washington State Department of Health (DOH) and external organizations. Below are descriptions of the major data systems used in this report and the strengths and limitations of each. The data sources are listed in alphabetical order as follows:

Behavioral Risk Factor Surveillance System
Death Certificate System
Hospitalization Data
Population Data—Census, intercensal, and postcensal estimates
Washington State Primary Care Clinic Inventory

Behavioral Risk Factor Surveillance System[133]

The Behavioral Risk Factor Surveillance System (BRFSS) is a statewide random-digit-dialing telephone survey coordinated by the Centers for Disease Control & Prevention (CDC) and conducted in all 50 states. Annual data are gathered from a randomly selected sample of adults aged 18 years and older living in households with telephones. Telephone interviews are conducted to collect information on preventive health practices and risk behaviors that are linked to chronic diseases, injuries, and preventable infectious diseases. To determine the prevalence of diabetes, survey respondents are asked whether a doctor has ever told them they had diabetes. Respondents who answer "yes" are considered to have diabetes and respondents who answer "no", "no, pre-diabetes or borderline diabetes", or women who answer "yes, but female only told during pregnancy" are considered not to have diabetes. People with diabetes are asked to provide additional information on insulin use, age at diagnosis, self-care practices, and receipt of preventive services. With this data we can monitor disparities in diabetes prevalence, self-care practices, and receipt of services. After the data are collected each year, weighting procedures are used on survey responses to adjust for differences in probability of selection, non-response, and telephone non-coverage. In addition, data are post-stratified as a blanket adjustment for non-coverage and non-response and to adjust results so that they better reflect the gender and age distribution of Washington State's adult population.

Survey Questions

The following list of BRFSS questions were used to construct indicators for this report.

Indicator	Question(s)
Diabetes prevalence	Have you ever been told by a doctor that you have diabetes?
Self-monitoring of blood glucose	About how often do you check your blood for glucose or sugar? Include times when checked by a family member or friend, but do not include times when checked by a health professional.
Foot exam	About how many times in the past 12 months has a health professional checked your feet for any sores or irritations?

[133] Information extracted from: A) Washington State Department of Health. Appendix B: Primary Data Sources. In Health of Washington State. Olympia, WA, 2004 Sep [cited 2004 April 21] pp. 1-2. Available from http://www.doh.wa.gov/HWS/Appendix.shtm and B) Washington State Department of Health. Center for Health Statistics. Washington State BRFSS 2003. Written Report. 14p.

Eye exam	When was the last time you had eye exam in which the pupils were dilated? This would have made you temporarily sensitive to bright light.
A1c test	A test for "A one C" measures the average level of blood sugar over the past three months. About how many times in the past 12 months has a doctor, nurse, or other health professional checked you for hemoglobin "A one C"?
Aspirin use	Do you take aspirin daily or every other day? Do you have a health problem or condition that makes taking aspirin unsafe for you?
Flu shot	During the past 12 months, have you had a flu shot?
Pneumococcal vaccination	Have you ever had a pneumonia shot? This shot is usually given only once or twice in a person's lifetime and is different from the flu shot. It is called the pneumococcal vaccine.
Diabetes education	Have you ever taken a course or class in how to manage your diabetes yourself?
Retinopathy	Has a doctor ever told you that diabetes has affected your eyes or that you had retinopathy?
Foot sores	Have you ever had any sores or irritations on your feet that took more than four weeks to heal?
Obese/overweight (body mass index)	About how much do you weigh without shoes? About how tall are you without shoes?
Physical activity during leisure time	Now thinking about the moderate physical activities you do (when you are not working) in a usual week, do you do moderate activities for at least 10 minutes at a time, such as brisk walking, bicycling, vacuuming, gardening, or anything else that causes small increases in breathing or heart rate? How many days per week do you do these moderate activities for at least 10 minutes at a time? On days when you do moderate activities for at least 10 minutes at a time, how much total time per day do you spend doing these activities? Now thinking about the vigorous physical activities you do (when you are not working) in a usual week, do you do vigorous activities for at least 10 minutes at a time, such as running, aerobics, heavy yard work, or anything else that causes large increases in breathing or heart rate? How many days per week do you do these vigorous activities for at least 10 minutes at a time?

	On days when you do vigorous activities for at least 10 minutes at a time, how much total time per day do you spend doing these activities?
Physical activity during work	When you are at work, which of the following best describes what you do? (mostly sitting or standing, mostly walking, mostly heavy labor or physically demanding work)
Smoke cigarettes	Have you smoked at least 100 cigarettes in your entire life? Do you now smoke cigarettes every day, some days, or not at all?
Smoking cessation	When was the last time a doctor, nurse or other healthcare provider advised you to quit, if ever? Did the health care professional who advised you to quit offer you any help, or refer you to a source of help, to quit tobacco use?
Hypertension	Have you ever been told by a doctor, nurse or other health professional that you have high blood pressure?
High cholesterol	Have you ever been told by a doctor, nurse or other health professional that your blood cholesterol is high?
Visit doctor for diabetes	About how many times in the past 12 months have you seen a doctor, nurse, or other health professional for your diabetes?
Health care coverage	Do you have any kind of health care coverage, including health insurance, prepaid plans such as HMOs, or government plans such as Medicare?
Regular provider (source of care)	Do you have one person you think of as your personal doctor or health care provider?
Days poor physical health	Now thinking about your physical health, which includes physical illness and injury, for how many days during the past 30 days was your physical health not good?
Days poor mental health	Now think about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?
Days unable to perform usual activities due to poor health	During the past 30 days, for about how many days did poor physical or mental health keep you from doing your usual activities, such as self-care, work, or recreation?

Caveats

- The response rate for the BRFSS changed from 61% in 1995 to 43% in 2004. Similar changes have been seen in all other states and in other telephone surveys. The drop is due to a combination of people being less willing to cooperate, new technology allowing people to screen phone calls, and replacement of land-based telephones at home with mobile cell phones. CDC has assessed the impact of low response rates and has concluded that as long as the response rate is between 30% and 80%, the results are not biased due to response rate.
- BRFSS might under-represent poorer, more mobile and non-white populations because they are less likely to live in homes with telephones. For example, based on 1990 census data, the mean income for household with telephones was $37, 613 and the mean income for households without telephones was $15,650. Moreover, 3.1% of whites did not have a phone compared to 8.3% of non-whites (refer to:

Washington State Population Survey—Characteristics of Households With and Without Telephones: Analysis with 1990 Census Data at http://www.ofm.wa.gov/ResearchBriefs/brief001.pdf).

- Washington's BRFSS did not represent people who do not speak English until 2003, when the survey was conducted in both English and Spanish. Thus, trend analysis was conducted only among English-speaking adults after 2002 to maintain continuity with previous years and make analysis of change over time comparable.
- BRFSS does not represent people who live in institutions.
- Characteristics of people who refuse to participate are unknown.
- Health risk behavior might be underestimated because people might be reluctant to report behaviors that others might not find acceptable.
- Use of preventive services might be underestimated because of recall error.

Reporting Data

- Numerator cell sizes (or number in sample) less than 10 are suppressed and show as a dash (-) in data tables. Use caution in interpreting numerator cell sizes between 10 and 30.
- The number in the denominator (or population) includes all respondents except those with missing, don't know, or refused answers. Denominator cell sizes less than 50 are suppressed and show as a dash (-) in data tables.

National Data

As a comparison, we used national BRFSS data from CDC Division of Adult and Community Health, Behavioral Risk Factor Surveillance System Online Prevalence Data at http://apps.nccd.cdc.gov/brfss.

For Further Information

Washington State Department of Health, Center for Health Statistics (360) 236-4322.
Washington State BRFSS web site: http://www.doh.wa.gov/EHSPHL/CHS/CHS-Data/brfss/brfss_homepage.htm.

Death Certificate System[134]

Diabetes mortality data were obtained through the Washington State Death Certificate System. This system collects data on all deaths in Washington, and those of Washington residents who die in other states. Data collected for each death include: age, gender, race/ethnicity, date of death, underlying and contributing causes of death, place of residence, place of occurrence, and zip code of residence. The data are estimated to be 99% complete.

Classification and coding of data on Washington death records follow the National Center for Health Statistics (NCHS) guidelines as defined in Vital Statistics Instruction Manuals parts 1 – 20 (published by US Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Center for Health Statistics, Hyattsville MD). Causes of death are coded according to

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[134] Information extracted from: A) Washington State Department of Health. Appendix B: Primary Data Sources. In Health of Washington State. Olympia, WA, 2004 Sep [cited 2004 April 21] pp. 9-10. Available from http://www.doh.wa.gov/HWS/Appendix.shtm and B) Centers for Disease Control and Prevention. National Diabetes Surveillance System. Atlanta, GA, last review 2006 Mar. [cited 2004 April 21]. Available from http://www.cdc.gov/diabetes/statistics/index.htm.

the International Classification of Disease, World Health Organization, Ninth Revision (ICD-9) for 1979 – 1998; Tenth Revision (ICD-10) for 1999 and later. The change from ICD-9 to ICD-10 coding is reflected in Figure 60 by the break in the trend line between 1998 and 1999. A maximum of 20 conditions may be listed for each death. For a listing of the ICD-9 and ICD-10 codes used in this report, refer to the *International Classification of Disease Codes* section in Appendix C: Technical Notes.

Issues Related to Race and Ethnicity

Death certificates use open-ended reporting of race, allowing for multiple racial entries. However, the multiple race data have not been used in this report because they are of uncertain quality and completeness. The determination of race when more than one race is reported follows decision rules established by the National Center for Health Statistics (NCHS). In most cases, the first race given is assigned as the person's race.

Reporting of race/Hispanic origin on death certificates is sometimes based on observing the decedent rather than questioning the next of kin. This procedure causes an underestimate of deaths for certain groups, particularly Native Americans, some of the Asian subgroups, and Hispanics. Thus, death rates based on death certificate data are lower than true death rates for these groups. For more information, refer to: National Center for Health Statistics. Quality of Death Rates by Race and Hispanic Origin: A Summary of Current Research, 1999. *Vital Health Stat* 1999:2(128) at http://www.cdc.gov/nchs/products/pubs/pubd/series/sr02/130-121/sr2_128.htm.

Hispanic origin was added as an ethnic category in the vital records system and collected as a separate item (in addition to race) in 1988. Prior to 1988, Hispanic data were provided by a racial category of "Mexican/Chicano" or "Mexican American." In a few instances, Hispanic ethnicity is marked unknown, and Hispanic is given as the person's race. Beginning in 1992, if a person's ethnicity is marked as unknown and his/her race is given as Hispanic, then that person's ethnicity is counted as Hispanic. About 60 deaths each year are reclassified in this way, resulting in a 14% increase in the number of Hispanics at death.

Caveats

- Unless otherwise noted, the mortality rates in this report use the first-listed (underlying) cause of death. For example, if a person dies of a stroke as a complication for diabetes, the underlying cause of death is reported as a stroke.
- Diabetes is underreported on death certificates. Among persons known to have diabetes, only about 40% have diabetes as one of any listed cause of death and only 10% have diabetes recorded as the first-listed (underlying) cause of death (refer to Bild DE, Stevenson JM. Frequency of recording of diabetes on U.S. death certificates: analysis of the 1986 National Mortality Followback Survey. *J Clin Epidemiol* 1992;45:275-81.). However, the extent of underreporting for additional diabetes-related conditions (e.g., diabetic ketoacidosis, heart disease, stroke, etc.) is unknown.

National Data

As a comparison, we used US diabetes death data from the National Vital Statistics System when applicable at http://www.cdc.gov/nchs/deaths.htm.

For Further Information

Washington State Department of Health, Center for Health Statistics, (360) 236-4324.
Washington State Death Certificate System web site: http://www.doh.wa.gov/EHSPHL/CHS/CHS-Data/death/deatmain.htm.

Hospitalization Data[135]

Diabetes hospitalization data was obtained through the DOH Comprehensive Hospital Abstract Reporting System (CHARS). CHARS includes data from all inpatient stays for all patients treated in state-licensed acute care hospitals in Washington, regardless of patient residence. CHARS does not include hospitalizations in U.S. military hospitals, U.S. Veterans Administration hospitals, or Washington State psychiatric hospitals. For each hospitalization CHARS data includes: hospital, zip code of residence, birth date, age, gender, discharge status, and first-listed (principal) and secondary diagnoses. Data on race or ethnicity are not available for hospitalizations at the state level. Data on education and income are not available for hospitalizations at the state or even the national level.

Source of payment is collected in CHARS to identify each payer group from which the hospital may expect some payment for the bill. Priority of payer is indicated in CHARS as primary or secondary payer. Payer identification is categorized as follows: Medicare, Medicaid (Washington State Department of Social and Health Services- DSHS, Healthy Options), HMO (Health Maintenance Organization, e.g. Kaiser, Group Health, Molina, Basic Health Plan), Commercial Insurance (e.g. Mutual of Omaha, Safeco), Health Care Service Contractors (private companies hired by private industry or governments, like a county, to deliver and run health care such as Premera Blue Cross), Worker's Compensation (includes state fund, self-insured employers, and Labor & Industries crime victim's claims), Self Pay, Other government sponsored patients (e.g. Military Health System TRICARE, Indian Health), Charity Care (as defined in WAC 246-453-010; includes those who cannot pay and whose bills are excused; to fall into this category the patient has to have no resources and not qualify for Medicaid)

Reasons for hospitalization are coded according to the International Classification of Disease, Clinical Modification of the Ninth Revision (ICD-9-CM). For a listing of the ICD-9 codes used in this report, refer to the International Classification of Disease Codes ***section in Appendix C: Technical Notes. The first diagnosis field is considered to be the principal reason the patient was admitted to the hospital. Beginning in 1993, there are up to eight other diagnosis fields for additional conditions that had an effect on the hospitalization. We used hospitalizations where the diagnosis was diabetes (ICD-9: 250), and age-adjusted rates to the US age distribution for the year 2000 (US Census Bureau).***

Caveats

- The unit of observation in this report is the hospitalization episode not the individual. Thus, one person hospitalized several times will be counted several times. As patients with diabetes may be hospitalized multiple times per year, the rates presented likely over-estimate the number of patients per year hospitalized for diabetes.
- The number of hospitalizations gives us a better picture of the public health impact of a condition. Each hospitalization for an illness or injury is an adverse event for the person who experiences it. Many hospitalizations are potentially avoidable through reductions in the factors that cause or complicate diseases and injuries or through early detection and rapid treatment.
- CHARS excludes emergency room visits; outpatient surgery; outpatient clinics; military and VA hospitals (greatest impact on rates reported for Island County because of the large proportion of residents

[135] Information extracted from: A) Washington State Department of Health. Appendix B: Primary Data Sources. In Health of Washington State. Olympia, WA, 2004 Sep [cited 2004 April 21] pp. 10-13. Available from http://www.doh.wa.gov/HWS/Appendix.shtm and B) Centers for Disease Control and Prevention. National Diabetes Surveillance System. Atlanta, GA, last review 2006 Mar. [cited 2004 April 21]. Available from http://www.cdc.gov/diabetes/statistics/index.htm.

connected with the military); free-standing surgeries; free standing mental health, substance abuse, and rehabilitation centers, and birthing centers.

- CHARS does not contain data on Washington residents hospitalized outside of Washington. This situation affects border counties, especially those adjacent to large population centers in other states. Asotin and Garfield counties are particularly affected by hospitalization in Idaho and Clark County is affected by hospitalizations in Oregon. Data on Washington residents hospitalized in Oregon may be obtained from the Oregon Hospital Discharge Database. However, this additional data was not included in our rate calculations among Washington residents. The hospitalization rates given in this report most likely underestimate the actual burden in these border counties.
- The total hospital charges presented are only hospital charges and do not include ancillary charges, such as anesthesiology. In addition, some charge information submitted by large organizations is incomplete in the CHARS dataset, which would affect and potentially underestimate total charges presented in this report. It is also important to note that the charge information may not match the actual cost incurred once final payments are received.
- The payer codes for each hospitalization which are most straightforward and unambiguous are Medicare and Medicaid. Health Care Service Contractor, HMO and commercial insurance are the most ambiguous.
- Hospitalizations paid by Medicaid and charity care may be underestimated because the anticipated payer is coded in at discharge and it takes the hospital time to determine the lack of coverage and resources to their satisfaction. The eventual payer may end up being Medicaid or charity care, but that is not known at the time of discharge.
- In this report, Washington residents and counties were designated with DIRM ZIP Code to County Boundary File, 2004 (purchased from Tele Atlas at http://www.teleatlas.com/stellent/idcplg?IdcService=SS_GET_PAGE&nodeId=9487&ssSourceNodeId=9482). Residence is based on five-digit ZIP codes. ZIP codes have been assigned to county based on US postal service conventions that assign ZIP codes to counties based on the physical location of the post office. When ZIP codes cross county borders, some hospitalizations are assigned to the wrong county. This phenomenon may be most important for Skamania County. ZIP code 98671 includes a large portion of Skamania, but all hospitalizations in that ZIP code are assigned to Clark County. Other counties are less affected, because the number of hospitalizations that are potentially assigned to the wrong county are a relatively small proportion of the total hospitalizations for that county.

National Data

As a comparison, we used US diabetes hospitalization data from the National Hospital Discharge Survey when applicable at http://www.cdc.gov/nchs/about/major/hdasd/nhds.htm.

For Further Information

Washington State Department of Health, Center for Health Statistics, (360) 236-4223.
Washington State CHARS web site: http://www.doh.wa.gov/EHSPHL/hospdata/Chars.htm.

Population Data—Census, intercensal, and postcensal estimates[136]

Population data (the denominator) used to calculate health indicator rates in this report came from two sources. Decennial population estimates (1990 and 2000) were obtained from the US Census Bureau, while intercensal (1991-1999) and postcensal (2000-2004) population estimates by ethnicity, race, sex, and age, were

[136] Information extracted from: A) Washington State Department of Health. Appendix B: Primary Data Sources. In Health of Washington State. Olympia, WA, 2004 Sep [cited 2004 April 21] pp. 6-8. Available from http://www.doh.wa.gov/HWS/Appendix.shtm and B) Washington State Department of Health. Center for Health Statisitics. Vista Sub-County Population Estimate Denominators. White Paper. Olympia, WA, 2005 Sep. 13p.

provided by Washington State Department of Health (WA DOH), Center for Health Statistics, Vista Partnership, Krupski Consulting (October 2004). Population data used to calculate health indicator rates by community-level education and poverty, and used in calculations of income inequality for this report, were also from the U.S. decennial census for 2000. The accuracy of the intercensal and postcensal population estimates depend to a large extent on the accuracy of the U.S. Census, because the U.S. Census provides the foundation from which they are developed.

Description of the Systems

Purpose: The United States Constitution mandates a count of people living in the United States every ten years to determine how many seats each state will have in the US House of Representatives. The US census is also used for political redistricting, distribution of federal and state funds, and other governmental needs. The primary purpose of intercensal interpolations is to provide a count of people in Washington between the decennial censuses. Both the US census counts and the Washington intercensal estimates are also used by many other entities for a diversity of purposes, such as the denominator for calculating rates of health events.
Coverage: The US census attempts to count everyone living in Washington on April 1st of the census year. In March 2001, the US Census Monitoring Board reported that approximately 98.5% of people living in Washington in April 2000 were counted in the 2000 census. Nationally, the Board estimated that 98.8% were counted. For discussions of accuracy and undercounts, see http://www.cmbp.gov/ or http://www.cmbc.gov/.
Years: US census for 1990 and 2000 and WA DOH, Center for Health Statistics, Vista Partnership, Krupski Consulting intercensal interpolations for 1991 – 1999 and postcensal interpolations for 2001 – 2003.
Key Data Elements: US census—age, gender, ethnicity, and race (more than one race allowed for 2000 census), and WA DOH, Center for Health Statistics, Vista Partnership, Krupski Consulting intercensal and postcensal interpolations—age, gender, Hispanic origin, and single race.
Data Collection: The Bureau of the Census located in the Department of Commerce, develops and mails census questionnaires to all known addresses where people might live including housing units and other places, such as hospitals and hotels, within the United States, Puerto Rico and other US territories. Information is gathered by a short form sent to five out of six housing units and a long form sent to the remaining addresses. The short form asks basic questions, such as name, age, gender, and race of everyone in the household. The long form includes the questions on the short form, plus additional demographic questions, such as income and education, and questions about housing. Census takers visit housing units in rural and remote areas to drop off and pick up forms and visit housing units that do not return census forms. Census workers also stage a one day operation to obtain information on homeless persons and others who might be missed in the traditional enumeration of housing units and group quarters.
Intercensal/Postcensal Interpolations: In collaboration with WA DOH, Center for Health Statistics, Krupski Consulting developed intercensal (1991 – 1999) and postcensal (2001 – 2003) estimates of the number of people in each Hispanic ethnicity, single race, sex and age group at the 2000 census block level, the 1990 census block level, school district, current zip code, county, and state levels of geography. The intercensal estimates were created using a linear extrapolation process. For the postcensal estimates, the Washington State Office of Financial Management's (OFM) projected estimates of changes in growth of counties and communities were used. To obtain bridged race population counts for 2000, Krupski Consulting emulated the National Center for Health Statistics (NCHS) race bridging process described below. The subcounty estimates were adjusted to county age by sex intercensal totals provided by OFM but were redistributed according to census counts at the block and blockgroup levels to produce the population components by Hispanic origin, single race, sex, and age routinely used in subcounty public health data analysis and community health assessment. In this way, the age by sex component of Krupski Consulting's intercensal interpolations are consistent with OFM's intercensal interpolations. The intercensal/postcensal interpolations from Krupski Consulting were created on behalf of a cooperative effort between Washington State Department of Health, Center for Health Statistics and Local Health Jurisdictions to procure sub-county population estimates for the purpose of community public health assessment. These estimates were made available so local health jurisdictions can calculate rates by age, race/ethnicity, and sex for smaller geographic areas.

Data Quality Procedures: US census data are subject to quality procedures employed by the US Census Bureau prior to release. These procedures evaluate the completeness of the count, try to remove individuals who have been counted more than once and make other adjustments required for an accurate count. More information on data quality can be found at http://www.census.gov/pred/www/eval_top_rpts.htm#COLLECTION. Population estimates developed by Krupski Consulting were validated in two ways: 1) Internal consistency checks—a. block groups added to tracts and tracts added to county totals, b. county age by sex totals matched published, official OFM estimates, c. race groups added to total over race within each age/sex cell; 2) Trend over time checks—examined whether there were unusually large increases in total persons from one year to the next, defined as a increase of more than 10%-15% in tracts with more than 1000 people. Some tracts showed these large increases, but they were fast-growing tracts with large differences between 1990 and 2000.

Issues Related to Race and Ethnicity

The 2000 census first asks people whether they are Hispanic or Latino/a. People are then asked to identify themselves as belonging to one or more racial groups as follows: "white; black, African American or Negro; American Indian or Alaska Native;" and 11 other groups that the census generally classified as Asian or Native Hawaiians and other Pacific Islanders in their reports. Conversely, in the 1990 Census people were asked to identify themselves as belonging to only one racial group, used somewhat different terminology in describing racial groups, combined the Asian and Pacific Islanders into one group and asked about race first and then about whether the person was Hispanic.

