
Healthy Smile, Healthy Life

Improving Oral Health in Spokane County

October 2010



Table of Contents

Acknowledgement	2
Purpose	3
Introduction	3
A Brief Look at Spokane County	3
Access to Care	
Availability of Services	4
Dentist Workforce	4
Medicaid	5
Emergency Department Use	7
Dental Status	
Dental Visits	8
Teeth Removed Because of Decay	8
Dental Insurance	9
Early Cavities	10
Sealants	10
Special Populations	
Pregnant Women	10
Seniors	12
Special Needs	14
Tobacco Users	15
Co-Morbidities	15
Preventive Measures	
Knowledge	16
Oral Health Maintenance	16
Sealants	16
Fluoride	16
Public Water Fluoridation	17
Toothpaste	17
Mouthrinse with Fluoride	17
Dietary Fluoride Supplements	18
Gel and Foam Fluoride	18
Varnish	18
Fluoride Concerns	18
Oral Health Comparison	19
Discussion	20
Opportunities	21
References	22

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Purpose

This report provides critical information for Spokane County, enabling the community to examine its oral health status and decide how to make improvements. Oral health is complex and influenced by many factors, such as the availability and use of fluoride, personal hygiene habits, and access to and use of preventive dental services. The purpose of this paper is to present findings about the oral health of residents in Spokane County, Washington. It will also examine the special considerations of select populations. Additionally, there is a discussion on public health's role in addressing findings and improving oral health.

Introduction

The mission of public health is assuring conditions in which people can be healthy.¹ Historically, public health services and interventions were targeted toward minimizing infectious disease. This was done through efforts to ensure public water was free from microorganisms that caused illness, food preparation was done in a manner that minimized the risk of illness, and the public was educated on the transmission and prevention of communicable diseases. Over time, water and food have become safer, such that many people do not even think about their safety. Advances in medicines and vaccines have greatly reduced the incidence of, and the poor health outcomes from, many diseases.

Public health professionals continue their work, sometimes unrecognized, to keep the community healthy through such basic measures as clean food and water, and access to preventive medicine. Additional work includes promoting healthy families through counseling, nutrition and parenting education, providing food resources, and connecting families to other services; preventing injury; and reducing chronic health conditions. However, one communicable disease issue remains largely unaddressed—cavity-causing bacteria in teeth.

As early as 1950, Dr. H. Trendly Dean, the first dental scientist at the National Institutes of Health and later the director of its dental research section, stated in a national radio address that, “We can’t divorce the mouth from the rest of the body.”² Today, oral health is oftentimes still isolated from other health factors that affect an individual. However, the status of one’s oral health provides an indication of one’s overall health and is important in many facets of daily life. Poor oral health may cause pain, loss of time from school or work, impact nutritional intake by limiting what can be chewed and eaten, and is a risk factor for other health conditions. In addition, oral health impacts mental health, confidence, and social relationships. Individuals with visibly poor oral health, such as decayed, missing, or broken teeth, may feel uncomfortable when others see their teeth, suffer lower self-esteem, and be less employable.

Dental decay and oral cancers are potentially preventable conditions. The human and financial costs of these oral health conditions can be minimized with preventive measures or early diagnosis and treatment. Although there may be different oral health needs and concerns across the life span, each person,

regardless of age, could benefit from access to, and use of, a good oral healthcare system.

Over the last several decades, there have been advances and improvements in dentistry, oral health products, and awareness in preventive oral health measures. Generally, oral health status has improved over time. Among seniors, periodontitis has declined and fewer seniors are losing all their teeth. Among adults, there has been a decrease in cavities, improved tooth retention, and progress in periodontal health. Among youth, there has been an increase in the use of dental sealants and a decrease in cavities in permanent teeth. These findings are supported when evaluating insurance claims, which show a decline in the use of restorative procedures.³ The exception to improved oral health is among children 2-5 years of age where there has been an increase in cavities in primary teeth.⁴