The 2000 Census and 2001 – 2003 postcensal interpolations from WA DOH, Vista Partnership, Krupski Consulting include designation of single race based on the NCHS race bridging process. The NCHS originally developed population data for 2000 in which people who chose more than one race in the 2000 U.S. Census were apportioned to a single race. The apportionment was based on National Health Interview Survey data. From 1997 – 2000, 4,898 survey participants selected more than one race in response to "What race do you consider yourself to be? Please select one or more of these categories [on a flashcard that had been handed to them]." Almost 4,000 of these people selected a single "primary" race when asked, "Which of these groups would you say best represents your race?" NCHS describes their method in detail in Vital and Health Statistics, Series 2 Number 135, United States Census 2000 Population with Bridged Race Categories, September 2003, available at http://www.cdc.gov/nchs/data/series/sr_02/sr02_135.pdf. NCHS developed bridged race population counts for each state and county in the U.S.

Caveats

- Although the Census Bureau attempts to obtain information from every known household, homeless persons, undocumented persons who deliberately avoided the census for fear of disclosure to the Immigration and Naturalization Services, urban poor living over commercial addresses, and others are undercounted by the census. The undercount is larger for some groups than for others. For example, an April 4, 2002 memorandum from the Census Bureau (DSSD Revised A.C.E. Estimates Memorandum Series PP-2) estimates that Native Hawaiians and Other Pacific Islanders are undercounted by almost 5% and American Indians by approximately 3%. The undercount might also affect some geopolitical jurisdictions more than others. In general, the smaller the group, the greater the potential for the undercount to be relatively large. (There is also a small group of people who were counted more than once resulting in an overcount. We do not have information on overcounts in Washington, but the national estimates are relatively small, i.e. less than one half of one percent for whites and Asians.)
- The 2000 census only allowed reporting of up to six people per household so large households may not have included everyone.
- College students are usually enumerated in the towns in which they attend college, although their health events might be reported in their parents' or guardians' towns. This phenomenon might affect rates of some conditions in counties with a high proportion of people who are attending college in that county (such as King County where University of Washington is located).

- People who are confined in institutional group quarters, such as mental hospitals and prisons, are reported separately and these numbers are not included in the population counts used in this document. This may affect rates of health events among some age and race groups with disproportionately high rates of incarceration or institutionalization.
- Military personnel are recorded as living in Washington jurisdictions where they actively serve. Due to these reporting rules, some jurisdictions might have military personnel who do not actually reside in those jurisdictions counted as part of the population. This phenomenon might affect rates of some conditions in counties with a high proportion of people who are active military (such as Island County).
- The unofficial WA DOH, Center for Health Statistics, Vista Partnership, Krupski Consulting sub-county estimates were developed for the purpose of calculating health indicator rates at smaller levels of geography for community public health assessment only, and not for estimating the population of cities, towns, and counties. Official population estimates for cities, towns and counties are produced under the authority of the Washington State Office of Financial Management (OFM) in accordance with RCW 43.62.020 and RCW 36.12.100. The OFM estimates are developed for official state planning, funding and program administration issues. Under no circumstances should the "unofficial" sub-county population estimates be used for these purposes.
- The WA DOH, Center for Health Statistics, Vista Partnership, Krupski Consulting estimates are not to be used to describe changes in population distributions. The only two years where the population data, down to the block group, are really accurate is 1990 and 2000; the years of the decennial census. All years in between must be estimated, which introduces bias. For instance, in reality changes in population are not likely to increase linearly. The linear extrapolation process used by Krupski Consulting does not account for things like differential growth among sub-populations, natural increase or decrease, and immigration or out migration. Since the estimation process introduces bias the data are not suitable for planning purposes. However, the data are suitable for looking for general trends.
- Population estimates should be used at the largest geographic area possible. Calculating rates at small geographies, especially below the zip code level, can be particularly misleading. Rates may result which are highly variable and have wide confidence intervals. Data users must be especially careful when stratifying calculations. By the time data is stratefied by year, age group, sex, race and ethnicity cells will have very small numbers. This may occur even for an entire zip code and even many counties. Unfortunately there is no rule of thumb that indicates when rates are out of line. Highly variable rates are not suitable for making any assessment decisions.
- The most recent data available from WA DOH, Center for Health Statistics, Vista Partnership, Krupski Consulting for this report were 2003 population estimates. 2004 postcensal estimates developed by the Washington State Office of Financial Management, http://www.ofm.wa.gov/pop/race/2004estimates.asp, were used to calculate more recent estimates of diabetes and pre-diabetes in Washington State and to determine physician need (ratio of population to primary physicians) by county from the 2005 Washington State Primary Care Clinic Inventory. OFM develops both intercensal and postcensal interpolations by age, sex, and race/ethnicity using information from the decennial censuses, annual data on the number of births and deaths in Washington, and a variety of other data, such as housing starts, to estimate migration into and out of Washington. More information on how these particular estimates are developed is available at www.ofm.wa.gov/pop/annex/process/overview.pdf.

For Further Information

US Bureau of Census web site: http://www.census.gov.
Washington State Department of Health, Center for Health Statistics, (360) 236-4324 (for information on WA DOH, Center for Health Statistics, Vista Partnership, Krupski Consulting, Washington State Population Estimates for Public Health, October 2004).
Washington State Office of Financial Management web site: http://www.ofm.wa.gov.

Washington State Primary Care Clinic Inventory[137]

In this report, we presented data on the number of primary care providers per county from the Washington State Primary Care Clinic Inventory. This inventory is a comprehensive list of about 1,425 unique primary care clinic locations in Washington State with name, physical address, clinic phone number, clinic type, and counts of primary care providers by primary care specialty. The list was initially created in January-August 2005. The main source of data comes from primary care clinic surveys administered to clinic business offices on a 3-5 year cycle in rural and small urban areas, and less frequently in large urban counties. Clinics are surveyed in partnership with local health jurisdictions to obtain data to designate areas as federal Health Professional Shortage Areas. Prior to survey distribution, initial clinic lists were developed by cross indexing the yellow pages information, hospital lists, and local health jurisdiction referral lists and verified with completed mail/fax surveys. Contact information (address and phone numbers) for Rural Health Clinics and Federally Qualified Health Centers was developed and extensively vetted with the assistance of the Washington Association of Community and Migrant Health Centers and the Rural Health Clinic Association of Washington. Practice and provider data was cross-verified and updated using internet searches of hospital referral directories, insurance directories, medical society directories, and clinic web sites.

Designation of Primary Care Specialty

This inventory uses the Federal Shortage Designation Branch's definition of primary care. Primary Care includes family/general practice, pediatrics, obstetrics/gynecology, and general internal medicine. Hospital-based pediatric and obstetrics/gynecology specialists and surgeons are excluded. The boundary between general internal medicine and internal medicine specialties is vague and many of the source documents used to create the inventory did not make clear distinctions. In the event distinctions were not clear—decisions were made to err on the side of inclusion.

Primary care specialties are based on information reported in the original source material. In cases where there were conflicts or uncertainty, the specialty was occasionally verified using American Medical Society on-line directories. In the event a provider had more than one primary care specialty, they were generally classified with the primary specialty of the clinic. If the primary specialty could not be identified they were assigned randomly.

Provider Counts

The inventory provides headcounts of providers by specialty. Counts of primary care providers or capacity was not adjusted to full-time equivalences (FTE). Findings from detailed county surveys suggest that for physician headcounts the statewide average is about .9 FTE per provider. FTE adjustments for Physician Assistants and Nurse Practitioners are about .8 FTE. Providers which worked at more than one location were assigned to the location they worked at most hours. Providers working less than 4 hours each week were not counted. Temporary providers were also included in the headcounts since they likely represented capacity that would eventually be replaced.

Caveats

- Data from counties with more recent "local survey" dates is more reliable.

[137] Information extracted from: Washington State Department of Health. Office of Community and Rural Health. Washington State Primary Care Clinic Inventory. Written Report. Olympia, WA, 2005 Aug. 4p.

- Clinics employing primary care providers and that appeared to provide a full scope of care were included in the inventory. The following were excluded: hospitals and emergency care providers, urgent care clinics (in most cases) and urgent care departments in HMOs (may be included in the future), primary care providers providing only specialty services (i.e., occupational medicine, sports medicine, fertility treatments, flight exams, etc.), public health clinics (except some locations operated by Public Health Seattle King County), free clinics with very limited hours, and practices only employing naturopathic physicians.
- Address and clinic type information is very accurate and stable. Clinic name is less accurate and stable. Some practices have more than one name.
- While overall clinic location and provider capacity in each clinic is fairly stable, headcounts across clinics may mask significant turnover of specific providers within some clinics. For example, clinic A may have 5 providers. The total number of providers 5 (+/-1) will stay fairly stable over a number of years.   But over 5 years, the clinic could have as many as 10 or 15 different individual providers filling those same 5 positions. The overall capacity remains fairly stable because clinics do not go in and out existence very rapidly. This may especially affect medium and large practices, which experience changes in staff more frequently than smaller clinics. But even in these larger organizations overall staffing levels are fairly stable. Even when a clinic closes or providers leave a certain location, in time new providers come in to take the place of most of the providers who left. So, while there maybe 25% turnover over 5 years for individual providers, the total headcount of providers may have only changed 4-5%.
- Information on primary care physicians is more reliable than information on physician assistants and nurse practitioners – especially in urban settings. Physician Assistants and Nurse practitioner are less likely to be individually identified in all sources.
- More than one practice can be located at the same address if there are different suite numbers.

For Further Information

Washington State Department of Health, Office of Community and Rural Health, (360) 236-2800.

Appendix B: Data Tables

CHAPTER ONE

Prevalence of Diabetes among Washington Adults (Figure 1)

Year	Numerator	Denominator	Age-adjusted Percent	Lower CI	Upper CI
1993	99	2,585	4.0	3.1	4.8
1994	135	3,340	4.1	3.3	4.8
1995	108	3,348	3.2	2.6	3.9
1996	125	3,589	3.5	2.8	4.1
1997	146	3,600	4.2	3.5	4.9
1998	175	3,600	5.0	4.1	5.8
1999	187	3,606	5.2	4.4	6.0
2000	201	3,580	5.5	4.7	6.3
2001	244	4,205	5.7	5.0	6.4
2002	307	4,882	5.9	5.1	6.7
2003	1,434	18,132	6.7	6.2	7.1
2004	1,487	18,046	6.5	6.1	6.9

Source: 1993-2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Percentages age-adjusted to 2000 US population. Lower CI and Upper CI show the 95% confidence interval around the percent. Prevalence estimates in 2003 and 2004 from respondents who completed telephone interview in English to be consistent with previous years.

Prevalence of Obesity among Washington Adults (Figure 1)

Year	Numerator	Denominator	Age-adjusted Percent	Lower CI	Upper CI
1993	352	2,534	14.3	12.8	15.8
1994	458	3,236	14.3	13.0	15.6
1995	441	3,225	14.0	12.7	15.4
1996	517	3,373	15.6	14.2	17.0
1997	518	3,405	15.3	13.9	16.7
1998	605	3,421	18.1	16.5	19.7
1999	628	3,453	18.2	16.8	19.7
2000	651	3,410	18.7	17.3	20.2
2001	797	4,026	19.2	17.9	20.5
2002	1,004	4,674	21.1	19.6	22.6
2003	4,108	17,375	21.6	20.8	22.4
2004	4,106	17,251	21.9	21.1	22.7

Source: 1993-2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Percentages age-adjusted to 2000 US population. Lower CI and Upper CI show the 95% confidence interval around the percent. Considered obese if body mass index 30.0+ kg/m^2. Prevalence estimates in 2003 and 2004 from respondents who completed telephone interview in English to be consistent with previous years.

Distribution of Income among Households in Washington (Figure 2)

Quintile	Cumulative households	Cumulative income	Proportion of income in quintile
Poorest fifth	0.2	0.039	0.039

Low fifth	0.4	0.137	0.098
Middle fifth	0.6	0.294	0.157
High fifth	0.8	0.527	0.233
Richest fifth	1.0	1.0	0.473

Source: U.S. Census 2000.

CHAPTER TWO

Prevalence of Diabetes among Adults by Education Level, Washington versus US (Figure 4)

	Washington State					**US**
Education level	**Numerator**	**Denominator**	**Percent**	**Lower CI**	**Upper CI**	**Percent**
Less than high school	197	1,619	9.4	7.9	11.1	13.0
High school graduate/GED	397	4,760	7.2	6.4	8.2	7.8
Some post high school	507	6,126	6.8	6.1	7.6	6.7
College graduate	353	6,060	5.2	4.6	5.9	4.9

P-value(association)=0.0000, P-value(trend)= 0.0416
Source: 2003 Washington State Behavioral Risk Factor Surveillance System (BRFSS) and 2003 National BRFSS. Lower CI and Upper CI show the 95% confidence interval around the percent.

Prevalence of Diabetes among Washington Adults by Employment Status (Figure 5)

Employment status	**Numerator**	**Denominator**	**Percent**	**Lower CI**	**Upper CI**
Employed, homemaker, student	596	12,562	4.0	3.6	4.4
Unemployed	74	1,147	5.4	4.1	7.2
Retired	574	3,913	15.1	13.7	16.6
Unable to work	206	921	22.7	19.3	26.6

P-value(association)=0.0000
Source: 2003 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent.

Prevalence of Diabetes among Adults by Income Level, Washington versus US (Figure 6)

	Washington State					**U.S.**
Annual household income	**Numerator**	**Denominator**	**Percent**	**Lower CI**	**Upper CI**	**Percent**
<$15,000	249	1,829	10.7	9.1	12.6	12.8
$15,000-$24,999	323	3,002	9.7	8.4	11.1	9.9
$25,000-$34,999	188	2,424	6.6	5.5	7.9	7.1
$35,000-$49,999	233	3,227	7.0	6.0	8.2	6.1
$50,000-$74,999	146	2,978	4.3	3.5	5.2	4.5
$75,000 or more	123	3,068	3.9	3.2	4.8	

P-value(association)=0.0000, P-value(trend)=0.0022
Source: 2003 Washington State Behavioral Risk Factor Surveillance System (BRFSS) and 2003 National BRFSS. Lower CI and Upper CI show the 95% confidence interval around the percent.

Prevalence of Diabetes among Washington Adults by Neighborhood Percent in Poverty (Figure 7)

Percent population in poverty	**Numerator**	**Denominator**	**Percent**	**Lower CI**	**Upper CI**
20+	157	1,818	6.8	5.6	8.3
10 to 19.9	680	7,761	7.8	7.1	8.6
5 to 9.9	481	6,801	6.1	5.5	6.8
0 to 4.9	109	1,820	5.4	4.3	6.7

P-value(association)=0.0009, P-value(trend)=0.2196

Source: 2003 Washington State Behavioral Risk Factor Surveillance System (BRFSS) and 2000 U.S. Census. Lower CI and Upper CI show the 95% confidence interval around the percent. To link poverty with individual BRFSS survey data, obtained the zip code for each respondent and then used Census data to assign each respondent a number representing the percent of persons in the same zip code who lived below the federal poverty line.

Prevalence of Diabetes among Washington Adults by Neighborhood Education Level (Figure 8)

Percent population with college education	Numerator	Denominator	Percent	Lower CI	Upper CI
0 to 9.9	72	850	7.0	5.3	9.2
10 to 19.9	750	8,049	8.6	7.8	9.4
20 to 29.9	327	4,157	6.8	6.0	7.7
30 to 39.9	159	2,686	5.0	4.1	6.0
40+	119	2,458	4.5	3.6	5.5

P-value(association)=0.0000, P-value(trend)=0.0312
Source: 2003 Washington State Behavioral Risk Factor Surveillance System (BRFSS) and 2000 U.S. Census. Lower CI and Upper CI show the 95% confidence interval around the percent. To link educational attainment with individual BRFSS survey data, we obtained the zip code for each respondent and then Census data to assign each respondent a number representing the proportion of adults, ages 25 and older, in the same zip code who had completed college.

Prevalence of Diabetes among Adults by Age, Washington versus US (Figure 9)

	Washington State					U.S.
Age group	Numerator	Denominator	Percent	Lower CI	Upper CI	Percent
18 to 24	11	1,407	0.6	0.3	1.2	0.7
25 to 34	53	2,719	1.9	1.4	2.7	1.6
35 to 44	129	3,551	3.6	2.9	4.4	3.6
45 to 54	283	3,930	6.9	6.0	8.0	7.4
55 to 64	364	3,048	12.6	11.2	14.2	12.9
65 and over	616	3,925	15.9	14.5	17.4	16.1

P-value(association)=0.0000, P-value(trend)=0.0013
Source: 2003 Washington State Behavioral Risk Factor Surveillance System (BRFSS) and 2003 National BRFSS. Lower CI and Upper CI show the 95% confidence interval around the percent.

Age-adjusted Prevalence of Diabetes among Washington Adults by Sex

			Crude			Age-adjusted		
Sex	Numerator	Denominator	Percent	Lower CI	Upper CI	Percent	Lower CI	Upper CI
Male	1,170	14,396	6.7	6.2	7.2	7.0	6.6	7.5
Female	1,781	22,691	6.3	6.0	6.7	6.1	5.8	6.5

P-value(association)=0.2711
Source: 2003-2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Percentages age-adjusted to 2000 US population. Lower CI and Upper CI show the 95% confidence interval around the percent.

Age-adjusted Prevalence of Diabetes among Washington Adults by Race and Ethnicity (Figure 10)

			Crude			Age-adjusted		
Racial/ethnic group	Numerator	Denominator	Percent	Lower CI	Upper CI	Percent	Lower CI	Upper CI
Non-Hispanic White	2,572	32,227	6.6	6.3	6.9	6.2	5.9	6.5
Non-Hispanic Black	61	569	9.2	7.0	12.2	11.8	9.0	15.4
Non-Hispanic Asian/Pacific Islander	54	885	4.3	3.1	5.9	7.8	5.8	10.5

Non-Hispanic American Indian/Alaska Native	73	625	12.0	8.8	16.2	13.8	10.3	18.1
Hispanic	137	2,220	4.3	3.5	5.3	8.8	7.0	11.0

P-value(association)=0.0000
Source: 2003-2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Percentages age-adjusted to 2000 US population. Lower CI and Upper CI show the 95% confidence interval around the percent. Persons of Hispanic origin may be of any race.

Prevalence of Diabetes among Adults by Race and Ethnicity, Washington versus US, 2003 (Figure 11)

	Washington State					**U.S.**
Racial/ethnic group	**Numerator**	**Denominator**	**Percent**	**Lower CI**	**Upper CI**	**Percent**
White race only	1,286	16,625	6.5	6.1	7.0	6.5
Black race only	25	274	8.6	5.6	13.2	10.0
Hispanic	75	1,141	4.7	3.5	6.3	6.2

Source: 2003 Washington State Behavioral Risk Factor Surveillance System (BRFSS) and 2003 National BRFSS. Lower CI and Upper CI show the 95% confidence interval around the percent. Persons of Hispanic origin may be of any race. Persons who are white or black may be of any ethnicity.

Prevalence of Diabetes among Washington Adults by Body Mass Index (Figure 12)

Body Mass Index (BMI)	**Numerator**	**Denominator**	**Percent**	**Lower CI**	**Upper CI**
BMI <25.0 kg/m^2	228	7,171	2.7	2.3	3.2
BMI 25.0-<30.0 kg/m^2 (overweight)	389	6,338	5.5	4.9	6.3
BMI >=30.0 kg/m^2 (obese)	741	4,155	15.4	14.2	16.8

P-value(association)=0.0000
Source: 2003 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent.

Prevalence of Diabetes among Washington Adults by Leisure Time Physical Activity (Figure 13)

Physical activity (PA) **during leisure time**	**Numerator**	**Denominator**	**Percent**	**Lower CI**	**Upper CI**
Regularly active	505	9,283	4.7	4.2	5.2
Insufficiently active	533	6,541	6.7	6.0	7.5
No activity	310	1,853	15.0	13.0	17.1

P-value(association)=0.0000
Source: 2003 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent. Regularly active=meet CDC physical activity recommendations of moderate-intensity activity for 30+ minutes on 5+ days/week or vigorous-intensity activity for 20+ minutes on 3+ days/week. Insufficiently active=get some physical activity during leisure time, but do not meet CDC recommendations. No activity=less than 10 minutes of moderate physical activity during leisure time per week.

Prevalence of Diabetes among Washington Adults by Smoking Status (Figure 14)

Cigarette smoking	**Numerator**	**Denominator**	**Percent**	**Lower CI**	**Upper CI**
Ever smoked (former or current smoker)	790	8,878	7.8	7.1	8.5
Never smoked	660	9,651	5.6	5.1	6.2

P-value(association)=0.0000
Source: 2003 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent.

Age-Specific Prevalence of Diabetes among Washington Adults by Race and Ethnicity (Figure 15)

Racial/ethnic	**Age**	**Numerator**	**Denominator**	**Percent**	**Lower**	**Upper**	**Percent difference**

group	group				CI	CI	in prevalence (p-value)
Non-Hispanic White	18-44	298	11,951	2.1	1.8	2.4	*Ref*
	45-54	440	6,893	6.1	5.5	6.9	*Ref*
	55-64	684	5,778	12.1	11.0	13.2	*Ref*
	65+	1,147	7,575	15.1	14.1	16.1	*Ref*
Non-Hispanic Black	18-44	13	337	3.3	1.8	5.7	1.1 (0.22)
	45-54	18	106	17.5	10.4	27.8	11.3 (0.01)
	55-64	15	57	23.9	12.9	40.0	11.8 (0.09)
	65+	15	66	24.5	14.5	38.3	9.4 (0.13)
Non-Hispanic Asian/Pacific Islander	18-44	*	*	*	*	*	*
	45-54	*	*	*	*	*	*
	55-64	16	71	17.2	9.9	28.0	5.1 (0.27)
	65+	23	74	29.5	19.2	42.5	14.4 (0.02)
Non-Hispanic American Indian/Alaska Native	18-44	16	295	7.0	3.6	13.0	4.9 (0.03)
	45-54	22	130	16.5	9.4	27.4	10.3 (0.02)
	55-64	14	121	15.0	8.1	26.1	2.9 (0.52)
	65+	21	79	32.0	19.0	48.5	16.9 (0.03)
Hispanic	18-44	41	1,650	1.8	1.2	2.6	-0.3 (0.42)
	45-54	34	306	10.3	6.7	15.5	4.2 (0.06)
	55-64	27	137	17.4	11.1	26.3	5.3 (0.17)
	65+	35	125	23.4	15.6	33.6	8.3 (0.07)

*Percentages based on fewer than 10 in the numerator or 50 in the denominator are suppressed. Use caution in interpreting numerator cell sizes between 10 and 30.
Non-Hispanic white: P-value(association)=0.0000, P-value(trend)=0.0513; Non-Hispanic black: P-value(association)=0.0000, P-value(trend)=0.1638; Non-Hispanic Asian/Pacific Islander: P-value(association)=insufficient sample, P-value(trend)=insufficient sample; Non-Hispanic American Indian/Alaska Native: P-value(association)=0.0006, P-value(trend)=0.0714; Hispanic/Latino: P-value(association)=0.0000, P-value(trend)=0.0678
Source: 2003-2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent. Persons of Hispanic origin may be of any race. *Ref* indicates reference category for comparison of differences in prevalence.

CHAPTER THREE

Health Behaviors and Self Care among Washington Adults With and Without Diabetes

Self-management	Diabetes Status	Numerator	Denominator	Percent	Upper CI	Lower CI	p-value
Obese	With diabetes	1,455	2,754	50.9	48.5	53.3	0.0000
	Without diabetes	6,867	32,383	20.0	19.4	20.5	
Overweight	With diabetes	2,292	2,754	82.5	80.5	84.3	0.0000
	Without diabetes	18,597	32,383	56.8	56.1	57.5	
Met physical activity recommendations*	With diabetes	565	1,316	44.3	40.9	47.7	0.0000
	Without diabetes	9,717	15,648	64.2	63.2	65.1	
Cigarette smoking	With diabetes	447	2,938	16.0	14.3	17.9	0.0004
	Without diabetes	6,549	33,972	19.6	19.1	20.2	
Daily blood glucose monitoring**	With diabetes	987	1,465	65.2	61.9	68.3	--
	Without diabetes	NA	NA	NA	NA	NA	

*2003 BRFSS. **2004 BRFSS.
Source: 2003-2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent. NA=not applicable. Considered obese if body mass index 30.0+ kg/m^2, overweight if body mass index 30.0+ kg/m^2. Adults met recommended levels of physical activity if they engaged in moderate-intensity activity for 30+ minutes on 5+ days/week or vigorous-intensity activity for 20+ minutes on 3+ days/week during leisure time, or reported mostly walking or doing heavy or physically demanding labor at work.

Prevalence of Obesity among Washington Adults with Diabetes by Age

Age group	Numerator	Denominator	Percent	Lower CI	Upper CI

18 to 44	200	349	53.5	46.6	60.3
45 to 64	774	1,221	60.9	57.3	64.3
65 to 74	306	625	46.0	41.1	51.0
75 and over	175	559	29.4	25.1	34.2

P-value(association)=0.0000, P-value(trend)=0.2067
Source: 2003-2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent. Considered obese if body mass index 30.0+ kg/m^2.

Prevalence of Obesity among Washington Adults with Diabetes by Sex

Sex	Numerator	Denominator	Percent	Lower CI	Upper CI
Male	546	1,146	47.4	43.8	51.1
Female	909	1,608	54.8	51.6	57.8

P-value(association)=0.0027
Source: 2003-2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent. Considered obese if body mass index 30.0+ kg/m^2.

Prevalence of Obesity among Washington Adults with Diabetes by Education Level (Figure 17)

Education level	Numerator	Denominator	Percent	Lower CI	Upper CI
Less than high school	159	320	46.1	39.4	52.9
High school graduate/GED	440	800	56.8	52.2	61.2
Some post high school	522	944	54.1	49.9	58.2
College graduate	333	685	43.1	38.5	47.8

P-value(association)=0.0001, P-value(trend)=0.5564
Source: 2003-2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent. Considered obese if body mass index 30.0+ kg/m^2.

Prevalence of Overweight and Obesity among Washington Adults with Diabetes by Race and Ethnicity (Figure 18)

Race group	Numerator	Denominator	Percent	Lower CI	Upper CI
Non-Hispanic White	1,999	2,404	82.4	80.2	84.3
Non-Hispanic Black	46	57	84.6	72.1	92.1
Non-Hispanic Asian/Pacific Islander	35	54	64.9	48.9	78.2
Non-Hispanic American Indian/Alaska Native	61	69	88.1	76.0	94.5
Hispanic	107	121	87.3	77.1	93.3

P-value(association)=0.0215
Source: 2003-2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent. Considered overweight if body mass index 25.0-29.9 kg/m^2, consider obese if body mass index 30.0+ kg/m^2. Persons of Hispanic origin may be of any race.

Percent of Washington Adults with Diabetes who Meet Recommended Levels of Physical Activity by Age

Age group	Numerator	Denominator	Percent	Lower CI	Upper CI
18 to 44	105	179	51.2	41.9	60.4
45 to 64	267	593	46.6	41.6	51.7
65 to 74	122	301	44.0	37.0	51.3
75 and over	70	241	31.4	24.6	39.2

P-value(association)=0.0043, P-value(trend)=0.0986
Source: 2003 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent. Adults met recommended levels of physical activity if they engaged in moderate-intensity activity for 30+ minutes on 5+ days/week or vigorous-intensity activity for 20+ minutes on 3+ days/week during leisure time, or reported mostly walking or doing heavy or physically demanding labor at work.

Percent of Washington Adults with Diabetes who Meet Recommended Levels of Physical Activity by Income Level (Figure 19)

Annual household income	Numerator	Denominator	Percent	Lower CI	Upper CI
<$15,000	81	224	36.8	28.4	46.1
$15,000-$24,999	125	293	42.7	35.6	50.2
$25,000-$34,999	72	177	37.3	28.9	46.7
$35,000-$49,999	99	215	42.7	34.8	51.0
$50,000-$74,999	77	136	61.9	51.9	71.0
$75,000 or more	58	118	53.2	42.7	63.5

P-value(association)=0.0017, P-value(trend)=0.0582
Source: 2003 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent. Adults met recommended levels of physical activity if they engaged in moderate-intensity activity for 30+ minutes on 5+ days/week or vigorous-intensity activity for 20+ minutes on 3+ days/week during leisure time, or reported mostly walking or doing heavy or physically demanding labor at work.

Percent of Washington Adults with Diabetes who Meet Recommended Levels of Physical Activity by Education Level (Figure 20)

Education level	Numerator	Denominator	Percent	Lower CI	Upper CI
Less than high school	62	175	36.5	27.9	46.1
High school graduate/GED	131	353	35.0	29.0	41.6
Some post high school	203	462	45.1	39.3	51.1
College graduate	168	325	55.3	48.6	61.9

P-value(association)=0.0001, P-value(trend)=0.0495
Source: 2003 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent. Adults met recommended levels of physical activity if they engaged in moderate-intensity activity for 30+ minutes on 5+ days/week or vigorous-intensity activity for 20+ minutes on 3+ days/week during leisure time, or reported mostly walking or doing heavy or physically demanding labor at work.

Prevalence of Current Cigarette Smoking among Washington Adults with Diabetes by Age

Age group	Numerator	Denominator	Percent	Lower CI	Upper CI
18 to 44	108	379	28.6	23.1	34.7
45 to 64	249	1,301	18.8	16.2	21.6
65 to 74	60	675	7.7	5.5	10.7
75 and over	29	580	6.0	3.9	9.0

P-value(association)=0.0000, P-value(trend)=0.0265
Source: 2003-2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent.

Prevalence of Current Cigarette Smoking among Washington Adults with Diabetes by Income Level (Figure 21)

Annual household income	Numerator	Denominator	Percent	Lower CI	Upper CI
<$15,000	110	471	24.9	19.9	30.6
$15,000-$24,999	117	690	19.3	15.4	23.9
$25,000-$34,999	65	397	19.1	14.5	24.9
$35,000-$49,999	53	454	12.9	9.5	17.3
$50,000-$74,999	37	291	13.7	9.5	19.3
$75,000 or more	21	244	9.1	5.6	14.5

P-value(association)=0.0002, P-value(trend)=0.0030
Source: 2003-2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent.

Prevalence of Current Cigarette Smoking among Washington Adults with Diabetes by Education Level (Figure 22)

Education level	Numerator	Denominator	Percent	Lower CI	Upper CI
Less than high school	74	345	24.2	18.8	30.5
High school graduate/GED	139	854	17.9	14.6	21.8
Some post high school	158	1,012	15.7	13.0	18.8
College graduate	74	716	11.4	8.7	14.8

P-value(association)=0.0006, P-value(trend)=0.0179
Source: 2003-2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent.

Access to Care among Washington Adults With and Without Diabetes

Access to Care	Diabetes status	Numerator	Denominator	Percent	Lower CI	Upper CI	p-value
Health insurance coverage	With diabetes	2,738	2,947	91.3	89.7	92.6	0.0000
	Without diabetes	29,524	34,039	84.9	84.3	85.4	
Personal health care provider	With diabetes	2,797	2,945	94.3	93.0	95.3	0.0000
	Without diabetes	27,507	34,002	77.6	77.0	78.2	

Source: 2003-2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent.

Percent of Washington Adults with Diabetes who Have Health Insurance Coverage by Age

Age group	Numerator	Denominator	Percent	Lower CI	Upper CI
18 to 44	319	380	81.7	75.9	86.4
45 to 64	1,174	1,303	89.2	86.7	91.3
65 to 74	667	676	98.8	97.4	99.4
75 and over	577	585	98.1	95.7	99.1

P-value(association)=0.0000, P-value(trend)=0.3309
Source: 2003-2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent.

Percent of Washington Adults with Diabetes who Have a Regular Health Care Provider by Age

Age group	Numerator	Denominator	Percent	Lower CI	Upper CI
18 to 44	338	381	87.4	82.3	91.2
45 to 64	1,235	1,300	94.4	92.6	95.8
65 to 74	657	675	98.3	97.0	99.1
75 and over	565	586	96.5	94.2	97.9

P-value(association)=0.0000, P-value(trend)=0.3957
Source: 2003-2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent.

Percent of Washington Adults with Diabetes who Have Health Insurance Coverage by Income Level (Figure 23)

Annual household income	Numerator	Denominator	Percent	Lower CI	Upper CI
<$15,000	416	474	83.7	77.9	88.2
$15,000-$24,999	619	693	85.8	81.4	89.3
$25,000-$34,999	371	399	89.1	83.9	92.8
$35,000-$49,999	433	455	93.9	90.1	96.3
$50,000-$74,999	283	291	96.4	92.1	98.4
$75,000 or more	241	244	98.5	95.0	99.5

P-value(association)=0.0000, P-value(trend)=0.0002

Source: 2003-2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent.

Percent of Washington Adults with Diabetes who Have a Regular Health Care Provider by Income Level (Figure 23)

Annual household income	Numerator	Denominator	Percent	Lower CI	Upper CI
<$15,000	435	473	89.2	83.9	92.9
$15,000-$24,999	652	692	93.0	89.6	95.3
$25,000-$34,999	387	399	96.0	92.2	98.0
$35,000-$49,999	437	455	95.5	92.4	97.3
$50,000-$74,999	273	289	93.2	88.8	96.0
$75,000 or more	242	244	99.3	97.0	99.8

P-value(association)=0.0004, P-value(trend)=0.0140
Source: 2003-2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent.

Percent of Washington Adults with Diabetes who Have Health Insurance Coverage by Education Level (Figure 24)

Education level	Numerator	Denominator	Percent	Lower CI	Upper CI
Less than high school	308	347	85.0	78.8	89.6
High school graduate/GED	786	857	88.8	85.3	91.5
Some post high school	944	1,014	91.5	88.7	93.7
College graduate	689	718	95.8	93.0	97.5

P-value(association)=0.0002, P-value(trend)=0.0042
Source: 2003-2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent.

Percent of Washington Adults with Diabetes who Have a Regular Health Care Provider by Education Level (Figure 24)

Education level	Numerator	Denominator	Percent	Lower CI	Upper CI
Less than high school	316	345	89.5	83.2	93.6
High school graduate/GED	815	857	94.2	91.9	96.0
Some post high school	967	1,014	94.7	92.4	96.3
College graduate	688	718	95.6	93.3	97.1

P-value(association)=0.0402, P-value(trend)=0.2009
Source: 2003-2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent.

Percent of Washington Adults with Diabetes who Have Health Insurance Coverage by Race and Ethnicity (Figure 25)

Racial/ethnic group	Numerator	Denominator	Percent	Lower CI	Upper CI
Non-Hispanic White	2,410	2,569	93.0	91.5	94.2
Non-Hispanic Black	53	61	84.0	68.8	92.6
Non-Hispanic Asian/Pacific Islander	46	54	79.9	60.7	91.2
Non-Hispanic American Indian/Alaska Native	68	73	85.3	64.2	95.0
Hispanic	111	137	76.0	65.1	84.3

P-value(association)=0.0000

Source: 2003-2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent. Persons of Hispanic origin may be of any race.

Percent of Washington Adults with Diabetes who Have a Regular Health Care Provider by Race and Ethnicity (Figure 25)

Racial/ethnic group	Numerator	Denominator	Percent	Lower CI	Upper CI
Non-Hispanic White	2,464	2,566	95.9	94.9	96.8
Non-Hispanic Black	56	61	92.7	82.9	97.1
Non-Hispanic Asian/Pacific Islander	47	54	88.5	76.2	94.8
Non-Hispanic American Indian/Alaska Native	65	73	80.7	61.1	91.7
Hispanic	116	137	81.2	70.3	88.7

P-value(association)=0.0000
Source: 2003-2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent. Persons of Hispanic origin may be of any race.

Prevalence of Diabetes among Washington Adults by County (Figure 26)

County	Numerator	Denominator	Percent	Lower CI	Upper CI
Adams	43	430	7.1	5.1	9.7
Asotin	59	467	11.4	8.6	15.0
Benton	62	697	6.9	5.3	9.0
Chelan	40	557	6.2	4.4	8.5
Clallam	57	582	8.8	6.5	11.6
Clark	156	2,004	7.4	6.2	8.8
Columbia	35	429	8.0	4.4	14.3
Cowlitz	59	602	7.3	5.5	9.6
Douglas	40	486	8.4	6.0	11.7
Ferry	33	422	6.6	4.4	9.7
Franklin	35	484	5.1	3.5	7.2
Garfield	51	448	9.8	7.2	13.3
Grant	53	572	7.5	5.6	10.1
Grays Harbor	55	551	8.9	6.7	11.9
Island	44	587	5.6	4.1	7.6
Jefferson	44	470	7.6	5.5	10.4
King	344	5,917	5.1	4.5	5.7
Kitsap	133	1,756	6.8	5.6	8.2
Kittitas	37	475	6.0	4.2	8.4
Klickitat	34	470	5.8	4.0	8.2
Lewis	48	538	6.7	4.9	9.0
Lincoln	34	441	6.3	4.2	9.2
Mason	51	502	10.2	7.1	14.4
Okanogan	44	499	8.4	6.0	11.6
Pacific	53	500	8.5	6.3	11.2
Pend Oreille	48	474	11.0	7.2	16.4
Pierce	275	3,022	7.7	6.8	8.8
San Juan	16	459	3.3	1.9	5.7
Skagit	53	605	7.7	5.7	10.3
Skamania	30	434	4.8	3.1	7.4

Snohomish	200	2,890	6.1	5.2	7.1
Spokane	188	2,228	7.4	6.3	8.6
Stevens	58	648	7.9	5.3	11.5
Thurston	131	1,834	6.0	4.9	7.2
Wahkiakum	46	424	11.3	4.7	24.6
Walla Walla	46	531	7.5	5.5	10.2
Whatcom	45	748	5.1	3.7	7.0
Whitman	47	515	7.3	5.2	10.0
Yakima	124	1,384	7.7	6.4	9.3
Statewide	2,951	37,087	6.5	6.2	6.8

*Percentages based on fewer than 10 in the numerator or 50 in the denominator are suppressed. Use caution in interpreting numerator cell sizes between 10 and 30.
Source: 2003-2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent.

Physician Need by County, Washington (Figure 26)

County	Population per primary care physician	Physician Need
Adams	1,349	Low
Asotin	2,000	Medium
Benton	1,273	Low
Chelan	1,590	Medium
Clallam	1,484	Low
Clark	1,916	Medium
Columbia	1,139	Low
Cowlitz	1,460	Low
Douglas	1,590	Medium
Ferry	1,175	Low
Franklin	1,724	Medium
Garfield	2,667	High
Grant	1,569	Medium
Grays Harbor	1,989	Medium
Island	2,639	High
Jefferson	2,044	High
King	1,218	Low
Kitsap	2,001	High
Kittitas	1,848	Medium
Klickitat	1,970	Medium
Lewis	1,624	Medium
Lincoln	2,244	High
Mason	3,392	High
Okanogan	1,660	Medium
Pacific	2,367	High
Pend Oreille	2,259	High
Pierce	2,000	Medium
San Juan	1,914	Medium
Skagit	1,245	Low
Skamania	2,000	Medium

Snohomish	2,035	High
Spokane	1,632	Medium
Stevens	1,695	Medium
Thurston	1,705	Medium
Wahkiakum	2,167	High
Walla Walla	1,359	Low
Whatcom	1,330	Low
Whitman	1,428	Low
Yakima	1,180	Low

Source: 2005 Washington State Primary Care Clinic Inventory and 2004 Washington State Office of Financial Management (OFM) population estimates. The data are population per primary care physician Full Time Equivalents (headcount by .9). This provides a general measure of overall primary care capacity and is categorized as follows: low need is less than 1500:1 (population per physician), medium need is 1500 -2000:1, high need is over 2000:1

Prevalence of Receiving Different Processes of Care among Washington Adults With and Without Diabetes

Process Measures	Diabetes Status	Numerator	Denominator	Percent	Lower CI	Upper CI	p-value
Biannual A1c test	With diabetes	979	1,316	75.6	72.5	78.4	--
	Without diabetes	NA	NA	NA	NA	NA	
Annual foot exam	With diabetes	1,087	1,464	75.1	72.1	77.8	--
	Without diabetes	NA	NA	NA	NA	NA	
Annual dilated eye exam	With diabetes	1,057	1,470	71.3	68.1	74.2	--
	Without diabetes	NA	NA	NA	NA	NA	
Receipt of multiple preventive services	With diabetes	311	1,244	22.3	19.6	25.2	--
	Without diabetes	NA	NA	NA	NA	NA	
Previous diabetes self-management class	With diabetes	965	1,485	66.5	63.4	69.6	--
	Without diabetes	NA	NA	NA	NA	NA	
Cholesterol screen	With diabetes	1,225	1,400	86.9	84.4	89.1	0.0000
	Without diabetes	8,775	16,577	48.2	47.3	49.2	
Influenza vaccination	With diabetes	930	1,492	60.7	57.4	63.9	0.0000
	Without diabetes	6,072	16,945	32.2	31.3	33.1	
Pneumococcal vaccination	With diabetes	833	1,433	53.8	50.4	57.2	0.0000
	Without diabetes	4,103	15,637	22.4	21.6	23.3	
Advised to quit smoking by health care professional*	With diabetes	155	276	53.3	45.4	60.9	0.6379
	Without diabetes	2,098	4,120	51.3	49.3	53.4	
Offered help to quit smoking*	With diabetes	78	153	52.2	41.7	62.5	0.9447
	Without diabetes	1,067	2,082	51.8	48.9	54.7	
Regular aspirin use	With diabetes	301	492	61.7	56.4	66.7	0.0000
	Without diabetes	1,276	4,461	26.5	25.1	28.1	

*2003-2004 BRFSS.
Source: 2003 and 2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). NA=not applicable. Lower CI and Upper CI show the 95% confidence interval around the percent. Multiple preventive services includes: biannual A1c test, annual foot exam, annual dilated eye exam, annual flu shot, and previous pneumococcal vaccination.

Prevalence of Biannual A1C Tests among Washington Adults with Diabetes by Income Level (Figure 27)

Annual household income	Numerator	Denominator	Percent	Lower CI	Upper CI
<$15,000	138	184	75.1	65.1	83.0
$15,000-$24,999	246	322	80.5	74.4	85.4

$25,000-$34,999	136	191	65.8	56.5	74.1
$35,000-$49,999	160	210	75.7	68.0	82.1
$50,000-$74,999	94	137	71.5	61.8	79.6
$75,000 or more	95	118	84.1	75.1	90.2

P-value(association)=0.0248, P-value(trend)=0.7249
Source: 2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent.

Prevalence of Annual Foot Exams among Washington Adults with Diabetes by Age (Figure 28)

Age group	Numerator	Denominator	Percent	Lower CI	Upper CI
18 to 44	133	187	70.5	61.4	78.2
45 to 64	506	644	79.2	74.9	82.9
65 to 74	253	342	76.9	71.1	81.9
75 and over	195	290	67.4	60.5	73.7

P-value(association)=0.0125, P-value(trend)=0.5280
Source: 2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent.

Prevalence of Annual Dilated Eye Exams among Washington Adults with Diabetes by Age

Age group	Numerator	Denominator	Percent	Lower CI	Upper CI
18 to 44	113	186	61.8	52.4	70.3
45 to 64	454	648	70.0	65.1	74.5
65 to 74	264	343	77.2	70.9	82.5
75 and over	226	292	77.1	70.5	82.5

P-value(association)=0.0076, P-value(trend)=0.1039
Source: 2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent.

Prevalence of Annual Dilated Eye Exams among Washington Adults with Diabetes by Education Level (Figure 29)

Education level	Numerator	Denominator	Percent	Lower CI	Upper CI
Less than high school	90	146	57.0	46.6	66.8
High school graduate/GED	302	454	63.3	57.0	69.2
Some post high school	381	502	75.5	70.3	80.0
College graduate	280	361	78.3	72.5	83.2

P-value(association)=0.0000, P-value(trend)=0.0659
Source: 2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS).
Lower CI and Upper CI show the 95% confidence interval around the percent.

Prevalence of Annual Flu Shot among Washington Adults with Diabetes by Age (Figure 30)

Age group	Numerator	Denominator	Percent	Lower CI	Upper CI
18 to 44	80	188	36.5	28.3	45.7
45 to 64	389	657	59.9	55.1	64.6
65 to 74	230	343	68.4	62.1	74.2
75 and over	231	303	76.1	69.7	81.6

P-value(association)=0.0000, P-value(trend)=0.0957
Source: 2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent.

Prevalence of Lifetime Pneumococcal Vaccination among Washington Adults with Diabetes by Age (Figure 30)

Age group	Numerator	Denominator	Percent	Lower CI	Upper CI

18 to 44	52	171	33.2	23.9	44.1
45 to 64	324	632	45.6	40.6	50.6
65 to 74	227	337	67.1	60.5	73.0
75 and over	230	292	77.9	71.5	83.2

P-value(association)=0.0000, P-value(trend)=0.0280
Source: 2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent.

Prevalence of Lifetime Pneumococcal Vaccination among Washington Adults with Diabetes by Sex

Sex	Numerator	Denominator	Percent	Lower CI	Upper CI
Male	299	544	50.3	44.9	55.7
Female	534	889	57.3	53.1	61.3

P-value(association)=0.0454
Source: 2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent.

Prevalence of Receiving Multiple Diabetes-Related Preventive Care Services among Washington Adults with Diabetes by Age

Age group	Numerator	Denominator	Percent	Lower CI	Upper CI
18 to 44	22	159	9.9	5.8	16.4
45 to 64	129	572	20.6	16.9	24.8
65 to 74	96	289	35.1	28.4	42.4
75 and over	64	223	25.7	19.5	33.1

P-value(association)=0.0000, P-value(trend)=0.3341
Source: 2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent. Multiple preventive services includes: biennial A1c test, annual foot exam, annual dilated eye exam, annual flu shot, and previous pneumococcal vaccination.

Prevalence of Receiving Multiple Diabetes-Related Preventive Care Services among Washington Adults with Diabetes by Income Level (Figure 31)

Annual household income	Numerator	Denominator	Percent	Lower CI	Upper CI
<$15,000	39	174	20.6	14.0	29.2
$15,000-$24,999	71	306	18.6	14.2	24.1
$25,000-$34,999	51	179	27.1	19.8	36.0
$35,000-$49,999	66	202	31.9	24.6	40.3
$50,000-$74,999	27	129	16.9	11.1	24.9
$75,000 or more	25	111	21.2	13.8	31.1

P-value(association)=0.0284, P-value(trend)=0.6877
Source: 2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent. Multiple preventive services includes: biennial A1c test, annual foot exam, annual dilated eye exam, annual flu shot, and previous pneumococcal vaccination.

Prevalence of Receiving Multiple Diabetes-Related Preventive Care Services among Washington Adults with Diabetes by Education Level (Figure 32)

Education level	Numerator	Denominator	Percent	Lower CI	Upper CI
Less than high school	21	109	15.1	8.9	24.6
High school graduate/GED	79	373	17.6	13.6	22.4
Some post high school	118	429	24.4	19.8	29.6
College graduate	93	330	26.1	20.7	32.4

P-value(association)=0.0399, P-value(trend)=0.0577
Source: 2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent. Multiple preventive services includes: biennial A1c test, annual foot exam, annual dilated eye exam, annual flu shot, and previous pneumococcal vaccination.