These improvements are specific to oral health conditions. Unfortunately, many people still experience dental decay. In the early 2000s, more than one-third of adults (38.8%) felt the condition of their teeth and mouth was fair or poor. This was an increase from 10 years prior, when it was 33.8%. In the same 10-year span, poor oral health was higher among older adults, minorities, those with a low income, and those with less than a high school education.⁵

A Brief Look at Spokane County

Spokane County is located in the center of the eastern edge of Washington State. Spokane County was the fourth most populous county in the state in 2009 with 465,000 individuals. This accounts for 7.0% of the state's population. The city of Spokane was the second most populous incorporated city in the state with 205,500 individuals. The city of Spokane accounts for 44.2% of the county population, with another 26.7% living in other incorporated municipalities in the county. The remaining 29.1% live in unincorporated areas in Spokane County.

The population in Spokane County is fairly evenly distributed between age groups—those 65 years of age or older make up the smallest portion of the overall population. In 2009, the population was comprised of 23.6% youth (0-17 years), 30.1% young adults (18-39 years), 33.0% older adults (40-64 years), and 13.3% seniors (65+ years).

Spokane County is not very racially diverse. Among county residents, 91.5% were White, 1.8% Black, 1.5% Native American/Alaska Native, 2.6% Asian/Pacific Islander, and 2.6% were of two or more races. Residents of Hispanic ethnicity comprised 3.3% of the population.

The projected median household income in Spokane County for 2009 was \$42,196 compared to \$55,413 statewide. In 2008, one in 10 individuals in the county lived below 100% federal poverty level (FPL) and three in 10 individuals lived below the 200% FPL. The proportion of Spokane County residents living in poverty, below 200% FPL, was significantly higher than the statewide proportion (29.2% and 26.0%, respectively).

ACCESS TO CARE

Availability of Services

In 2009, Spokane County had 341 licensed dentists, a rate of 74 dentists per 100,000 population. The dentist rate in Spokane County was lower than the rate statewide (87 per 100,000). An estimated ideal dentist-to-population ratio is one dentist for every 1,100-1,500 population, or 67-91 dentists per 100,000 population.⁷ Spokane County falls within this range, but accessibility to a dentist varies within the county. As of March 2010, Spokane County was designated a dental care health professional shortage area (HPSA) for low-income or homeless individuals.⁸ The designation of an HPSA is given when the rate is below 20 dentists per 100,000 population. There were 190 dentists in Spokane County accepting Medicaid clients in 2009. Including individuals who reside outside Spokane County, but are seen by a dentist within Spokane County, the average number of Medicaid clients per provider was 288. Statewide, the average was 297 clients per provider.

Safety net facilities serve low-income and uninsured individuals. There are four safety net facilities in Spokane County that offer dental services.⁹ They are:

CLINICS/SAFETY NET FACILITIES

Community Health Association of Spokane (CHAS)

Downtown Clinic • 1001 W. 2nd Ave.

Community Health Association of Spokane (CHAS)

Maple Street Clinic - Administration • 3919 N. Maple St.

The Native Project

1803 W. Maxwell

Spokane Falls Family Clinic (Yakima Valley Farm Workers Clinic)

120 W. Mission

Safety net clinics provide dental care services to individuals who are unable to obtain dental services through private dental offices. In safety net clinics, “20% [of the dental work] is preventive and 80% is restorative.”¹⁰ Although this is reflective of the distribution of work in a private practice,¹¹ these public dental clinics are overwhelmed with clients and oftentimes understaffed. It can be challenging to recruit dentists to work in public clinics for a variety of factors: poor reimbursement, lower salary, or wanting to manage their own business.