Prevalence of Annual Cholesterol Screening among Washington Adults with Diabetes by Age

Age group	Numerator	Denominator	Percent	Lower CI	Upper CI
18 to 44	127	186	73.2	65.0	80.1
45 to 64	568	635	89.5	86.1	92.2
65 to 74	302	322	94.4	90.0	96.9
75 and over	227	256	86.5	79.2	91.5

P-value(association)=0.0000, P-value(trend)=0.5259
Source: 2003 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent.

Prevalence of Annual Cholesterol Screening among Washington Adults with Diabetes by Sex

Sex	Numerator	Denominator	Percent	Lower CI	Upper CI
Male	514	569	90.1	86.5	92.8
Female	711	831	83.6	79.9	86.7

P-value(association)=0.0073
Source: 2003 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent.

Prevalence of Hypertension and High Blood Cholesterol among Washington Adults With and Without Diabetes

Health Outcomes	Diabetes Status	Numerator	Denominator	Percent	Lower CI	Upper CI	p-value
Hypertension	With diabetes	965	1,449	66.0	62.8	69.0	0.0000
	Without diabetes	4,151	17,099	20.8	20.0	21.5	
Blood pressure medication	With diabetes	861	958	88.2	85.0	90.8	0.0000
	Without diabetes	2,880	4,144	63.7	61.7	65.6	
High blood cholesterol	With diabetes	780	1,357	57.4	54.0	60.7	0.0000
	Without diabetes	4,499	13,371	31.1	30.2	32.1	

Source: 2003 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent. High blood cholesterol assessed among adults who ever had cholesterol screen by health care professional.

Prevalence of Hypertension among Washington Adults with Diabetes by Age (Figure 33)

Age group	Numerator	Denominator	Percent	Lower CI	Upper CI
18 to 44	74	190	45.7	36.8	54.8
45 to 64	435	647	66.9	62.2	71.4
65 to 74	248	329	75.1	68.9	80.4
75 and over	207	281	74.1	67.5	79.8

P-value(association)=0.0000, P-value(trend)=0.2494
Source: 2003 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent.

Prevalence of Hypertension among Washington Adults with Diabetes by Income Level (Figure 34)

Annual household income	Numerator	Denominator	Percent	Lower CI	Upper CI
<$15,000	171	248	64.4	55.5	72.4
$15,000-$24,999	228	322	73.3	66.7	79.0
$25,000-$34,999	124	187	63.2	53.7	71.8
$35,000-$49,999	148	233	66.9	59.2	73.8
$50,000-$74,999	97	145	68.7	59.2	76.9
$75,000 or more	67	123	52.8	42.5	62.9

P-value(association)=0.0191, P-value(trend)=0.3515
Source: 2003 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent.

Percent of Washington Adults with Diabetes Who Take Medication for High Blood Pressure by Age

Age group	Numerator	Denominator	Percent	Lower CI	Upper CI
18 to 44	53	74	72.0	57.8	82.9
45 to 64	384	431	87.3	82.3	91.0
65 to 74	232	246	94.8	90.1	97.3
75 and over	191	206	93.5	87.0	96.8

P-value(association)=0.0000, P-value(trend)=0.2731
Source: 2003 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent.

Percent of Washington Adults with Diabetes Who Regularly Use Aspirin by Age

Age group	Numerator	Denominator	Percent	Lower CI	Upper CI
35 to 44	16	53	32.8	19.5	49.6
45 to 64	143	221	64.9	56.9	72.0
65 to 74	77	117	68.7	57.8	77.8
75 and over	65	100	64.9	53.4	74.9

P-value(association)=0.0007, P-value(trend)=0.2320
Source: 2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent.

Percent of Washington Adults with Diabetes Who Regularly Use Aspirin by Sex

Sex	Numerator	Denominator	Percent	Lower CI	Upper CI
Male	144	208	70.0	62.2	76.8
Female	157	283	52.9	45.9	59.7

P-value(association)=0.0013
Source: 2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent.

Percent of Washington Adult Smokers with Diabetes Who Were Advised to Quit Smoking by Health Care Provider by Age

Age group	Numerator	Denominator	Percent	Lower CI	Upper CI
18 to 44	35	58	49.8	34.1	65.6
45 to 64	101	164	61.7	51.8	70.6
65 and over	19	54	27.8	14.9	45.9

P-value(association)=0.0109
Source: 2003-2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent.

Prevalence of Diabetes Self-Management Education among Washington Adults with Diabetes by Income Level (Figure 35)

Annual household income	Numerator	Denominator	Percent	Lower CI	Upper CI
<$15,000	139	223	66.4	57.3	74.4
$15,000-$24,999	226	370	60.0	53.1	66.6
$25,000-$34,999	129	210	60.7	52.1	68.6
$35,000-$49,999	155	220	69.2	61.1	76.3
$50,000-$74,999	102	145	74.3	65.2	81.7
$75,000 or more	93	121	76.0	66.0	83.7

P-value(association)=0.0206, P-value(trend)=0.0483
Source: 2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent.

Prevalence of Diabetes Self-Management Education among Washington Adults with Diabetes by Education Level (Figure 36)

Education level	Numerator	Denominator	Percent	Lower CI	Upper CI
Less than high school	73	149	51.5	41.6	61.4
High school graduate/GED	274	458	58.0	51.8	64.0
Some post high school	353	506	71.5	66.3	76.1
College graduate	260	365	73.2	67.2	78.5

P-value(association)=0.0000, P-value(trend)=0.0961
Source: 2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent.

Prevalence of Poor Physical or Mental Health Days in Past Month among Washington Adults With and Without Diabetes (Figure 37)

Health Status	Diabetes Status	Numerator	Denominator	Percent	Lower CI	Upper CI	p-value
Poor physical health (1+ days per month)	With diabetes	1,562	2,832	53.2	50.8	55.6	0.0000
	Without diabetes	12,191	33,491	36.2	35.6	36.9	
Poor physical health (14+ days per month)	With diabetes	876	2,832	28.6	26.5	30.7	0.0000
	Without diabetes	3,723	33,491	9.6	9.2	10.0	
Poor mental health (1+ days per month)	With diabetes	1,049	2,870	37.6	35.3	39.9	0.9930
	Without diabetes	12,055	33,520	37.6	36.9	38.2	
Poor mental health (14+ days per month)	With diabetes	445	2,870	15.7	14.1	17.5	0.0000
	Without diabetes	3,462	33,520	10.0	9.6	10.5	
Poor physical or mental health (1+ days per month)	With diabetes	1,799	2,768	64.8	62.5	67.1	0.0000
	Without diabetes	17,760	32,993	54.7	54.0	55.4	
Poor physical or mental health (14+ days per month)	With diabetes	1,048	2,768	35.9	33.7	38.2	0.0000
	Without diabetes	6,181	32,993	17.5	17.0	18.1	
Inability to perform usual activities due to poor health (1+ days per month)	With diabetes	1,014	2,884	34.4	32.2	36.7	0.0000
	Without diabetes	7,506	33,821	22.1	21.5	22.7	
Inability to perform usual activities due to poor health (14+ days per month)	With diabetes	533	2,884	17.9	16.2	19.7	0.0000
	Without diabetes	2,205	33,821	5.6	5.3	5.9	

Source: 2003-2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent.

Prevalence of Poor Mental Health Days in Past Month among Washington Adults with Diabetes by Age (Figure 38)

At least one day in past month of poor mental health:

Age group	Numerator	Denominator	Percent	Lower CI	Upper CI
18 to 44	218	374	57.3	50.6	63.8
45 to 64	553	1,274	42.2	38.8	45.7
65 to 74	160	650	24.3	20.3	28.8
75 and over	117	569	21.0	17.2	25.3

P-value(association)=0.0000, P-value(trend)=0.0187

Source: 2003-2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent.

Prevalence of Poor Physical Health Days in Past Month among Washington Adults with Diabetes by Sex
At least one day in past month of poor physical health:

Sex	Numerator	Denominator	Percent	Lower CI	Upper CI
Male	548	1,135	47.3	43.7	51.0
Female	1,014	1,697	59.4	56.4	62.3

P-value(association)=0.0000
Source: 2003-2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent.

Prevalence of Poor Mental Health Days in Past Month among Washington Adults with Diabetes by Sex
At least one day in past month of poor mental health:

Sex	Numerator	Denominator	Percent	Lower CI	Upper CI
Male	351	1,138	33.6	30.2	37.2
Female	698	1,732	41.6	38.7	44.6

P-value(association)=0.0007
Source: 2003-2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent.

Prevalence of Poor Physical or Mental Health Days in Past Month among Washington Adults with Diabetes, by Income Level
At least one day in past month of poor physical or mental health:

Annual household income	Numerator	Denominator	Percent	Lower CI	Upper CI
<$15,000	340	442	74.5	67.3	80.6
$15,000-$24,999	449	647	69.4	64.5	74.0
$25,000-$34,999	222	374	62.0	55.6	68.0
$35,000-$49,999	272	434	63.3	57.7	68.6
$50,000-$74,999	172	285	61.0	54.0	67.7
$75,000 or more	132	240	57.7	50.3	64.8

P-value(association)=0.0035, P-value(trend)=0.0048
Source: 2003-2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent.

Association Between Poor Physical or Mental Health Days in Past Month and Income Level among Washington Adults with Diabetes (Figure 39)
At least one day in past month of poor physical or mental health:

Annual household income	Odds ratio	Lower CI	Upper CI	p-value
<$15,000	2.1	1.4	3.4	0.001
$15,000-$24,999	1.7	1.1	2.4	0.007
$25,000-$34,999	1.2	0.8	1.8	0.383
$35,000-$49,999	1.3	0.9	1.9	0.225
$50,000-$74,999	1.1	0.8	1.7	0.512
$75,000 or more	1.0			

Source: 2003-2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the odds ratio. The overall effect of income on poor mental and physical health days was significant (p-value=0.0062).

Prevalence of Poor Physical or Mental Health Days in Past Month among Washington Adults with Diabetes by Education Level
At least one day in past month of poor physical or mental health:

Education level	Numerator	Denominator	Percent	Lower CI	Upper CI
Less than high	215	308	69.3	62.3	75.5

school					
High school graduate/GED	509	800	64.4	59.9	68.7
Some post high school	651	960	67.8	63.8	71.6
College graduate	417	689	60.0	55.3	64.4

P-value(association)=0.0336, P-value(trend)=0.3835
Source: 2003-2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent.

Association Between Poor Physical or Mental Health Days in Past Month and Education Level among Washington Adults with Diabetes (Figure 40)
At least one day in past month of poor physical or mental health:

Education level	Odds ratio	Lower CI	Upper CI	p-value
Less than high school	1.5	1.0	2.2	0.028
High school graduate/GED	1.2	0.9	1.6	0.168
Some post high school	1.4	1.1	1.8	0.01
College graduate	1.0			

Source: 2003-2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the odds ratio. The overall effect of education on poor mental and physical health days was significant (p-value=0.0384).

Prevalence of Limited Activity Days due to Poor Health among Washington Adults with Diabetes by Age
At least one day in past month when poor physical or mental health prevented usual activities:

Age group	Numerator	Denominator	Percent	Lower CI	Upper CI
18 to 44	164	374	37.1	31.2	43.4
45 to 64	492	1,278	38.6	35.2	42.0
65 to 74	209	659	29.4	25.3	33.9
75 and over	149	570	26.9	22.6	31.7

P-value(association)=0.0003, P-value(trend)=0.1275
Source: 2003-2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent.

Prevalence of Limited Activity Days due to Poor Health among Washington Adults with Diabetes by Sex
At least one day in past month when poor physical or mental health prevented usual activities:

Sex	Numerator	Denominator	Percent	Lower CI	Upper CI
Male	340	1,148	30.4	27.1	33.8
Female	674	1,736	38.6	35.8	41.5

P-value(association)=0.0003
Source: 2003-2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent.

Prevalence of Limited Activity Days due to Poor Health among Washington Adults with Diabetes by Income Level (Figure 41)
14 days or more in past month when poor physical or mental health prevented usual activities:

Annual household income	Numerator	Denominator	Percent	Lower CI	Upper CI
<$15,000	151	456	32.3	26.8	38.5
$15,000-$24,999	138	681	19.3	15.7	23.5
$25,000-$34,999	55	396	18.6	13.9	24.5
$35,000-$49,999	70	448	18.1	13.9	23.2
$50,000-$74,999	24	289	8.7	5.5	13.4
$75,000 or more	19	242	7.4	4.4	12.2

P-value(association)=0.0000, P-value(trend)=0.0107

Source: 2003-2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent.

Prevalence of Limited Activity Days due to Poor Health among Washington Adults with Diabetes by Education Level (Figure 42)

14 days or more in past month when poor physical or mental health prevented usual activities:

Education level	Numerator	Denominator	Percent	Lower CI	Upper CI
Less than high school	90	328	28.1	22.4	34.6
High school graduate/GED	160	841	20.4	17.0	24.4
Some post high school	183	993	16.9	14.2	20.0
College graduate	99	712	13.1	10.4	16.3

P-value(association)=0.0000, P-value(trend)=0.0059

Source: 2003-2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent.

Prevalence of Retinopathy and Foot Ulcers among Washington Adults With Diabetes

Health Outcomes	Numerator	Denominator	Percent	Lower CI	Upper CI
Retinopathy	314	1,478	22.4	19.6	25.5
Foot ulcers	211	1,487	14.2	12.0	16.7

Source: 2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent.

Prevalence of Retinopathy among Washington Adults with Diabetes by Income Level (Figure 43)

Annual household income	Numerator	Denominator	Percent	Lower CI	Upper CI
<$15,000	64	222	33.8	24.2	45.1
$15,000-$24,999	92	367	26.6	20.8	33.3
$25,000-$34,999	33	210	18.5	12.7	26.3
$35,000-$49,999	43	221	19.9	14.3	26.9
$50,000-$74,999	25	145	15.9	8.7	27.3
$75,000 or more	21	121	16.5	10.1	25.8

P-value(association)=0.0240, P-value(trend)=0.0087

Source: 2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent.

Prevalence of Previous Foot Ulcer among Washington Adults with Diabetes by Age (Figure 44)

Age group	Numerator	Denominator	Percent	Lower CI	Upper CI
18 to 44	41	188	22.2	15.2	31.1
45 to 64	97	656	13.5	10.6	17.1
65 to 74	42	344	12.4	8.7	17.3
75 and over	31	298	10.4	6.8	15.6

P-value(association)=0.0161, P-value(trend)=0.1039

Source: 2004 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the percent.

Diabetes-Related Hospitalizations by First-Listed Diagnosis, Washington (Figure 45)

First-listed diagnosis	Number of hospital discharges	Percent of diabetes-related hospital discharges	Crude			Age-adjusted rate			Length of stay (days)	Average length of stay in days (min-max)	Total hospital charges ($)	Average charge per discharge ($)
			Rate	Lower CI	Upper CI	Rate	Lower CI	Upper CI				
Diabetes	5,838	8.3%	9.6	9.3	9.8	9.6	9.4	9.9	25,027	3 (1-83)	83,650,527	8,343
Diabetic Keto-acidosis	1,899	2.7%	3.1	3.0	3.3	3.1	3.0	3.2	5,661	2 (1-34)	18,433,264	7,299
Coronary Heart Disease	6,708	9.6%	11.0	10.7	11.3	11.3	11.1	11.6	23,600	3 (1-69)	210,873,480	23,611
Stroke	2,577	3.7%	4.2	4.1	4.4	4.5	4.3	4.6	10,479	3 (1-172)	40,178,286	11,682
Pneumonia or Influenza	3,428	4.9%	5.6	5.4	5.8	5.9	5.7	6.1	15,902	4 (1-60)	44,804,400	9,516
Lower Extremity Condition	3,535	5.0%	5.8	5.6	6.0	5.9	5.7	6.1	19,013	4 (1-83)	65,738,216	12,045
Lower Extremity Amputation	996	1.4%	1.6	1.5	1.7	1.7	1.6	1.8	8,190	6 (1-120)	28,321,106	20,445

Source: 2003 Washington State Comprehensive Hospital Abstract Reporting System (CHARS). Rates per 10,000 total population, age-adjusted to 2000 US population. Lower CI and Upper CI show the 95% confidence interval around the rate.

Hospitalizations with Diabetes as First-Listed Diagnosis by County, Washington (Figure 46)

County	Number of hospital discharges	Percent of total hospital discharges	Crude			Age-adjusted			Length of stay (days)	Average length of stay in days (min-max)	Total hospital charges ($)	Average charge per discharge ($)
			Rate	Lower CI	Upper CI	Rate	Lower CI	Upper CI				
Adams	63	9.4%	12.7	9.7	16.2	14.4	11.0	18.5	306	3 (1-31)	846,500	7,877
Asotin	45	8.1%	7.3	5.3	9.7	6.6	4.8	8.9	177	3 (1-25)	466,950	5,156
Benton	363	7.4%	8.2	7.4	9.1	8.7	7.8	9.7	1,635	3 (1-70)	4,847,945	7,613
Chelan	172	7.1%	8.5	7.2	9.8	8.5	7.2	9.8	696	3 (1-24)	1,663,668	5,978
Clallam	269	7.3%	13.8	12.2	15.5	12.0	10.5	13.7	1,123	3 (1-23)	2,808,952	5,906
Clark	634	7.6%	5.8	5.4	6.3	6.3	5.8	6.8	2,713	3 (1-36)	6,138,148	6,381
Columbia	13	5.2%	10.6	5.6	18.1	9.8	5.0	18.5	85	4 (1-24)	148,704	6,533
Cowlitz	229	5.7%	8.1	7.0	9.1	7.8	6.8	8.9	875	3 (1-20)	2,301,926	7,387
Douglas	69	6.1%	6.9	5.4	8.8	6.9	5.3	8.7	334	3 (1-34)	669,902	5,969
Ferry	23	6.7%	10.5	6.7	15.8	9.2	5.7	14.4	111	3 (1-23)	284,926	4,449
Franklin	162	9.1%	10.4	8.8	12.0	11.6	9.9	13.7	624	3 (1-19)	1,802,747	7,432
Garfield	*	*	*	*	*	*	*	*	*	*	*	*
Grant	227	7.9%	9.9	8.6	11.2	10.6	9.2	12.1	1,337	3 (1-109)	3,550,843	6,881
Grays Harbor	366	8.0%	17.8	16.0	19.6	16.6	15.0	18.5	1,437	3 (1-26)	4,209,762	7,286
Island	147	6.7%	6.7	5.6	7.8	6.4	5.4	7.6	680	3 (1-42)	2,146,040	7,573
Jefferson	63	5.3%	7.9	6.1	10.1	7.2	5.4	9.6	230	3 (1-15)	682,604	7,304
King	4,786	9.1%	9.0	8.8	9.3	9.2	8.9	9.4	20,517	3 (1-91)	65,553,865	7,692
Kitsap	598	7.4%	8.5	7.8	9.2	8.6	8.0	9.4	2,409	3 (1-35)	6,031,384	6,035
Kittitas	59	7.0%	5.7	4.3	7.3	6.1	4.6	8.0	215	2 (1-32)	598,587	6,059
Klickitat	44	8.4%	7.6	5.5	10.2	7.5	5.4	10.1	126	2 (1-11)	278,633	4,686

Lewis	270	7.7%	12.9	11.3	14.4	12.7	11.2	14.4	1,012	3 (1-60)	2,747,316	6,986
Lincoln	48	6.9%	15.7	11.6	20.9	11.9	8.7	16.3	228	4 (1-14)	543,823	6,195
Mason	157	6.4%	10.5	8.9	12.1	9.9	8.4	11.6	551	3 (1-15)	1,383,726	6,740
Okanogan	145	8.5%	12.2	10.2	14.2	11.1	9.4	13.1	774	3 (1-83)	1,687,661	6,062
Pacific	83	7.2%	13.2	10.5	16.4	10.5	8.2	13.5	373	3 (1-55)	930,361	4,903
Pend Oreille	44	9.0%	12.4	9.0	16.7	10.6	7.6	14.7	299	4.5 (1-25)	915,806	8,750
Pierce	2,226	8.6%	10.2	9.8	10.7	10.6	10.1	11.0	9,892	3 (1-60)	32,705,889	8,296
San Juan	21	7.8%	4.8	3.0	7.3	5.3	3.1	8.8	109	3 (1-32)	289,780	6,450
Skagit	383	8.5%	12.1	10.9	13.3	11.6	10.5	12.9	1,669	3 (1-41)	4,404,057	6,922
Skamania	15	5.8%	5.1	2.8	8.3	5.5	3.0	9.2	69	4 (1-12)	114,537	5,272
Snohomish	1,635	8.9%	8.7	8.3	9.1	9.2	8.8	9.7	6,966	3 (1-74)	24,277,804	8,417
Spokane	1,338	9.2%	10.5	9.9	11.0	10.4	9.9	11.0	6,902	3 (1-90)	18,276,379	7,191
Stevens	250	13.0%	20.6	18.1	23.2	20.5	18.0	23.4	1,078	3 (1-33)	2,183,842	5,898
Thurston	527	7.9%	8.3	7.6	9.0	8.2	7.5	8.9	2,047	3 (1-43)	7,159,458	7,596
Wahkiakum	14	7.5%	12.3	6.7	20.6	12.3	6.3	22.2	41	3 (1-5)	95,713	7,017
Walla Walla	126	6.4%	7.6	6.3	8.9	7.4	6.1	8.8	608	3 (1-35)	1,922,831	8,150
Whatcom	572	10.2%	11.1	10.2	12.0	11.1	10.2	12.1	2,058	3 (1-23)	3,962,256	4,744
Whitman	91	8.6%	7.5	6.0	9.2	9.3	7.4	11.5	450	3 (1-23)	1,124,427	6,817
Yakima	867	9.3%	12.8	12.0	13.7	13.5	12.6	14.5	4,166	3 (1-83)	11,779,919	6,783
Statewide	17,147	8.5%	9.5	9.3	9.6	9.6	9.4	9.7	74,951	3 (1-109)	221,573,426	7,274

*Rates based on fewer than 5 hospitalizations are suppressed. Rates based on less than 20 hospitalizations are likely to be unstable and imprecise.
Source: 2001-2003 Washington State Comprehensive Hospital Abstract Reporting System (CHARS). Rates per 10,000 total population, age-adjusted to 2000 US population. Lower CI and Upper CI show the 95% confidence interval around the rate.

Hospitalizations with Diabetes as First-Listed Diagnosis by Age and Sex, Washington (Figure 47)

Age and Sex Groups	Number of hospital discharges	Crude Rate	Lower CI	Upper CI
Age				
<45 years	2,413	6.2	5.9	6.4
45-64 years	1,925	12.8	12.2	13.4
65-74 years	709	20.5	19.0	22.0
75 years or more	791	23.2	21.6	24.8
Sex	5,838			
Male	3,072	10.1	9.8	10.5
Female	2,766	9.0	8.7	9.4
	5,838			
By Sex & Age				
Males				
<45 years	1,254	6.3	5.9	6.6
45-64 years	1,065	14.3	13.4	15.1
65-74 years	362	22.2	19.9	24.5
75 years or more	391	29.8	26.9	32.8
Females	3,072			
<45 years	1,159	6.1	5.7	6.4
45-64 years	860	11.3	10.6	12.1
65-74 years	347	19.0	17.0	21.0

75 years or more	400	19.1	17.2	20.9

Source: 2003 Washington State Comprehensive Hospital Abstract Reporting System (CHARS). Rates per 10,000 total population. Lower CI and Upper CI show the 95% confidence interval around the rate.

Hospitalizations with Diabetes as First-Listed Diagnosis by Community Type, Washington (Figure 48)

Community Type	**Number of hospital discharges**	**Crude**			**Age-adjusted**			**Length of stay** (days)	**Average length of stay in days** (min-max)	**Total hospital charges** ($)	**Average charge per discharge** ($)
		Rate	**Lower CI**	**Upper CI**	**Rate**	**Lower CI**	**Upper CI**				
Urban Core	4,387	9.5	9.2	9.8	9.6	9.3	9.9	18,770	3 (1-74)	64,720,419	8,542
Suburban	500	8.0	7.3	8.7	8.2	7.5	9.0	2,030	3 (1-43)	6,640,658	8,743
Large town	489	10.8	9.9	11.8	10.8	9.9	11.8	2,124	3 (1-60)	6,360,437	7,606
Rural	462	11.9	10.8	12.9	11.2	10.2	12.3	2,103	3 (1-83)	5,929,014	6,949

Source: 2003 Washington State Comprehensive Hospital Abstract Reporting System (CHARS). Rates per 10,000 total population, age-adjusted to 2000 US population. Lower CI and Upper CI show the 95% confidence interval around the rate.

Distribution of Hospitalizations with Diabetes by Payer Source, Washington

Primary payer source	Diabetes as any diagnosis	Diabetes as first-listed diagnosis
Medicare	56.3% (39,379)	37.8% (2,208)
Medicaid	12.0% (8,368)	25.3% (1,478)
Health Maintenance Organization (HMO)	8.3% (5,810)	6.8% (397)
Commercial Insurance/ Health Care Service Contractor	19.3% (13,538)	22.4% (1,310)
Worker's Compensation	0.6% (389)	0.2% (10)
Self-pay	2.2% (1,538)	5.8% (341)
Other government sponsored patients	1.3% (883)	0.9% (54)
Charity care	0.2% (104)	0.7% (40)

*Percentages based on fewer than 5 hospitalizations are suppressed. Percentages based on less than 20 hospitalizations are likely to be unstable and imprecise.
Source: 2003 Washington State Comprehensive Hospital Abstract Reporting System (CHARS). Data are presented as percent and number of hospitalizations in parenthesis. Source of payment is collected in CHARS to identify each payer group from which the hospital may expect some payment for the bill. Priority of payer is indicated in CHARS as primary or secondary payer.

Distribution of Hospitalizations with Diabetes as First-Listed Diagnosis by Payer Source and Age, Washington (Figure 51)

Primary payer source	<45 years	45-64 years	65-74 years	75+ years
Medicare	12.5% (301)	32.3% (621)	83.8% (594)	87.5% (692)
Medicaid	40.1% (967)	24.8% (478)	3.4% (24)	1.1% (9)
Health Maintenance Organization (HMO)	7.1% (172)	7.4% (143)	4.5% (32)	6.3% (50)
Commercial Insurance/ Health Care Service Contractor	28.3% (683)	28.4% (546)	6.9% (49)	4.1% (32)
Worker's Compensation	*	0.4% (7)	*	*
Self-pay	10.1% (244)	4.7% (90)	0.7% (5)	*
Other government sponsored patients	0.8% (19)	1.3% (24)	0.7% (5)	0.8% (6)
Charity care	1.0% (24)	0.8% (16)	*	*

*Percentages based on fewer than 5 hospitalizations are suppressed. Percentages based on less than 20 hospitalizations are likely to be unstable and imprecise.
Source: 2003 Washington State Comprehensive Hospital Abstract Reporting System (CHARS). Data are presented as percent and number of hospitalizations in parenthesis. Source of payment is collected in CHARS to identify each payer group from which the hospital may expect some payment for the bill. Priority of payer is indicated in CHARS as primary or secondary payer.

Distribution of Hospitalizations with Diabetes as First-Listed Diagnosis by Payer Source and Community Type, Washington (Figure 52)

Primary payer source	Urban core	Suburban	Large town	Rural
Medicare	36.4% (1,598)	37.0% (185)	42.1% (206)	47.4% (219)
Medicaid	25.8% (1,131)	21.4% (107)	25.6% (125)	24.9% (115)
Health Maintenance	7.3% (320)	7.4% (37)	4.9% (24)	3.5% (16)

Organization (HMO)				
Commercial Insurance/ Health Care Service Contractor	23.0% (1,010)	26.0% (130)	18.8% (92)	16.9% (78)
Worker's Compensation	21.0% (9)	*	*	*
Self-pay	5.9% (260)	4.4% (22)	6.5% (32)	5.8% (27)
Other government sponsored patients	0.8% (37)	1.0% (5)	1.2% (6)	1.3% (6)
Charity care	0.5% (22)	2.6% (13)	*	*

*Percentages based on fewer than 5 hospitalizations are suppressed. Percentages based on less than 20 hospitalizations are likely to be unstable and imprecise.
Source: 2003 Washington State Comprehensive Hospital Abstract Reporting System (CHARS). Data are presented as percent and number of hospitalizations in parenthesis. Source of payment is collected in CHARS to identify each payer group from which the hospital may expect some payment for the bill. Priority of payer is indicated in CHARS as primary or secondary payer. Charity care and other government sponsored insurance in each community type is <1%.

CHAPTER FIVE

Trends in Diabetes Death Rates, Washington (Figure 53)

Year	Age-adjusted rate
1990	18.1
1991	17.5
1992	18.9
1993	20.9
1994	21.4
1995	22.2
1996	23.9
1997	21.8
1998	23.2
1999	24.5
2000	24.5
2001	25.3
2002	26.4
2003	26.0
2004	25.2

Source: 1990-2004 Washington State Death Certificates. Diabetes as underlying cause of death. Rates per 100,000 total population, age-adjusted to 2000 US population.

Diabetes Death Rates by Community Type, Washington (Figure 54)

Community Type	Number of deaths	Population	Age-adjusted rate	Lower CI	Upper CI
Urban Core	1,065	4,622,218	25.0	23.5	26.6
Suburban	159	624,282	29.0	24.6	34.0
Large town	146	451,153	30.4	25.6	35.8
Rural	138	389,740	29.2	24.5	34.7

Source: 2003 Washington State Death Certificates. Diabetes as underlying cause of death. Rates per 100,000 total population, age-adjusted to 2000 US population. Lower CI and Upper CI show the 95% confidence interval around the rate.

Diabetes Death Rates by County, Washington (Figure 55)

County	Number of deaths	Population	Age-adjusted rate	Lower CI	Upper CI
Adams	14	49,801	34.8	19.0	58.6
Asotin	23	62,001	28.2	17.7	43.7
Benton	105	443,999	27.3	22.3	33.1
Chelan	37	202,602	16.0	11.2	22.3
Clallam	73	194,654	23.6	18.4	30.4
Clark	253	1,088,299	28.4	24.9	32.1
Columbia	*	*	*	*	*
Cowlitz	96	283,202	31.4	25.4	38.4
Douglas	19	99,501	19.1	11.5	30.1
Ferry	5	21,896	23.8	7.6	60.7
Franklin	27	155,299	24.7	16.2	36.4
Garfield	*	*	*	*	*
Grant	52	229,401	25.1	18.7	32.9
Grays Harbor	88	205,699	35.2	28.2	43.7
Island	55	219,499	23.0	17.3	30.1
Jefferson	25	79,748	20.8	13.4	33.4
King	1,040	5,311,914	21.6	20.3	23.0
Kitsap	187	705,100	29.7	25.5	34.3
Kittitas	17	104,001	16.6	9.6	27.3
Klickitat	28	57,902	43.6	28.9	64.3
Lewis	120	210,105	46.0	38.1	55.3
Lincoln	8	30,497	17.7	7.5	41.7
Mason	47	149,598	25.2	18.5	34.1
Okanogan	34	119,101	25.5	17.7	36.2
Pacific	27	62,899	26.7	17.4	42.1
Pend Oreille	12	35,398	26.3	13.5	51.2
Pierce	538	2,172,097	28.7	26.4	31.3
San Juan	7	43,802	10.3	4.1	29.9
Skagit	118	315,900	31.7	26.2	38.1
Skamania	10	29,702	38.7	18.4	72.4
Snohomish	402	1,884,100	26.5	23.9	29.2
Spokane	334	1,276,599	25.5	22.8	28.4
Stevens	34	121,300	25.9	17.9	36.9
Thurston	181	637,296	29.5	25.3	34.1
Wahkiakum	9	11,400	56.7	25.8	132.0
Walla Walla	51	166,401	26.5	19.7	35.3
Whatcom	113	517,301	22.6	18.6	27.3
Whitman	18	121,903	18.9	11.1	30.5
Yakima	199	675,501	31.9	27.6	36.7
Statewide	4,413	18,111,911	25.9	25.2	26.7

*Rates based on fewer than 5 deaths are suppressed. Rates based on less than 20 deaths are likely to be unstable and imprecise.
Source: 2001-2003 Washington State Death Certificates. Diabetes as underlying cause of death. Rates per 100,000 total population, age-adjusted to 2000 US population. Lower CI and Upper CI show the 95% confidence interval around the rate.

Diabetes Death Rates by Race and Ethnicity, Washington (Figure 56)

Racial/ethnic group	**Number of deaths**	**Population**	**Age-adjusted rate**	**Lower CI**	**Upper CI**
Non-Hispanic White	3,761	14,583,371	24.2	23.5	25.0
Non-Hispanic Black	212	660,395	66.9	57.8	77.2
Non-Hispanic Asian/Pacific Islander	222	1,175,351	33.6	29.1	38.7
Non-Hispanic American Indian/Alaska Native	84	271,698	55.1	42.9	70.4
Hispanic	131	1,421,096	42.7	35.0	51.7

Source: 2001-2003 Washington State Death Certificates. Diabetes as underlying cause of death. Rates per 100,000 total population, age-adjusted to 2000 US population. Lower CI and Upper CI show the 95% confidence interval around the rate. Persons of Hispanic origin may be of any race.

Diabetes Death Rates by Race and Ethnicity, Washington versus US (Figure 57)

	United States*, 2002	Washington, 2001-2003		
Racial/ethnic group	**Age-adjusted rate**	**Age-adjusted rate**	**Lower CI**	**Upper CI**
Non-Hispanic White	22.2	24.2	23.5	25.0
Non-Hispanic Black	50.3	66.9	57.8	77.2
Non-Hispanic Asian/Pacific Islander	17.4	33.6	29.1	38.7
Non-Hispanic American Indian/Alaska Native	43.2	55.1	42.9	70.4
Hispanic	35.6	42.7	35.0	51.7

Source: 2001-2003 Washington State Death Certificates and 2002 National Death Certificates. Diabetes as underlying cause of death. Rates per 100,000 total population, age-adjusted to 2000 US population. Lower CI and Upper CI show the 95% confidence interval around the rate. Persons of Hispanic origin may be of any race. For US data, the race groups "Asian or Pacific Islander" and "American Indian or Alaska Native" include persons of both Hispanic and non-Hispanic origin.

Diabetes Death Rates by Neighborhood Education Level, Washington (Figure 58)

Percent population with college education	Number of deaths	Population	Age-adjusted rate	Lower CI	Upper CI
40+	519	3,590,704	15.3	14.0	16.7
30-39.9	543	2,564,883	21.2	19.4	23.0
20-29.9	1,093	4,378,332	25.3	23.8	26.9
10-19.9	1,656	6,096,467	29.7	28.3	31.1
0-9.9	469	1,481,511	40.5	36.9	44.3

Source: 2001-2003 Washington State Death Certificates and 2000 U.S. Census. Diabetes as underlying cause of death. Rates per 100,000 total population, age-adjusted to 2000 US population. Lower CI and Upper CI show the 95% confidence interval around the rate. To link educational attainment with individual death data, we first obtained records of death with the address where the person lived when the death occurred coded to a census tract. We then used Census data to assign to each record a number representing the proportion of adults, ages 25 and older, in the same census tract who had completed college.

Diabetes Death Rates by Neighborhood Percent in Poverty, Washington (Figure 59)

Percent population in poverty	Number of deaths	Population	Age-adjusted rate	Lower CI	Upper CI
20+	552	2,006,083	34.5	31.7	37.6
10-19.9	1627	5,418,382	29.3	27.9	30.8
5-9.9	1404	6,317,184	23.2	22.0	24.4
0-4.9	697	4,365,564	19.0	17.6	20.5

Source: 2001-2003 Washington State Death Certificates and 2000 U.S. Census. Diabetes as underlying cause of death. Rates per 100,000 total population, age-adjusted to 2000 US population. Lower CI and Upper CI show the 95% confidence interval around the rate. To link poverty and death data, we obtained records of death with the address where the person lived when the death occurred coded to a census tract. We then used Census data to assign to each record a number representing the percent of persons in the same census tract who lived below the federal poverty line.

Trends in Diabetes Death Rates by Race and Ethnicity, Washington (Figure 60)

Racial/Ethnic Group	Number of deaths	Percent of total deaths	Population	Age-adjusted rate	Lower CI	Upper CI
2001-2003						
Non-Hispanic White	3,761	3.0%	14,583,374	24.2	23.5	25.0
Non-Hispanic Black	212	6.3%	660,395	66.9	57.8	77.2
Non-Hispanic Asian/Pacific Islander	222	5.7%	1,175,351	33.6	29.1	38.7
Non-Hispanic American Indian/Alaska Native	84	4.8%	271,698	55.1	42.9	70.4
Hispanic	131	5.0%	1,421,096	42.7	35.0	51.7
2000-2002						
Non-Hispanic White	3,674	3.0%	14,465,837	24.2	23.4	25.0
Non-Hispanic Black	178	5.5%	650,522	58.3	49.6	68.2
Non-Hispanic Asian/Pacific Islander	194	5.5%	1,148,204	30.5	26.2	35.5
Non-Hispanic American Indian/Alaska Native	69	4.3%	269,658	48.1	36.5	63.2
Hispanic	118	4.9%	1,373,244	38.5	31.2	47.2
1999-2001						
Non-Hispanic White	3,537	2.9%	14,381,221	23.7	22.9	24.5
Non-Hispanic Black	177	5.5%	635,866	60.4	51.4	70.7
Non-Hispanic Asian/Pacific Islander	150	4.6%	1,107,086	24.7	20.7	29.3
Non-Hispanic American Indian/Alaska Native	59	3.7%	267,718	45.3	33.5	60.7
Hispanic	113	5.0%	1,307,702	38.1	30.7	46.9
1996-1998						
Non-Hispanic White	3,078	2.6%	14,043,800	21.9	21.1	22.6
Non-Hispanic Black	159	5.2%	582,374	61.8	52.1	72.9
Non-Hispanic Asian/Pacific Islander	98	3.6%	963,173	19.2	15.4	23.9
Non-Hispanic American Indian/Alaska Native	74	5.0%	261,412	59.7	45.8	77.4
Hispanic	105	5.1%	1,130,802	39.1	31.3	48.6
1995-1997						
Non-Hispanic White	2,983	2.6%	13,911,469	21.6	20.9	22.4
Non-Hispanic Black	151	5.0%	562,001	59.8	50.1	71.0
Non-Hispanic Asian/Pacific Islander	86	3.3%	909,150	18.4	14.5	23.2
Non-Hispanic American Indian/Alaska Native	68	4.7%	258,576	59.5	45.1	77.9
Hispanic	92	4.7%	1,060,434	38.1	30.0	48.0
1994-1996						
Non-Hispanic White	2,914	2.6%	13,765,149	21.6	20.8	22.4
Non-Hispanic Black	149	4.9%	541,488	60.5	50.7	72.0
Non-Hispanic Asian/Pacific Islander	82	3.2%	855,122	17.9	14.0	22.7
Non-Hispanic American Indian/Alaska Native	58	4.2%	254,848	52.2	38.5	70.0
Hispanic	83	4.4%	985,598	36.7	28.5	46.8
1993-1995						
Non-Hispanic White	2,717	2.4%	13,618,825	20.5	19.8	21.3
Non-Hispanic Black	146	4.9%	520,916	61.7	51.6	73.5
Non-Hispanic Asian/Pacific Islander	64	2.6%	801,347	15.2	11.5	19.9

Non-Hispanic American Indian/Alaska Native	52	3.9%	250,920	46.6	34.0	63.5
Hispanic	77	4.3%	908,122	34.6	26.6	44.6
1992-1994						
Non-Hispanic White	2,515	2.3%	13,452,310	19.4	18.7	20.2
Non-Hispanic Black	141	4.9%	499,088	60.1	50.1	71.9
Non-Hispanic Asian/Pacific Islander	65	2.7%	745,872	16.5	12.5	21.6
Non-Hispanic American Indian/Alaska Native	45	3.5%	246,427	38.8	27.6	54.4
Hispanic	69	3.9%	827,504	31.8	24.2	41.6
1991-1993						
Non-Hispanic White	2,299	2.1%	13,274,895	18.2	17.4	18.9
Non-Hispanic Black	122	4.6%	476,186	54.6	44.8	66.4
Non-Hispanic Asian/Pacific Islander	60	2.7%	689,081	16.9	12.6	22.4
Non-Hispanic American Indian/Alaska Native	41	3.2%	241,707	37.8	26.4	53.9
Hispanic	70	4.1%	746,333	33.9	25.8	44.2
1990-1992						
Non-Hispanic White	2,124	2.0%	13,008,996	17.1	16.4	17.9
Non-Hispanic Black	109	4.2%	455,829	50.8	41.2	62.3
Non-Hispanic Asian/Pacific Islander	58	2.9%	643,916	17.1	12.8	22.9
Non-Hispanic American Indian/Alaska Native	40	3.3%	235,867	39.1	26.9	56.1
Hispanic	67	4.0%	684,595	36.3	27.4	47.7

Source: 1990-2003 Washington State Death Certificates. Diabetes as underlying cause of death. Rates per 100,000 total population, age-adjusted to 2000 US population. Lower CI and Upper CI show the 95% confidence interval around the rate. Data format changed between 1998 and 1999, indicated in table by break in trend between 1996-1998 and 1999-2001. Persons of Hispanic origin may be of any race.

Appendix C: Technical Notes

These notes describe the analytic methods that were used throughout this report and how important terms were defined and measured. Topics are listed alphabetically.

Age-Adjusted Rates[138]

Sometimes we want to compare the health status of two groups of people or populations, such as Washington residents and those of the US. Because many health indicators change with age, a higher rate in one group than in another may simply reflect that the first group is older than the second. Age-adjustment or standardization is a method of developing rates that eliminate the impact of different age distributions in the different groups. Often we also want to examine changes in health status in the same population over a period of time in which the population may have aged. For example, increases in the prevalence of diabetes over the last 10 years. In this instance, rates are age-adjusted to eliminate the effect of different age distributions across years.

In this report, age-adjusted rates were computed by multiplying the rate for a specific age group in a given population by the proportion of people in the same age group in a standard population and then adding across age groups. All age-adjusted rates in this document have been adjusted to the 2000 US standard population using eleven age groups (<1, 1-4, 5-14, 15-24, 25-34, 35-44, 45-54, 55-64, 65-74, 75-84, 85+ years) for death and hospital discharge rates and six age groups (18-24, 25-34, 35-44, 45-64, 65+ years) for BRFSS proportions.

Confidence Intervals[139]

[138] Information extracted from: Washington State Department of Health. Guidelines for Using and Developing Rates for Public Health Assessment. Olympia, WA, 2001 [cited 2004 April 21]. Available from http://www.doh.wa.gov/Data/Guidelines/Rateguide.htm.
[139] Information extracted from: Washington State Department of Health. Guidelines for Using Confidence Intervals for Public Health Assessment. Olympia, WA, 2002 Jan. [cited 2004 April 21]. Available from http://www.doh.wa.gov/Data/Guidelines/ConfIntguide.htm.

Confidence intervals (CI) are a calculated range of values used to describe the precision of a point estimate, such as a mortality or hospitalization rate or the frequency of reported behaviors. The constructed intervals are expected to cover the true value in a population. They are used to account for uncertainty that arises from natural variation inherent in the world around us. Confidence intervals from sample survey data, like the BRFSS, also account for the difference between a sample from a population and the population itself. Confidence intervals do not account for several other sources of uncertainty, including missing or incomplete data, bias resulting from non-response to a survey, or poor data collection. Confidence intervals are sometimes used to approximate statistical tests of significance (see *Statistically Significant Differences* section below).

In our analysis, we used confidence levels of 95%, meaning that in 95 out of 100 instances the confidence interval reported covers the true population value (or the constructed interval has a 95% chance of including the true value). Throughout this report, the minimum and maximum values of the confidence intervals are presented in tables, generally adjacent to point estimates and labeled "Lower CI" and "Upper CI." Confidence intervals in charts and graphs are shown by the vertical lines, with the minimum and maximum values shown by the horizontal lines at each end.

BRFSS: The BRFSS has a complex sample design with stratification and unequal weighting of observations that affects the computation of variance of estimates. Computation of standard errors and confidence intervals from complex survey samples must account for the design effect of the survey. In this report, we used Stata 9.0 software which is designed to analyze data from complex survey samples using Taylor series linearization methods. For the confidence interval calculation in BRFSS analysis, Stata uses the Student t-distribution with degrees of freedom determined by the sample survey design. In most instances, the confidence intervals on population proportions in this report use a logit transform so that the lower and upper confidence intervals are asymmetric (or not symmetrical) around the point estimate. Confidence intervals are generally wider and statistical significance is harder to achieve with complex sample survey data (like BRFSS) compared to data collected from simple random samples.

Hospital discharge and death rates: Confidence intervals for hospital discharge and death rates were calculated according to methods presented in the WA DOH *Guidelines for Using Confidence Intervals for Public Health Assessment* (http://www.doh.wa.gov/Data/Guidelines/ConfIntguide.htm). The methods used are as follows:

1) For age-standardized rates, the confidence intervals were calculated based on the gamma distribution (Fay and Feuer, 1997)—section 4.2, equations (4) & (5). This method produces valid confidence intervals even when the numbers of cases is very small.

2) For crude and age-specific rates, the confidence intervals were calculated directly from the Poisson distribution (along with a Poisson calculated standard error) when the number of observed cases was less than 100—section 4.4.

3) For crude and age-specific rates, the confidence intervals were calculated from the normal distribution (along with a Poisson calculated standard error) when the number of observed cases was 100 or more--section 4.4, equation (10).

Education and Poverty at the Community Level[140]

Health researchers debate the relative importance of neighborhood and individual characteristics in relation to health, but evidence suggests that both factors are important even though the relative importance likely differs for different health indicators. In this report and where possible, we provide information from the scientific literature and WA State data regarding the relative importance of individual education and poverty compared to the general level of education and poverty in the community for diabetes health status and outcomes.

To study the relationship between education and poverty at the community level and diabetes risk and mortality, we linked individual-level data (death certificates and BRFSS survey responses) with census information on whether a person lives in a neighborhood characterized by relatively high or low educational attainment and high or low income or poverty. For this report, our measure of community-level education was defined as the proportion of adults, ages 25 and older, in a select geographic region (U.S. census tract or zip code) who had completed college. Our measure of poverty at the community level was defined as the percent of persons in a select geographic region who live below the federally defined poverty line. This threshold varies by the size and ages of persons living in a household. In 2000, a household with two adults and two children with a combined income of $17,050 was living at the federal poverty line.

The following description of the methods used to assess community-level education and poverty were adopted from Washington State Department of Health, *Health of Washington State – 2004 supplement*, at http://www.doh.wa.gov/HWS/HWS2004supp.htm.

Educational Attainment

To link educational attainment and death data, we first obtained records of death with the address where the person lived when the death occurred coded to a census tract. Census tracts are small geographic areas within counties that generally have about 2,500 to 8,000 residents. Census tracts are designed to be as homogeneous as possible with respect to population characteristics, economic status, and living conditions (U.S. Census Bureau, Geographic Areas Reference Manual, Chapter 10, http://www.census.gov/geo/www/garm.html). We then used U.S. Census 2000 Summary File 3, Table P37 (Sex by Educational Attainment for the Population 25 Years and Over), available through American Fact Finder (http://factfinder.census.gov/home/saff/main.html?_lang=en), to assign to each record a number representing the proportion of adults, ages 25 and older, in the same census tract who had completed college.

To link educational attainment with individual BRFSS survey data, we obtained the zip code for each respondent and then used U.S. Census 2000 Summary File 3, Table P37 (Sex by Educational Attainment for the Population 25 Years and Over) to assign each respondent a number representing the proportion of

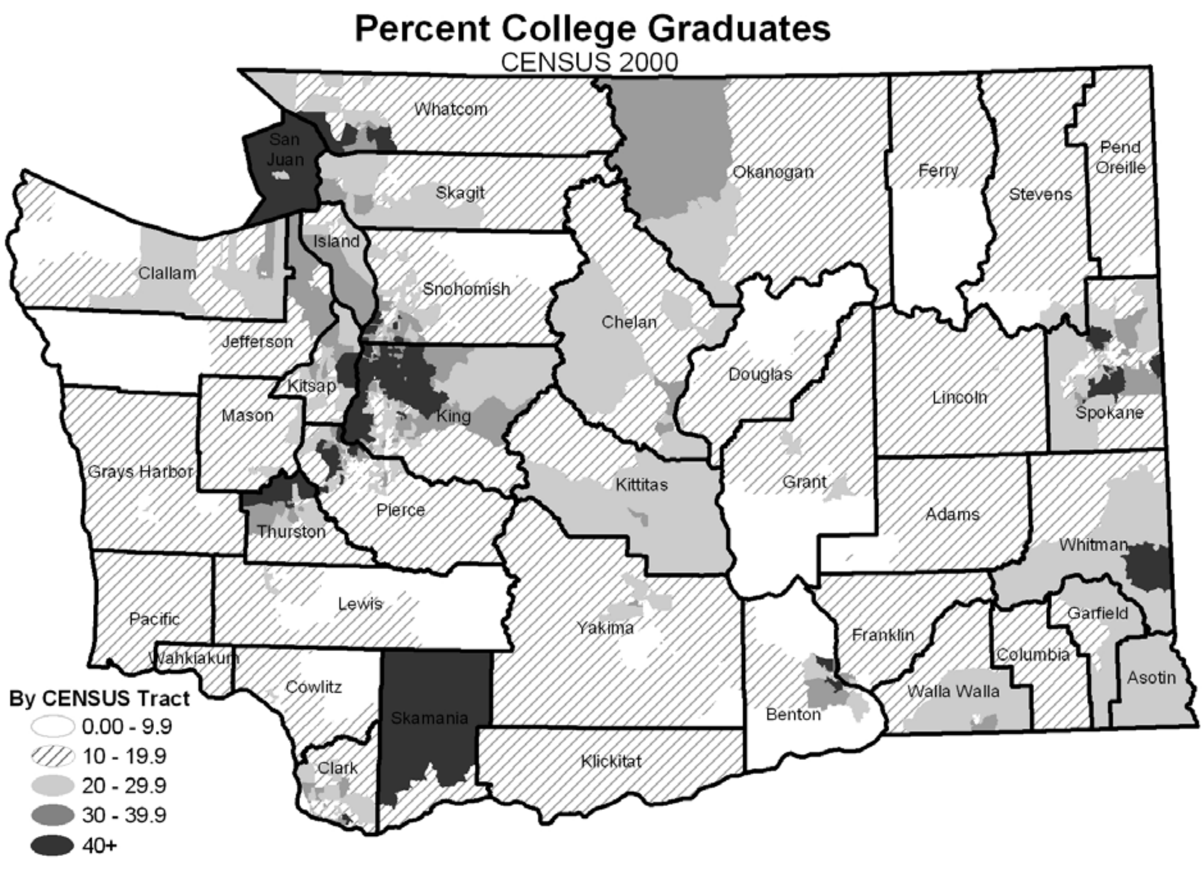
[140] Information extracted from: Washington State Department of Health. Appendix A: Technical Notes. In Health of Washington State. Olympia, WA, 2004 Sep [cited 2004 April 21] pp. 2-4, 6-8. Available from http://www.doh.wa.gov/HWS/Appendix.shtm.

adults, ages 25 and older, in the same zip code who had completed college. When adding census data to the BRFSS data set, we were unable to assess educational attainment at the census tract level because the lowest level of geographic aggregation for the BRFSS is zip code.

Finally, we divided people into five groups depending on the proportion in the census tract or zip code that had completed college. We selected 40% or more as the highest cut point, because that point resulted in about 20% of the total population being in the highest group. We then used cut points of 10%, 20%, and 30% to define four additional levels of education. The resulting five groups and the proportion of the Washington population in each group are as follows:

Percent College Graduates	0 – 9.9	10 – 19.9	20 – 29.9	30 – 39.9	30 or more
Percent Washington Population	8.2	33.6	24.2	14.1	19.9

This measure of education describes the general educational level of a community, which contributes to the context in which one lives. To some extent, the measure also describes individuals; an adult living in a neighborhood where a large proportion of adults have completed college is more likely to have a college degree compared to someone who lives in a neighborhood where fewer adults have completed college. Likewise, children living in neighborhoods where a large proportion of adults completed college are more likely to have parents with college educations compared to children living in neighborhoods where fewer adults completed college.



Poverty

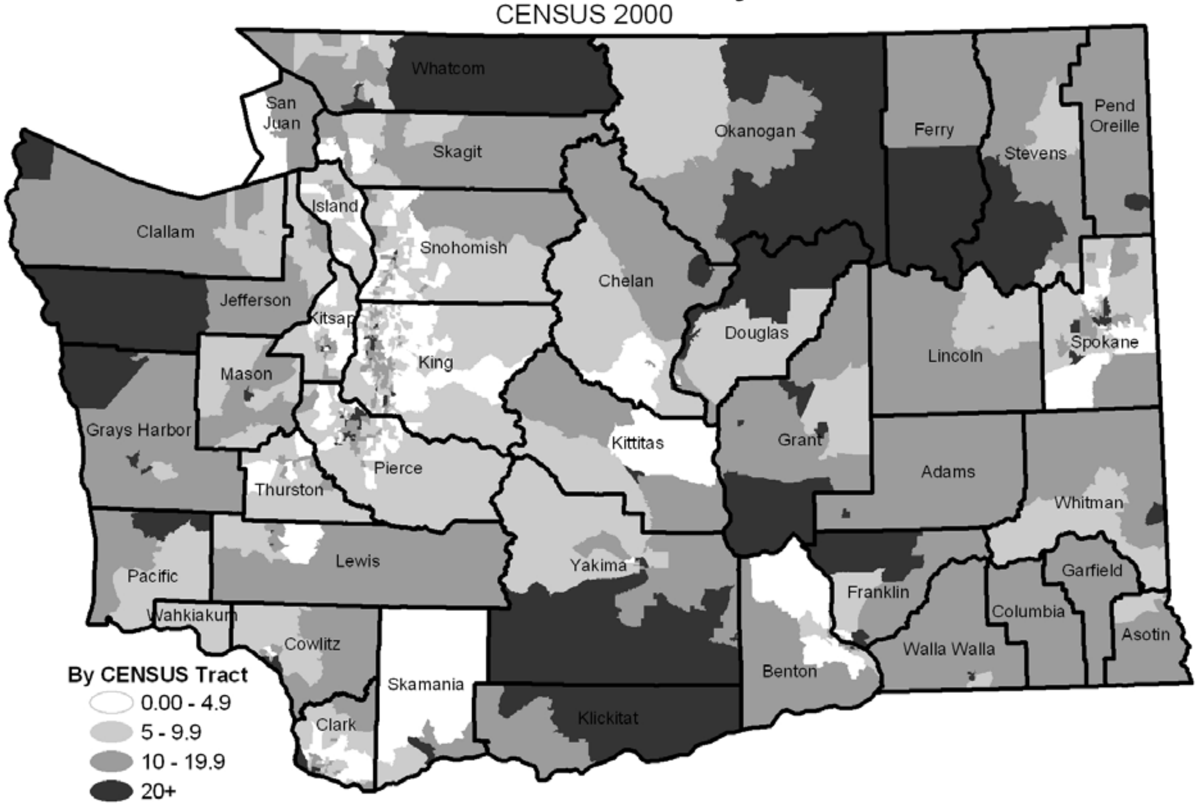
To link poverty and death data, we again obtained records of death with the address where the person lived when the death occurred coded to a census tract. We then used U.S. Census 2000 Summary File 3, Table P87 (Poverty Status in 1999 by Age), available through American Fact Finder (http://factfinder.census.gov/home/saff/main.html?_lang=en), to assign to each record a number representing the percent of persons in the same census tract who lived below the federal poverty line. To link poverty with individual survey data, we obtained the zip code for each respondent and then used U.S. Census 2000 Summary File 3, Table P87 (Poverty Status in 1999 by Age) to assign each respondent a number representing the percent of persons in the same zip code who lived below the federal poverty line.

For our final measure of poverty, we divided people into four groups depending on the percent of persons in the census tract or zip code area who lived in poverty. We used the same groupings as those described in the appendix of Krieger et al. (Kreiger N, Chen JT, Waterman PD, Soobader MJ, Subramanian, SV, Carson R. Geocoding and monitoring of US socioeconomic inequalities in mortality and cancer incidence: Does the choice of area-based measure and geographic level matter? *Am J Epidemiol.* 2002;156(5):471-82.). Using these categorical cut points allows for comparison across geographic areas and time. Additionally, the federal government defines areas in which 20% of the population lives in poverty as federal poverty areas that qualify for programs such as urban empowerment zones and low-income housing programs. The groups and the proportion of the Washington population in each group are as follows:

Percent in Poverty	0 – 4.9	5 – 9.9	10 – 19.9	20 or more
Percent Washington Population	24.4	35.1	30.0	10.5

The percent of persons living below the federal poverty line describes the general economic level of people in one's nearby community and the neighborhood context in which one lives. To some extent, the measure also describes individuals; people living in neighborhoods where a high proportion of the population is poor are more likely to be poor themselves compared to people who live in neighborhoods where there is less poverty.

Percent in Poverty
CENSUS 2000



Caveats

- In this report we did not include the individual educational level reported on death certificates in our analysis of the relationship between education and diabetes mortality. A previous Washington State Department of Health assessment of education as recorded on death certificates indicated possible inaccuracies for education of the decedent. Specifically, the number of high school graduates and persons with some education beyond college may be over-reported on death certificates.
- A measure of the proportion of the population who have completed college was chosen, because Washington data on individual educational attainment and major risk and protective factors for health suggest that completion of college has a stronger relationship with factors related to health than completion of high school (refer to: Washington State Department of Health, *2002 Health of Washington State*, Major Risk and Protective Factors section at http://www.doh.wa.gov/HWS/RPF.shtm). Additionally, since a measure of low economic resources (i.e., poverty) was chosen as our economic indicator, using a measure of high education might help broaden the perspective on socioeconomic factors.
- While several measures have been used to study the relationship between health and economic resources, research has shown that the percent of the population living in poverty at the census tract level offers a robust measure for detecting relationships between economic factors and health (refer to: Kreiger N, Chen JT, Waterman PD, Soobader MJ, Subramanian, SV, Carson R. Geocoding and monitoring of US socioeconomic inequalities in mortality and cancer incidence: Does the choice of area-based measure and geographic level matter? *Am J Epidemiol.* 2002;156(5):471-82.).

Estimates of Diabetes and Pre-diabetes in Washington State

Methods used to estimate the total burden of diabetes (diagnosed and undiagnosed) and pre-diabetes in Washington State are described below. Synthetic estimates were created from national data when statewide data was not available.

Diagnosed diabetes: The estimated number of people with diagnosed diabetes in Washington State is around 298,500. This number is the sum of the estimated numbers of those younger than 20 years (about 3,700) and those age 20 years or older (about 294,800) with diagnosed diabetes.

The number of adults aged 20 years or older with diagnosed diabetes was obtained by applying the estimated prevalence of diagnosed diabetes in this age group (6.6%) from the 2004 Washington State BRFSS to the 2004 Washington State resident population estimate of this age group (4,467,124) obtained from the Washington State Office of Financial Management (OFM) at http://www.ofm.wa.gov/pop/race/2004estimates.asp. The number of persons younger than 20 with diagnosed diabetes was estimated by applying the 1999-2003 National Health Interview Survey prevalence estimate of diagnosed diabetes in this age group (0.22%) as reported in the 2005 CDC National Diabetes Fact Sheet to the 2004 Washington State resident population estimate of this age group (1,700,676) obtained from OFM.

Undiagnosed diabetes: The estimated number of people with undiagnosed diabetes in Washington State is around 126,000. This estimate is based on the national figure that undiagnosed diabetes constitutes about 30% of total diagnosed diabetes. This estimate was used in the 2005 CDC National Diabetes Fact Sheet and obtained by personal communication with Linda Geiss, Chief Surveillance Section, Division of Diabetes Translation, CDC. The estimate for Washington State was calculated as follows: [(total number with diagnosed diabetes)(0.30)]/(0.70) = [(294,800)(0.30)]/(0.70) = 126,000.

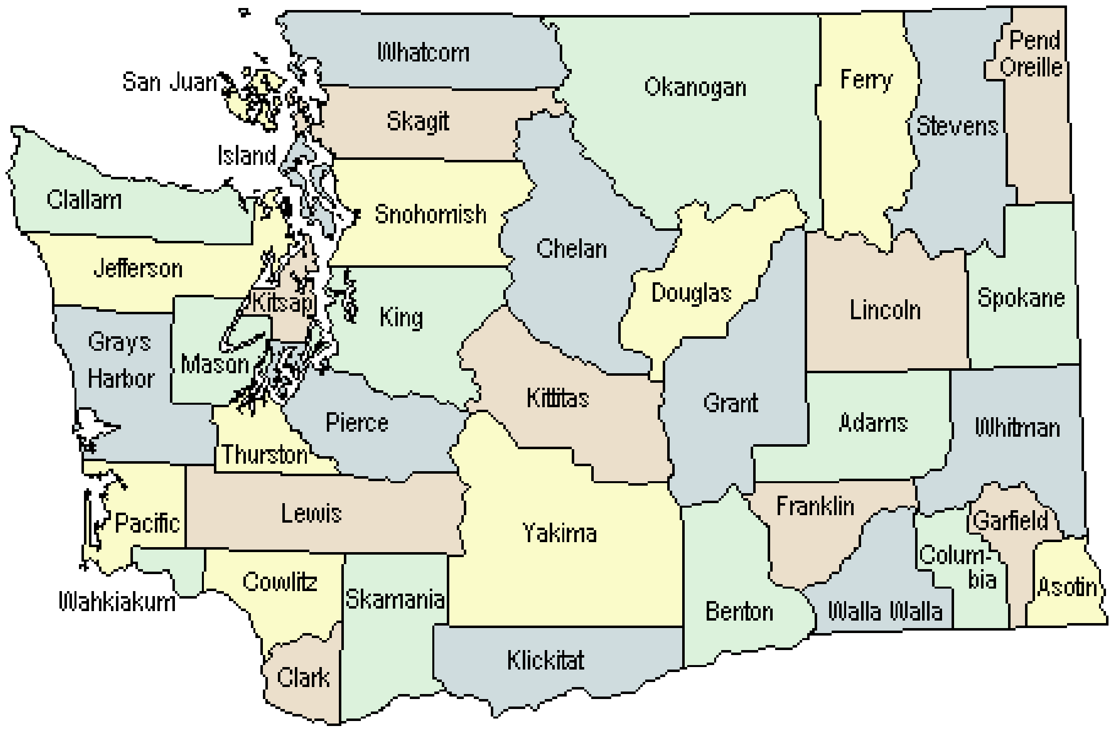
Pre-diabetes: The estimated number of people aged 40-74 years with pre-diabetes in Washington State is around 963,000. This number was estimated by applying the 1988-1994 National Health and Nutrition Examination Survey (NHANES III) prevalence estimate of pre-diabetes among adults aged 40-74 years (40.1%) as reported in the 2005 CDC National Diabetes Fact Sheet to the 2004 Washington State resident population estimates for this age group (2,401,964) obtained from OFM.

Caveats

- Both diagnosed and undiagnosed diabetes estimates do not include gestational diabetes.
- An estimate of undiagnosed diabetes among persons less than 20 years of age was not included because population-based data are lacking at both the national and state level.

Geographic Variation by County

County-level data for diabetes prevalence, hospitalizations, and mortality are presented in this report. The map of Washington State below identifies counties by name and may be used to assist interpretation of maps throughout the report.



The maps in this report compare county rates to the state average. Counties in darker shades have higher rates while counties in lighter shades have lower rates. Counties with significant differences from the state rate, based on comparison of confidence intervals, are highlighted in the text of the report. The actual rates and 95% confidence intervals for each county and Washington State, can be found in the data tables presented in Appendix B.

In this report, county-level hospitalization rates are likely to underestimate the true hospitalization burden for certain counties that border Oregon and Idaho (i.e., Asotin, Clark, and Garfield counties) or have a large proportion of residents that are served by military or VA hospitals (i.e., Island County). Please refer back to the description of the CHARS data source in Appendix A for further details about these data limitations.

Healthy People 2010[141]

Healthy People 2010 is a document that provides national health promotion and disease prevention objectives. These objectives were developed under the guidance of the United States Department of Health and Human Services incorporating input from federal, state, and local agencies and extensive public

[141] Information extracted from: Washington State Department of Health. Appendix A: Technical Notes. In Health of Washington State. Olympia, WA, 2004 Sep [cited 2004 April 21] pp. 5-6. Available from http://www.doh.wa.gov/HWS/Appendix.shtm.

comment. Additional information about Healthy People 2010 goals can be found at
http://www.healthypeople.gov/

For comparison and where possible, we have provided information on Washington data related to Healthy People 2010.

Income Inequality Index

The GINI coefficient was chosen as the measure to describe income inequality in Washington State for this report. Methods used to calculate the GINI coefficient for counties in Washington State were developed and reported as follows by Eric Ossiander, Washington State Department of Health, Office of Non-Infectious Conditions Epidemiology, January 2006.

The Gini coefficient is a measure of the distribution of income within a population (refer to: Kawachi I, Kennedy BP. The relationship of income inequality to mortality: does the choice of indicator matter? *Soc Sci Med* 1997;45:1121–7.). It is derived from the Lorenz curve, which compares the cumulative total income to the cumulative population (Figure 1). The Gini coefficient is calculated as the ratio of the area between the 45-degree line and the Lorenz curve, to the whole area under the 45-degree line. If all households in the population had the same income the Lorenz curve would fall on the 45-degree line, and the Gini coefficient would be zero. If one household had all the income, then the Lorenz curve would fall on the axes, and the Gini coefficient would be one. Thus the Gini coefficient varies from 0 to 1, with larger values indicating greater income inequality.

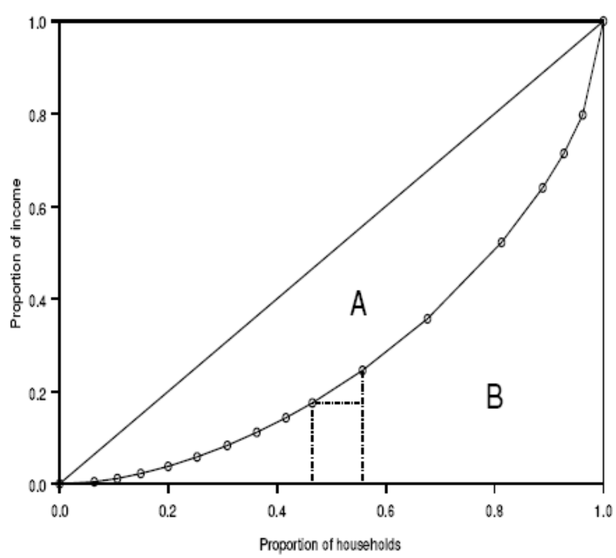


Figure 1: The Lorenz curve for King County, from 2000 Census data.

The Gini coefficient is the ratio of the area between the 45-degree line and the Lorenz curve to the entire area under the 45-degree line. This is A/(A+B). Since A+B = 1/2, the Gini coefficient is 1 - 2B. For each income category, the vertical segment under the Lorenz curve is composed of a rectangle and a triangle. A SAS program was created to compute the area of these, and then sums them to calculate B. Algebraically, the Gini index can be calculated by:

$$\text{Gini} = 1 - \sum_{k=0}^{n-1} (H_{k+1} - H_k)(I_{k+1} + I_k)$$

where $\boldsymbol{H}$ = cumulative proportion of households, $\boldsymbol{I}$ = cumulative proportion of income, and $\boldsymbol{n}$ = number of income categories in the data. This formula can also be used to calculate the Gini coefficient when individual-level or household-level income data is available, in which case $\boldsymbol{n}$ would be the number of individuals or households in the data. The Gini coefficient is typically computed using US Census 2000 data from Summary File 3, Table P52 (Household Income in 1999) and Table P54 (Aggregate Household Income in 1999—Dollars) available through American Fact Finder (http://factfinder.census.gov/home/saff/main.html?_lang=en). A brief description of the data from each table is listed below:

Table P52, Household Income in 1999, Summary File 3, US Census 2000

Field name	Description
P052001	'Total number of households (HH)'
P052002	'HH income Less than $10,000'
P052003	'HH income $10,000 to $14,999'
P052004	'HH income $15,000 to $19,999'
P052005	'HH income $20,000 to $24,999'
P052006	'HH income $25,000 to $29,999'
P052007	'HH income $30,000 to $34,999'
P052008	'HH income $35,000 to $39,999'
P052009	'HH income $40,000 to $44,999'
P052010	'HH income $45,000 to $49,999'
P052011	'HH income $50,000 to $59,999'
P052012	'HH income $60,000 to $74,999'
P052013	'HH income $75,000 to $99,999'
P052014	'HH income $100,000 to $124,999'
P052015	'HH income $125,000 to $149,999'
P052016	'HH income $150,000 to $199,999'
P052017	'HH income $200,000 or more'

Table P54, Aggregate Household Income in 1999—Dollars, Summary File 3, US Census 2000

P054001	'Aggregate HH income'
P054002	'Aggregate HH income, Less than $200,000'
P054003	'Aggregate HH income, $200,000 or more'

The census data give the number of households in each income category, but do not provide the cumulative income in the category. The total income in a category can be estimated by multiplying the number of households in the category by the midpoint of the income range for that category. In order to improve this estimate, and to ensure that the total cumulative income used for the calculations matches the aggregate income reported by the Census, we sum the estimated category totals up to the $150,000–$199,999 category, and divide the Census-reported aggregate income up to $200,000 by the estimated sum to obtain an adjustment factor. Then we multiply the estimate for each category by the adjustment factor.

Gini coefficients for Washington State counties, from 2000 US Census data.

County	GINI coefficient	County	GINI coefficient
Adams County	0.40126	Lewis County	0.42159

Asotin County	0.42970	Lincoln County	0.40475
Benton County	0.40161	Mason County	0.39155
Chelan County	0.45880	Okanogan County	0.44787
Clallam County	0.42184	Pacific County	0.43573
Clark County	0.39019	Pend Oreille County	0.43745
Columbia County	0.41727	Pierce County	0.40639
Cowlitz County	0.41338	San Juan County	0.51821
Douglas County	0.41107	Skagit County	0.44168
Ferry County	0.44517	Skamania County	0.39903
Franklin County	0.46281	Snohomish County	0.37909
Garfield County	0.40480	Spokane County	0.43768
Grant County	0.42223	Stevens County	0.42751
Grays Harbor County	0.42438	Thurston County	0.40234
Island County	0.39475	Wahkiakum County	0.38463
Jefferson County	0.44272	Walla Walla County	0.42352
King County	0.45053	Whatcom County	0.44333
Kitsap County	0.40963	Whitman County	0.47559
Kittitas County	0.50371	Yakima County	0.44354
Klickitat County	0.42086		

International Classification of Disease Codes[142]

Several International Classification of Disease (ICD) codes were used to identify health conditions in the analysis of hospital discharge and death data for this report. Causes of death are coded according to the International Classification of Disease, World Health Organization, Ninth Revision (ICD-9) for 1979 – 1998; Tenth Revision (ICD-10) for 1999 and later. When assessing trends in diabetes death rates over time, we applied a comparability ratio of 1.0082 to rates prior to 1999 to make them comparable to rates in later years when coding switched to ICD-10. In the CHARS data, conditions are coded according to ICD-9 only. Below is a list of the ICD codes used in this report.

When assessing hospitalizations with diabetes (for example, see Figure 45), two common health conditions related to diabetes, retinopathy and end-stage renal disease, were not included in our analysis. Although these are important and devastating complications of diabetes, we were unable to include these conditions because there are no consistent guidelines or consensus about what ICD-9 codes should be used to define them.

Diabetes-related conditions	ICD-9	ICD-10
Diabetes mellitus	250	E10-E14
Diabetic ketoacidosis	250.1	E101, E111, E121, E131, E141

[142] Information extracted from: A) Washington State Department of Health. Center for Health Statistics. Washington State Vital Statistics Report, Olympia, WA, last updated 2006 Apr. [cited 2004 May 5]. Available from http://www.doh.wa.gov/ehsphl/chs/chs-data/death/dea_VD.htm and B) Centers for Disease Control and Prevention. National Center for Chronic Disease Prevention and Health Promotion. Division of Diabetes Translation. National Diabetes Surveillance System. Atlanta, GA, last review 2006 Mar. [cited 2004 April 21]. Available from http://www.cdc.gov/diabetes/statistics/index.htm.

Major cardiovascular disease	390-434, 436-448	I00-I78
- Heart disease	390-398, 402, 404, 410-429	I00-I09, I11, I13, I20-I51
- Coronary (ischemic) heart disease	410-414, 429.2	I20-I25
- Stroke	430-434, 436-438	I60-I69
- Heart Failure	428	I50
Influenza or pneumonia	480-487	J10-J18
Non-traumatic lower extremity amputation	84.1 procedure code (excluding ICD-9 codes of 895-897)	
Lower extremity conditions	*Listed below:*	
- Peripheral arterial disease	250.7, 440.2, 442.3, 443.8-443.9, 444.22	
- Ulcer/Inflammation/Infection	454, 707.1, 680.6-680.7, 681.1, 682.6-682.7, 711.05-711.07, 730.05-730.07, 730.15-730.17, 730.25-730.27, 730.35-730.37, 730.85-730.87, 730.95-730.97, 785.4	
- Neuropathy	337.1, 357.2, 355, 358.1, 713.5, 094.0, 250.6	

Multivariate Analysis and Odds Ratios[143]

When an outcome of interest (for example diabetes) was associated with a particular characteristic (for example annual household income), and both the outcome and this characteristic were associated with another factor (such as age), multivariate logistic regression analysis were performed to control for the effects of the other factor in order to reveal the association of interest. In this example a multivariate analysis would reveal the association between diabetes and income independent of the effect of age.

An odds ratio (OR) was the measure of association estimated from the logistic regression analysis to quantify the relationship between a characteristic (demographic factor, behavior, or circumstance) and health outcome. An odds ratio is calculated as:

Odds ratio = (a/b)/(c/d) = ad/bc

[143] Information provided by: Kleinbaum DG and Klein M. Logistic Regression: A self-learning text. 2nd edition. Statistics for Biology and Health (series). Dietz K, Gail M, Krickeberg A, Samet TJ, eds (series). Springer-Verlag New York, Inc. New York, NY. 2002.

a = number of persons with health outcome and with characteristic of interest

b = number of persons without health outcome, but with characteristic of interest

c = number of person with health outcome, but without characteristic of interest

d = number of persons without health outcome and without characteristic of interest

An odds ratio approximates how much more likely (or unlikely) it is for a health outcome to be present among those with a particular characteristic than among those without a characteristic. For example, if the health outcome is the presence or absence of diabetes and the characteristic of interest is whether or not the person is obese, then OR=3.0 indicates that diabetes is three times more likely to occur among persons who are obese than among those who are not obese. If the characteristic of interest is whether or not a person gets regular physical activity, then OR=0.5 indicates that the odds of diabetes among those who get regular physical activity versus the odds of diabetes among those who do not get regular physical activity is one half (or those who do regular physical activity are 50% less likely to develop diabetes compared to those who do not do regular physical activity). An odds ratio of 1.0 means that the characteristic of interest does not affect or change the health outcome.

In Chapter 2 of this report we use multivariate analysis to examine variations in diabetes prevalence when multiple factors are taken into account. A simple analysis model was constructed based on modeling strategy guidelines presented by Kleinbaum and Klein.[144] The purpose of this analysis was to obtain a single overall estimate of the effect of socioceconomic position or SEP (as measured by income, education, and employment status) on self-reported diabetes adjusted for other clinically and biologically meaningful critical factors (such as age, sex, race/ethnicity, body mass index, physical activity level, and access to health care). To assess confounding, we monitored the changes in odds ratio for our SEP measures corresponding to different subsets of potential confounders (or critical factors) in the model. We chose a reduced model with a subset of these critical factors that was considered to control for confounding by giving essentially the same estimated odds ratio for the SEP measures as the full model that included all potential confounders. Interaction involving these factors was not assessed in this report. We may assess interaction in future analysis. A Wald test was used to indicate which groups within each characteristic of interest in the multivariate logisitic regression analysis may or may not be significant, after adjusting for other critical factors. Moreover, when visually comparing confidence intervals presented, if the confidence interval includes one, the odds ratio is not significant, meaning the characteristics of interest is not associated with the health outcome. Table 2 below corresponds with the same abbreviated table in Chapter 2, but also shows the odds ratio for each of the critical factors adjusted for in the final model.

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[144] Information provided by: Kleinbaum DG and Klein M. Logistic Regression: A self-learning text. 2nd edition. Statistics for Biology and Health (series). Dietz K, Gail M, Krickeberg A, Samet TJ, eds (series). Springer-Verlag New York, Inc. New York, NY. 2002: 165-167, 199-201.

Table 2. Relationship Between Self-Reported Diabetes and Individual-level Socioeconomic Position Among Washington Adults in Multivariate Logistic Regression Analysis						
Factors	**Odds Ratio** (OR) **prior to adjusting for other factors**			**Odds Ratio** (OR) **after adjusting for other factors**		
Socioeconomic position measures	OR	Lower CI	Upper CI	OR	Lower CI	Upper CI
Household income						
<$25,000	2.7*	2.3	3.4	2.0*	1.6	2.7
$25,000-$49,999	1.8*	1.5	2.2	1.4*	1.1	1.8
$50,000 or more	*Ref*			*Ref*		
Education level						
Less than high school	2.2*	1.7	2.9	1.5*	1.1	2.0
High school graduate/GED	1.4*	1.2	1.8	1.0	0.8	1.3
Some post high school	1.4*	1.1	1.7	1.1	0.9	1.4
College graduate	*Ref*			*Ref*		
Employment status						
Employed, student, homemaker	*Ref*			*Ref*		
Unemployed	1.7*	1.2	2.4	1.4	1.0	2.0
Retired	4.3*	3.6	5.2	1.5*	1.2	1.9
Unable to work	7.7*	5.9	10.1	2.5*	1.8	3.6
Critical factors (confounders)						
Age (years)						
18 to 34	*Ref*			*Ref*		
35 to 44	3.1*	2.0	4.8	2.8*	1.8	4.5
45 to 64	7.9*	5.4	11.5	5.8*	3.8	8.9
65 to 74	13.2*	8.8	19.7	7.7*	4.8	12.3
75 and over	16.1*	10.7	24.3	9.9*	6.1	16.2
Sex						
Male	*Ref*			*Ref*		
Female	0.9	0.7	1.0	0.7*	0.6	0.9
Race and ethnicity						
Non-Hispanic White	*Ref*			*Ref*		
Non-Hispanic Black	1.5	0.8	2.6	1.7	0.9	3.2
Non-Hispanic Asian/Pacific Islander	0.8	0.5	1.3	1.9*	1.1	3.3
Non-Hispanic Am Indian/Alaska Native	2.0*	1.2	3.4	1.9*	1.0	3.6
Hispanic	0.8	0.5	1.2	1.3	0.8	2.0
Body mass index (BMI)						
BMI <25.0 kg/m^2	*Ref*			*Ref*		
BMI 25.0 to <30.0 kg/m^2 (overweight)	2.3*	1.8	3.0	2.0*	1.5	2.5
BMI 30.0 kg/m^2 or more (obese)	7.3*	5.8	9.2	5.9*	4.6	7.5
Physical activity						
Met CDC physical activity recommendations	*Ref*			*Ref*		
Did not meet recommendations	2.4*	2.1	2.8	1.3*	1.1	1.6
Personal doctor or health care provider						
Yes	4.3*	3.0	6.3	2.9	1.9	4.2
No	*Ref*			*Ref*		

*P<.05, meaning the odds ratio of this category is significantly greater than the reference category based on an adjusted Wald test.

Source: 2003 Washington State Behavioral Risk Factor Surveillance System (BRFSS). Lower CI and Upper CI show the 95% confidence interval around the odds ratio. *Ref* indicates reference category for comparison of differences in odds ratios. Persons of Hispanic origin may be of any race. Adults met recommended levels of physical activity if they engaged in moderate-intensity activity for 30+ minutes on 5+ days/week or vigorous-intensity activity for 20+ minutes on 3+ days/week during leisure time, or reported mostly walking or doing heavy or physically demanding labor at work.

Overweight and Obese based on Body Mass Index[145]

Body Mass Index or BMI is a tool for indicating weight status and is an easy and inexpensive method for population assessment of overweight and obesity. BMI is based on an individual's height and weight, and is calculated as:

BMI = [(Weight in Pounds)/(Height in inches) x (Height in inches)] x 703

-or-

BMI = [(Weight in Kilograms)/(Height in Meters) x (Height in Meters)]

The Centers for Disease Control and Prevention categorizes BMI among adults as follows: underweight (below 18.5 kg/m^2), normal weight (18.5-24.9 kg/m^2), overweight (25.0-29.9 kg/m^2), obese (30.0+ kg/m^2). BMI was calculated in the BRFSS using self-report height and weight of survey respondents. Of BRFSS female respondents: a typical woman 5 feet 5 inches tall with a normal BMI weighed 130 pounds, a typical woman considered overweight based on BMI weighed 160 pounds, and a typical obese woman weighed 200 pounds. Of BRFSS male respondents: a typical man 5 feet 11 inches tall with a normal BMI weighed 160 pounds, a typical overweight man weighed 190 pounds, and an obese man weighed 235 pounds.

The relation between fatness and BMI differs with age and gender (refer to: Gallagher D, et al. How useful is BMI for comparison of body fatness across age, sex and ethnic groups? *American Journal of Epidemiology* 1996;143:228–239.). For example, women are more likely to have a higher percent of body fat than men for the same BMI. On average, older people may have more body fat than younger adults with the same BMI. Two people can also have the same BMI, but a different percent body fat. For example, a bodybuilder with a large muscle mass and a low percent body fat may have the same BMI as a person who has more body fat because BMI is calculated using weight and height only. According to the weight categories, any adult with a BMI over 25 would be classified as overweight, although this may not always mean they have excess fat.

[145] Information provided by: A) Centers for Disease Control and Prevention. Division of Nutrition and Physical Activity, National Center for Chronic Disease Prevention and Health Promotion. BMI—Body Mass Index: About BMI for Adults. Atlanta, GA, last review 2006 Apr. [cited 2004 April 21]. Available from http://www.cdc.gov/nccdphp/dnpa/bmi/adult_BMI/about_adult_BMI.htm.

The BMI ranges are based on scientific findings of the effect body weight has on disease and death (refer to: World Health Organization. Physical status: The use and interpretation of anthropometry. Geneva, Switzerland: World Health Organization 1995. WHO Technical Report Series.). As a person's BMI increases, the risk for many diseases (including diabetes) increases as well (refer to: Calle EE, et al. BMI and mortality in prospective cohort of U.S. adults. *New England Journal of Medicine*. 1999;341:1097–1105.). However, BMI alone cannot be used to predict risk for disease. Weight is only one factor that is related to disease and death. For more information on body mass index and how it relates to health, refer to CDC's BMI web site at http://www.cdc.gov/nccdphp/dnpa/bmi/bmi-adult.htm.

Race and Hispanic Ethnicity[146]

Although there are diseases for which "race" and "ethnic group" are markers for genetic factors (such as malignant melanoma or sickle cell anemia), most scientists do not believe that race and ethnicity are biological constructs. Rather, in explaining the relationships of race and ethnicity to human health, race and ethnicity are best viewed as proxies for the effects of complex social, cultural, economic, and political factors.

Racism and discrimination are thought to influence health outcomes in a number of ways. *Institutional racism* has been described as: "the way government and other public and private institutions systematically afford white people an array of social, political and economic advantages, simply because they are white, while marginalizing and putting at a disadvantage African Americans and other people of color."[147] Institutional racism is the mechanism by which non-Caucasians are restricted from accessing good housing, education, employment, income, medical care, and healthy environments. *Personally mediated racism* includes actions arising from judgments made about the abilities, motivations and intentions of others based on their race.[148] Personally mediated racism creates stress-producing experiences of increased surveillance by police and shopkeepers. It may set a child on an inferior educational path when a teacher assumes the child can't learn more challenging material. It may lead to worse health outcomes when a physician fails to prescribe needed medical treatments due to assumptions about ability to comply or pay for treatment. Finally, *internalized racism*, defined as "acceptance by members of the stigmatized races of negative messages about [their] abilities and intrinsic worth", influences health through low achievement, poor self-esteem and intra-racial violence.

The U.S. Census Bureau uses the concept of race to reflect self-identification and not to denote any clear-cut scientific definition of biological stock. As with the U.S. Census, race as collected by the systems used to generate data for this document is not intended to denote a clear-cut definition of biological stock. For some systems, the race data reflect self-classification by people according to the race with which they most closely identify (for example reporting of race/Hispanic origin in the Washington State Behavioral Risk Factor Surveillance System telephone survey is based on self-report). For other systems someone else reports the race of the person (for example reporting of race/Hispanic origin on death certificates is based on observing the decedent or questioning the next of kin). These reports are most likely to reflect the race with which the person most closely identifies when the person reporting the race knows or knew the person well, such as

[146] Information extracted from: Washington State Department of Health. Appendix A: Technical Notes. In Health of Washington State. Olympia, WA, 2004 Sep [cited 2004 April 21] pp. 8-9. Available from http://www.doh.wa.gov/HWS/Appendix.shtm.

[147] Viewed 3/1/2006 from: http://www.eraseracismny.org/institutional_racism/, accessed 2/28/2006

[148] Jones, C., *Addressing the underlying causes of health disparities: What is the role of public health?* Electronic Health Promotion Conference:Plan for Success: Strengthening the Public's Health through Health Promotion. Viewed 3/2/2006 from: http://www.dhpe.org/PlanforSuccess/files/003.htm

when next-of-kin report race on a death certificate. At times, someone who does not know the person well makes a judgment about the person's race, such as when a health care worker records race in a medical chart without first asking the person. In these instances, the race may not represent that with which the person most closely identifies.

Ethnicity, as used by the U.S. Census Bureau, refers to "the ancestry, nationality group, lineage, or country of birth of the person or the person's parents or ancestors before their arrival in the United States." People of Hispanic or Latino ethnicity have their origins in a Hispanic or Spanish-speaking country such as Mexico or Cuba, or other Spanish-speaking countries of Central or South America. People of Hispanic ethnicity can be of any race. Following national guidelines, most data systems currently separate Hispanic ethnicity from race. They generally first ask about Hispanic ethnicity. For example, the Behavioral Risk Factor Surveillance system asks, "Are you Hispanic or Latino?" It then asks about race.

Federal guidelines currently specify five racial categories including American Indian or Alaska Native, Asian, black or African American, Native Hawaiian or other Pacific Islander, and white. Until the 1997 revisions, federal guidelines grouped Asians and Pacific Islanders. The 1997 revisions were used in the 2000 U.S. Census, but most states, including Washington, did not adopt these conventions until 2003.

In some instances where we could not develop Washington State data by race we provided information on differences in race from the scientific literature or from previously published Washington State reports. Readers should be advised that this information must be interpreted with caution. Racial patterns in Washington might be different from those seen elsewhere and differences by race in previously published reports might have been due to under- or overestimating the number of people in different racial groups. See *Guidelines for Using Race and Ethnic Groups in Data Analyses* (http://www.doh.wa.gov/Data/Guidelines/Raceguide1.htm) for a more detailed discussion of these issues.

Statistically Significant Differences[149]

Statistically significant differences – differences between estimates that are not likely due to chance alone – are identified in this report in a variety of ways.

Comparison of Confidence Intervals: Some significant differences can be identified by visually comparing confidence intervals (CI) in graphs or comparing the bounds reported in Appendix B data tables. Comparison of confidence intervals is a good approximation to a statistical test. For example, when comparing two percentages, if the 95% CI of a percentage overlaps the point estimate for the other percentage, the two percentages are NOT statistically significantly different. If the confidence intervals do not overlap, the percentages ARE significantly different. If the confidence intervals overlap with each other, but not with the point estimates, the two percentages may or may not be significantly different, in which case, formal statistical testing for significance was needed to produce a p-value. The only exception being when we assessed differences between groups for hospitalization and death rates; in this instance we only visually compared confidence intervals to identify differences.

Statistical tests: Statistical tests were performed that generated p-values to assess the significance of differences observed between groups. P-values less than 0.05 indicate that both

[149] Information extracted from: Washington State Department of Health. Guidelines for Using Confidence Intervals for Public Health Assessment. Olympia, WA, 2002 Jan. [cited 2004 April 21]. Available from http://www.doh.wa.gov/Data/Guidelines/ConfIntguide.htm. For BRFSS analysis used methods from:*Using Stata to Analyze BRFSS Survey Data*. Workshop presented at the 19th Annual BRFSS Conference (March 9, 2002) by Donna Brogan, Ph.D., Professor or Biostatistics, Rollins School of Public Health, Emory University, Atlanta, GA.

groups are statistically significantly different at the 95% confidence level. The statistical test chosen depended upon the type of data, variable format, and analysis being conducted.

On most occasions for two-way tabulations a Pearson chi-square test of independence was done to determine if the two categorical variables being compared were significantly associated with each other (for example, diabetes [yes, no] and sex [male, female]). When a variable had multiple categories (for example, annual household income [<$25,000, $25,000-<$50,000, $50,000+]) or race/ethnicity [non-Hispanic whites, non-Hispanic blacks, Hispanics, etc.), a Pearson Chi-square test was initially used to determine if the two variables measured were significantly related overall. Then subsequent analysis was conducted to determine exactly which groups of a variable with multiple categories were statistically significant different from each other.

To determine the significance of the difference in prevalence (proportion) between two categories in the BRFSS, we used the command *lincom* after *svy: mean* in Stata (refer to workshop by Donna Brogan in footnote above) The *svy:mean* command can only be used with dichotomous outcome variables where 1=yes and 0=no (i.e., in this situation the calculated mean would equal the prevalence). One can use *svy:mean* to estimate prevalence for dichotomous variables by a specific domain (e.g., age or sex), then follow-up with *lincom* command to compare different domains on prevalence (such as: Do men and women differ on the prevalence of diabetes? Does one income group differ from another income group on the prevalence of diabetes?) The *lincom* command defines a linear combination of means (proportions) generated in the previous *svy:mean* command. For example if we looked at the difference in diabetes prevalence (1=yes, 0=no) for two racial categories (non-Hispanic whites =1, non-Hispanic blacks=2), the first term in the linear combination is the mean of the diabetes variable (proportion with diabetes) for the level of race that is non-Hispanic white. The second term in the linear combination is the mean of the diabetes variable (proportion with diabetes) for the level of race that is non-Hispanic black. The non-Hispanic blacks mean (proportion) is subtracted from the non-Hispanic white mean (proportion). The command *lincom* will estimate the difference in means (proportions), the estimated standard error of the difference, a confidence interval on the difference, and conduct a t-test of the null hypothesis that the non-Hispanic white and non-Hispanic black proportions in the population are equal to each other.

When a logistic regression analysis was performed to determine how much more likely (or unlikely) it is for a health outcome to be present among those with a particular characteristic than among those without a characteristic, a Wald test was used to identify significant odds ratios across different categories in a statistical model. When logistic regression analysis was performed in multivariate analysis, a Wald test was also used to identify significant independent effects of select characteristics or risk factors (income, education) on a particular outcome (diabetes), while controlling for other critical factors (age, sex, race/ethnicity).

Throughout this report, continuous variables (for example age) were generally categorized at biologically meaningful cut points. However, in some instances, logistic regression analysis and the Wald test were used to determine if a continuous variable (for example GINI coefficient) was significantly related to a particular outcome.

For BRFSS analysis, statistical tests were adjusted to account for the design effect of the complex sample survey. A Pearson chi square test (design-based F statistic with a second order correction by Rao and Scott—1981, 1984) was used when performing two-way tabulations. A t-test was performed when computing estimates of linear combinations of parameters (e.g., differences in proportions) after survey estimation. An adjusted Wald test was used in logistic regression analyses.

Trend Analysis[150]

We used Joinpoint statistical software version 3.0 (developed by the National Cancer Institute, April 2005) to analyze trends in age-standardized health indicator rates over time. We also used Joinpoint to test for trends across categorical variables to determine if an outcome measure (such as prevalence of diabetes) increases or decreases in value across ordered groupings of another variable (for example, level of education in four categories from low to high).

The Joinpoint Regression Program analyzes rates that are originally calculated in Stata to test if an apparent change in trend is significant. The software takes age-standardized rates for select years or proportions across a categorical variable, along with their associated standard errors, to fit the simplest joinpoint model that the data allow. A Monte Carlo Permutation method is used to test the significance of the different models fitted to the data. P-values from the permutation tests are used to determine which joinpoint model is selected that best fits the data. A p-value of less than 0.05 at the 95% confidence level indicates the model has 1 or more joinpoints (i.e., reject the null hypothesis of 0 joinpoints, there is a significant change in trend). For assessing trends across categorical variables, the model with 0 joinpoints should be selected via the permutation test (p=1.000, do not reject the null hypothesis of 0 joinpoints).

Models are specified as linear on the log of the response, which allows for the calculation of the annual percentage rate change (APC) across years for each segment of a model. The Joinpoint program also computes a 95% confidence interval around the APC estimate. If the confidence

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[150] Information provided by: National Cancer Institute. Cancer Control & Population Sciences. Statistical Research and Applications Branch. Joinpoint Regression Program. Bethesda, Maryland [cited 2004 April 21]. Available from http://srab.cancer.gov/joinpoint/.

interval includes zero, the percent change is not significant, meaning no increasing or decreasing trend was observed across time for a particular segment of a model. The Joinpoint program also shows the estimates of regression coefficients of each model (i.e., intercepts and slopes). To assess trends across categorical variables, the p-value from the slope of a model with 0 joinpoints are used to identify increasing or decreasing trends that are statistically significant.

Urban-Rural Community Type [151]

An assessment of differences in diabetes health status by urban-rural community type was conducted using sub-county Rural Urban Commuting Area (RUCA) codes. The RUCA system is a ten-tiered Census-based classification scheme that utilizes the standard Bureau of Census urban area and place definitions in combination with commuting information to characterize geographic regions (i.e., census tracts, zip codes, etc.) according to their rural and urban status and relationships. In our analysis, we used RUCA version 2.0 (July 2005) sub-county codes developed by the WWAMI (Washington, Wyoming, Alaska, Montana, & Idaho) Rural Health Research Center (RHRC) at the University of Washington. These codes are based on 2004 zip codes and 2000 Census commuting data.

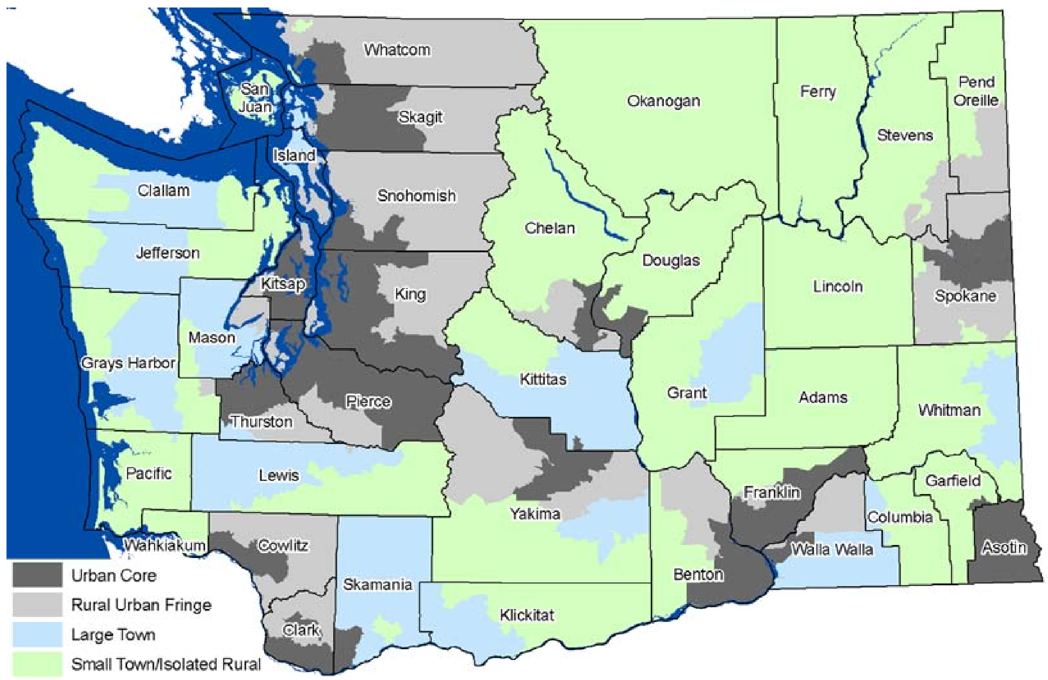
The Washington State Department of Health, Office of Community and Rural Health, developed a four-tiered consolidation of sub-county RUCA codes. The community types are classified as follows:

- **Urban Core** Areas - continuously built up areas of 50,000 persons or more. These areas correspond to US Bureau of the Census defined Urbanized Areas.
- **Suburban** (Urban Rural Fringe) Areas - areas with high commuting relationships with Urban Core Areas. Suburban areas also include Large Town, Small Town and Isolated Rural Areas with high commuting levels to Urban Core Areas.
- **Large Town** Areas - towns with populations between 10,000 and 49,999 and surrounding rural areas with high commuting levels to these towns.
- **Rural** (Small Town and Isolated Rural) Areas - towns with populations below 10,000 and areas with strong commuting relationships to these towns and isolated rural areas.

In analysis for this report, individuals were assigned to one of four sub-county Rural Urban Communing Area (RUCA) categories in the death, CHARS, and BRFSS data by zip code of residence. The map below displays the distribution of RUCA areas across Washington State.

[151] Information extracted from: Washington State Department of Health. Guidelines For Using Rural-Urban Classification Systems for Public Health Assessment. Olympia, WA, 2001. [cited 2004 April 21]. Available from http://www.doh.wa.gov/Data/Guidelines/RuralUrban.htm. Updates were provided by Vince Schueler in the Washington State Department, Office of Community and Rural Health.

Four Tier Consolidation of RUCA Codes by Zip Code



Additional information about the RUCA system is available in the WA DOH *Guidelines for Using Rural-Urban Classification Systems for Public Health Assessment* (http://www.doh.wa.gov/Data/Guidelines/RuralUrban.htm), and WWAMI Rural Health Research Center (http://www.fammed.washington.edu/wwamirhrc/).

Appendix D: Policies and Strategies to Address Health Disparities

U.S. Policy Development at the National Level

Health services researcher Nicole Lurie has identified 8 steps that could be undertaken by the US Federal government as part of a systems approach to addressing the social and economic conditions driving health disparities.[152]

These include:

- Continued leadership and education to the general public and to policy makers on the part of federal agencies like the Centers for Disease Control,
- Developing a surgeon general's report, to serve as a catalyst for action;
- Developing standing mechanisms for policy development among sectors, such as assigning a senior public health official to each cabinet level secretary and as staff on key committees in Congress to address the non-medical determinants of health;
- Promoting policy collaboration among government departments to address social determinants of health, similar to the Safe Schools/Healthy Students collaboration among the Departments of Health and Human Services, Education, and Justice to prevent youth violence and drug use;
- Ensuring sufficient resources to monitor and report on the social and economic indicators;
- Strengthening the science base, in order to better understand the pathways and mechanisms by which socioeconomic conditions affect health, and to provide evidence for the effectiveness of intervention strategies;
- Leveraging Government as an employer, to model innovative wellness policies that improve employee health by assuring that new and renovated federal worksites are structured to assure high indoor air quality and promote physical activity;
- Expanding the definition and scope of health policy to include policies, which influence economic conditions and educational opportunities.

Policy Development: Lessons from European Nations

In many parts of the world, health promotion has come to be understood not only as an approach that "moves beyond health care" but also as a commitment to social reform and equity. The World Health Organization (WHO) is largely responsible for creating this broad understanding through dissemination of its 38 *Health for All* targets, adopted by member states of the European region of WHO in 1984.[153] Some targets reflected the traditional focus on individual behavior modification; others focused on interactions between individuals and their environments and on the political instruments needed to address the social determinants of health.

Between 1990 and 2001, a number of European nations began to take steps to reduce health inequalities. A study of nine countries, including the UK, Finland, France, Greece, Italy, Lithuania, the Netherlands, Spain, and Sweden, showed that nations were in various phases of awareness, willingness to take action, and development of strategies. Activities ranged from initial documentation of health disparities and a call for policy development; to establishment of a national research program on disparities; to recommendations by

[152] Lurie, N. (2002). What the federal government can do about non-medical determinants of health. *Health Affairs,* 21(2):94-106.
[153] Kickbusch, I. (2003). The contribution of the World Health Organization to a new public health and health promotion. *American Journal of Public Health,* 93(3): 383-388.

government advisory committees for strategies to address disparities; to establishment of government policies to reduce disparities.[154] Three nations (United Kingdom, the Netherlands, and Sweden) that were most advanced in developing strategies to address social determinants of health are displayed in Table 3, below.

Table 3. Comparison of three comprehensive packages of policies to reduce inequalities in health in Europe[155]

Independent inquiry into inequalities in health (UK, 1998): <u>39 Main recommendations (123 with subclauses)</u> *7 overarching policy areas reviewed, corresponding to the major departments of state:* • Taxation and social security • Education • Employment • Housing and environment • Mobility, transport, and pollution • Nutrition and the common agricultural policy • National Health Service *Demographic factors over the life course considered, including:* • Mothers, children, and families • Young people and adults of working age • Older people • Ethnic origin • Sex *Three priority areas emphasized as crucial to addressing inequalities:* 1. Health inequalities impact assessment 2. A high priority for the health of families with children 3. Reduction in income inequalities and improvement of living standards of poor households	Program committee on socioeconomic inequalities in health (Netherlands, 2001): <u>26 recommendations</u> *4 Specific strategies:* 1. Reduction of inequalities in education, income, and other socioeconomic factors—e.g., no increase in income inequalities; antipoverty measures; benefits to counter health effects of poverty 2. Reduction of the negative effects of health problems on socioeconomic position—e.g., decent benefits for work-incapacity; improved labor market participation of chronically ill 3. Reduction of the negative effects of socioeconomic position on health—e.g., reduction of smoking, overweight, physical and psychosocial work load in lower socioeconomic groups 4. Improve access and quality of health care for lower socioeconomic groups—e.g., preserve equal access; strengthen primary care in deprived neighborhoods This package includes 11 quantitative targets relating to intermediate outcomes. In general, strong emphasis on continuation of research, development, monitoring and evaluation.	National Public Health Commission (Sweden, 2000): <u>18 health policy objectives</u> *6 overarching themes:* 1. Strengthening social capital—e.g., reduce poverty; reduce segregation in housing; reduce isolation and loneliness 2. Growing up in a satisfactory environment—e.g., secure parent-child bond; schools that strengthen pupils' self-confidence 3. Improving conditions at work—e.g., low unemployment; adapt physical and mental work demands; reduced overtime 4. Creating a satisfactory physical environment—e.g., green areas and playgrounds; high standards of building; safe traffic environment 5. Stimulating health-promoting life habits—e.g., more physical exercise; reduce overweight; reduce unwanted pregnancies 6. Developing a satisfactory infrastructure for health—e.g., strengthening prevention; coordination of public health efforts; intensified research. Development of indicators for achievement recommended.

Programmatic Strategies at the Community Level

A number of local community-based initiatives have been described in the scientific literature that illustrates how interventions to improve social and economic conditions may be integrated into health programs. The projects described below vary in the extent to which they integrate health promotion, disease prevention and a social determinants approach. Only a few address diabetes specifically.

<u>*Havana, Cuba: Plan Cayo Hueso*</u>[156]

[154] Mackenbach, J., Bakker, M.J. (2003). Tackling socioeconomic inequalities in health: Analysis of European experiences. *The Lancet,* 362 (9393):1409-1414.

[155] Ibid.

An example of the WHO's "Healthy Cities" projects, this intervention addressed health disparities through improvements in housing and urban infrastructure in a depressed portion of the inner city. The project used participatory research methods within an ecosystem health framework, stressing linkages between government agencies and social activists, mobilization of people and local resources through existing social structures, and self-definition by the local community. Not only did the rigorously evaluated project result in the achievement of process objectives (housing & street repairs, improved sewage and drainage systems, better lighting and revitalized neighborhood social and cultural activities); it also resulted in improvement in some lifestyle-related risk factors and self-rated health in the most vulnerable subgroups (elderly and adolescents). The intervention directly addressed social determinants (housing and infrastructure) that affect health, through community empowerment and mobilization, and improved communication and collaboration between various government agencies and community groups.

Detroit, Michigan: East Side Village Health Worker Partnership[157]

The Partnership is a community-based participatory research and intervention project based on collaboration among academia, public health practitioners, and the local community residents. Its purpose is to reduce the disproportionate health risks experienced by residents of Detroit's east side. Researchers interviewed community members to allow them to "name and frame" local issues. Using a stress process model to map the interaction between socio-economic factors and health outcomes, researchers then guided the community in developing interventions to address the relevant social conditions. Interventions included working with local police precincts to increase community safety, enhancing economic security by developing micro-enterprise activities, strengthening social networks, and implementing the Healthy Eating and Exercise to reduce Diabetes (HEED) project. HEED has gotten a lot of attention through its use of mini-markets to improve access to healthy foods in deprived neighborhoods and walking clubs for seniors—moreover, the elements of community empowerment and addressing economic issues make this a unique project in addressing social determinants of health.

Chicago, Illinois: Southeast Diabetes Community Action Coalition[158]

Community residents, medical and social service providers, and a local university founded the Diabetes Community Action Coalition as part of its local REACH 2010 efforts, to address high rates of diabetes morbidity and mortality in Chicago's underserved minority neighborhoods. A participatory action research model guided the project from conceptualization through implementation, and included capacity building trainings for community members on diabetes prevention, coalition building, research methods and action planning. The research encouraged key stakeholders outside of the health care sector to participate (e.g., business sector, church groups) and incorporated examination of the sociopolitical context affecting the health of the community. The project provided the community with an opportunity to focus on preventing the onset of diabetes and its complications. The project underscores the importance of community research in catalyzing social action aimed at community and systems change. Community empowerment, capacity building and participatory action research were used as a vehicle for improving access and quality of health care for disadvantaged and underserved populations. It should be noted that while the socio-political context

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[156] Spiegel, J., Bonet, M., Yassi, A., Tate, R.B., Concepcion, M., Canizares, M. (2003). Evaluating the effectiveness of a multi-component intervention to improve health in an inner-city Havana community. *International Journal of Occupational and Environmental Health*, 9(2):118-27.
[157] Schulz, A.J., Parker, E.A., Israel, B.A., Allen, A., Decarlo, M., Lockett, M. (2002). Addressing social determinants of health through community-based participatory research: the East Side Village Health Worker Partnership. *Health Education and Behavior*, 29(3):326-41.
[158] Giachello, A.L., Arrom, J.O., Davis, M., Sayad, J.V., Ramirez, D., Nandi, C., Ramos, C. (2003). Reducing diabetes health disparities through community-based participatory action research: the Chicago Southeast Diabetes Community Action Coalition. *Public Health Report,* 118(4):309-23.

driving these conditions was discussed in the planning process, neither Phase I nor Phase II of the project directly address social determinants.

England, New Deal for Communities[159]

This project is an example of national policy implemented at the local level. This project was designed to reduce health inequities by improving socioeconomic conditions in 39 of the country's most deprived communities. The initiative supports intensive regeneration of neighborhoods by bringing together diverse partners to identify community needs, and subsequently develop and implement projects to meet those standards. The initiative has the financial and political support of national leadership, and draws on a history of community involvement in solving local problems. Despite challenges, the initiative is proving successful in demonstrating how improving the socioeconomic conditions in deprived communities can reduce health inequities.

King County Neurons to Neighborhoods[160]

This project is a policy-oriented intervention developed by Public Health Seattle and King County in collaboration with academic institutions, local and state government, education, childcare resources and referral organizations. Neurons to neighborhoods is the result of in-depth planning on the part of a task force comprised of stakeholders representing multiple sectors. The WHO extensive review of the literature on childhood development was used to identify all the biologic, social, economic systems that influence early childhood cognitive, social, emotional, and physical development. The project currently supports healthy development among preschoolers in King County. School readiness (an outcome goal) is being assessed among kindergarten children in two school districts. Data will then be used to mobilize community action to improve school readiness. Holistic, human-development through the lifespan approach, aims to address social determinants through changing community assets and services, the socioeconomic environment, and by strengthening social networks.

[159] http://www.gos.gov.uk/gol/People_sustain_comms/Neighbourhoodrenewal/202213/, viewed 2-5-2006.
[160] Horsley, K., Ciske, S.J. (2005). From neurons to King County neighborhoods: partnering to promote policies based on the science of early childhood development. *American Journal of Public Health*, 95: 562-566.

Appendix E: Glossary of Key Public Health Terms

The following terms may be found in the Diabetes Disparities Report. Others are simply useful public health terms to know with respect to racial and ethnic health disparities. This glossary was developed by the Colorado Department of Public Health and Environment's Office of Health Disparities. http://www.cdphe.state.co.us.

Access to health care:
The potential for or actual entry of a population into the health system. Entry is dependent on the wants, resources, and needs that individuals bring to the care-seeking process. Ability to obtain wanted or needed services may be influenced by many factors, including travel distance, waiting time, available financial resources, and availability of a regular source of care. [1]

Biological Expression of Social Inequality:
How people literally embody and biologically express experiences of economic and social inequality, from before birth to death. Biological expression of inequality is a reflection of the impacts of poverty, deprivation (material and social), and diverse types of discrimination on health status and health outcomes throughout the lifecourse.[2]

Community:
A group of people who have common characteristics; communities can be defined by location, race, ethnicity, age occupation, interest in particular problems or outcomes, or other common bonds. Ideally, there should be available assets and resources, as well as collective discussion, decision making, and action. [1]

Cultural Competence:
Is a developmental process that evolves over an extended period of time. Individuals, organizations, and systems are at various levels of awareness, knowledge and skills along the cultural competence continuum. It requires organizations to:

- Have a defined set of values and principles, and demonstrate behaviors, attitudes, policies, and structures that enable them to work effectively cross-culturally;
- Have the capacity to (1) value diversity, (2) conduct self-assessment, (3) manage the dynamics of difference, (4) acquire and institutionalize cultural knowledge, and (5) adapt to the diversity and cultural contexts of communities they serve;
- Incorporate the above into all aspects of policymaking, administration, practice, and service delivery and systematically involve consumers, key stakeholders and communities. [9]

Determinants of Health:
The leading factors that contribute in aggregate to health status in an individual or populations. Determinants include: income, education level, living environment, personal behavior, health care access, genetics and social/cultural issues. See also “Root Causes”

Diversity:
Diversity refers to other individual differences and characteristics by which persons may self-define. This includes but is not limited to an individual's age, gender, sexual orientation, religion or spiritual identification, physical ability/disability, social and economic class background, and residential location.[7]

Health:
A state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.[4]

Health Disparity:
A statistically significant difference in a health indicator between groups that persists over time. (Also see "Racial and Ethnic Health Disparities.")

Health Equity:
1) Distribution of disease, disability and death in such a way as to not create a disproportionate burden on one population.
2) The absence of persistent health differences over time, between racial and ethnic groups.

Health Indicator:
A measure that reflects, or indicates, the state of health of persons in a defined population. Examples - rates of disease, disability and death.

Health Literacy:
Health literacy is the degree to which individuals can obtain, process, and understand the basic health information and services they need to make appropriate health decisions. But health literacy goes beyond the individual. It also depends upon the skills, preferences, and expectations of those health information providers: our doctors, nurses, administrators, home health workers, the media, and many others. Health literacy arises from a convergence of education, health services, and social and cultural factors, and brings together research and practice from diverse fields.[8]

High Risk Group:
A group in the community with an elevated risk of health problems.

Infrastructure:
The resources (e.g., personnel, information, monetary, and organizational) used by the public health system to provide the capacity to perform its duties.

Prevention:
Anticipatory action taken to prevent the occurrence of an adverse health event or to minimize its effects after it has occurred. Prevention is fundamental to the field of public health and differentiates it from the field of medicine, which largely focuses on treatment.

Population Health:
An approach to health that aims to improve the health of the entire population and to reduce health inequities among population groups. Population health is fundamental to the field of public health and differentiates it from the field of medicine, which largely focuses on the health of individuals.

Public Health Mission:
To fulfill society's interest in assuring conditions in which people can be healthy,[6] Public Health carries out its mission through organized, interdisciplinary efforts that address the physical, mental and environmental health concerns of communities and populations.

Race/Ethnicity:
Race and ethnicity are social, not biological constructs, referring to social groups, often sharing cultural heritage and ancestry. Race and ethnicity are not valid biological or genetic categories.

Racial and Ethnic Health Disparities:
Persistent differences in health indicators by race and ethnicity across multiple categories (chronic

disease, communicable disease, intentional and unintentional injuries and maternal and child health indicators).

Racism:
Racism and discrimination are thought to influence health outcomes in a number of ways. *Institutional racism* has been described as: "the way government and other public and private institutions systematically afford white people an array of social, political and economic advantages, simply because they are white, while marginalizing and putting at a disadvantage African Americans and other people of color."[10] Institutional racism is the mechanism by which non-Caucasians are restricted from accessing good housing, education, employment, income, medical care, and healthy environments. *Personally mediated racism* includes actions arising from judgments made about the abilities, motivations and intentions of others based on their race.[11] Personally mediated racism creates stress-producing experiences of increased surveillance by police and shopkeepers. It may set a child on an inferior educational path when a teacher assumes the child can't learn more challenging material. It may lead to worse health outcomes when a physician fails to prescribe needed medical treatments due to assumptions about ability to comply or pay for treatment. Finally, *internalized racism*, defined as "acceptance by members of the stigmatized races of negative messages about [their] abilities and intrinsic worth", influences health through low achievement, poor self-esteem and intra-racial violence.

Root Causes (Also referred to as "Fundamental Causes" or "Upstream Causes):
Many people understand causes of health problems to be things such as viruses and individual behaviors. While these are undeniable causes, what can explain why some groups of people have higher rates of viruses (like HIV) or unhealthy behaviors (like smoking) than others? *Root causes* are primary causes of health problems that underlie the more obvious causes (literally visualize the roots of a plant beneath the soil). Social problems are often root causes that result in health inequalities through complex pathways. For example, racism is a root cause because it causes things like income inequality, lack of power, residential and occupational segregation, and stress in marginalized groups. These things in turn cause things like inadequate health care, working in dangerous environments, living in cramped conditions where infections spread easily, smoking, and the inability to afford nutritious food. These things, in turn, are related to a host of health problems like injury, infectious and chronic disease, and mental illness. While addressing root causes will not eliminate disease and death, it will reduce health disparities between populations.

Systems Change:
The process of improving the capacity of the public health system to work with many sectors to improve the health status of all people in a community.

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[1] Turnock, B.J. (2001) Public Health: What it is and How it Works. Aspen Publishers, Inc.: Gaithersburg.

[2] Kreiger, N. (2002). A Glossary for Social Epidemiology. Epidemiological Bulletin, 23 (1).

[3] US Department of Health and Human Services, Public Health Services, Centers for Disease Control and Prevention (1992). Principles of Epidemiology. CDC: Atlanta.

[4] Preamble to the Constitution of the World Health Organization as adopted by the International Health Conference, New York, 19-22 June, 1946; signed on 22 July 1946 by the representatives of 61 States (Official Records of the World Health Organization, no. 2, p. 100) and entered into force on 7 April 1948.

[5] http://www.healthypeople.gov/

[6] Institute of Medicine http://www.iom.edu/

[7] Schnieder Corey, Marianne and Gerald Corey. Becoming a Helper. 4th ed. Brooks/Cole.

[8] Health Literacy: A Prescription to End Confusion. Report Brief. April 2004.

[9] National Center for Cultural Competence. Georgetown University Center for Child and Human Development, University Center for Excellence in Developmental Disabilities http://gucchd.georgetown.edu/nccc/framework.html

[10] Viewed 3/1/2006 from: http://www.eraseracismny.org/institutional_racism/, accessed 2/28/2006

[11] Jones, C., *Addressing the underlying causes of health disparities: What is the role of public health?* Electronic Health Promotion Conference:Plan for Success: Strengthening the Public's Health through Health Promotion. Viewed 3/2/2006 from: http://www.dhpe.org/PlanforSuccess/files/003.htm