Spokane Regional Health District established its Access to Baby and Child Dentistry (ABCD) program in 1995. This program

provides enrollment, education, and dental resources for Medicaid-eligible children younger than 6 years of age. Services covered include fluoride varnish, examination, education, and restorative care. Nearly 190 dentists in Spokane County are certified to participate in the program. The Access to Baby and Child Dentistry Expanded (ABCDE) program has included the medical community in providing education, an oral health assessment, a fluoride varnish, and a dental referral.¹²

An evaluation of the ABCD program done in 2002 demonstrated that it is effective in improving the oral health of children and is relatively inexpensive. Children in Spokane County were compared to children in a county with similar demographics, except without an ABCD program. Spokane County children had more sound teeth, fewer decayed or filled teeth, fewer crowned primary teeth, and fewer missing primary teeth. Medicaid dental expenditures for children were approximately \$15 more per child in Spokane County than in the non-ABCD county. Considering that children in the non-ABCD county had twice the rate of decayed or filled teeth, the extra \$15 cost in an ABCD county is a good investment.¹³

Dentist Workforce

In 2007, the average age of dentists in Washington State was 49 years. It is estimated that half of the current dentists will retire within 15 years (by 2022). In 2009, 38% of dentists in Spokane County were 56 years of age or older. As the baby boomer generation retires from the workforce, a gap is likely to occur in specialized professions such as dentistry. A decrease in the number of dentists will be accompanied by an increasing population. Projections are that a widening gap in the dentist-to-population ratio will occur given the estimated retirements and incoming graduates.¹⁴

Washington State has one dental school, the University of Washington School of Dentistry (UWSOD). Each year, 55 dental students enroll. Through the UWSOD Regional Initiatives in Dental Education (RIDE) program, some dental students spend their first year of dental school in Spokane. The RIDE program counts among its partners Eastern Washington University and Washington State University. The primary mission of RIDE is to provide access to high quality, publicly-funded dental education to states and regions in the Northwest in order to develop dentists who will make a personal commitment to serving the needs of rural and underserved communities. Students return to eastern Washington for 4-6 months of community training experiences. The RIDE program is projected to increase the number of new dentists graduating from UWSOD by 15% beginning in 2012.¹⁵

Medicaid

Medicaid reimburses providers for services and treatments given to low-income individuals and families. Medicaid provides comprehensive dental coverage for children and adolescents. It also provides limited coverage for eligible adults, but excludes crowns and some surgical procedures. Prior authorization is required for some services.^{16,17}

In 2009, there were 105,825 Spokane County residents with Medicaid—nearly one in four residents (22.8%). There were 46,227 residents with Medicaid who were seen by a dentist in Spokane County, and an additional 8,482 individuals who reside outside the county, but were seen by dentists within Spokane County. Less than half (43.7%) of eligible Medicaid members in Spokane County used dental resources. Members younger than 21 years of age had a higher utilization rate than adults 21 years of age or older. Spokane County residents had a higher dental utilization rate than did members statewide (Table 1).

A total of \$17.3 million was paid for Medicaid dental services for county residents in 2009. Per eligible member, the cost was \$163.58 per year, or \$13.63 per month. Per user of dental

services, the cost was \$374.47 per year, or \$31.21 per month. About three-fourths of Medicaid dental payments were among residents younger than 21 years of age. Except for per-user cost among children 0-5 years of age, Spokane County had a higher cost than Washington State in both per-member cost and per-user cost (Table 2).

Statewide among Medicaid members who received dental services, the majority used diagnostic and preventive services. Yet, the highest proportion of funds was paid for restorative services (Figure 1). These findings hold true for each age group, only the proportions vary between age groups. Among all ages, 92.4% received diagnostic services (x-rays and examination), 76.8% received preventive services (cleanings, topical fluoride, and sealants), and 38.0% received restorative services (fillings and crowns). Restorative care accounted for 31.5% of total payments, while diagnostic and preventive care each accounted for 17% of payments (Figure 1). Assuming the statewide proportions remain similar in Spokane County, \$5.5 million was spent on restorative care for Medicaid members in 2009.

TABLE 1
Medicaid Population, Dental Services, Utilization and Cost by Age Group
Spokane County and Washington State, 2009

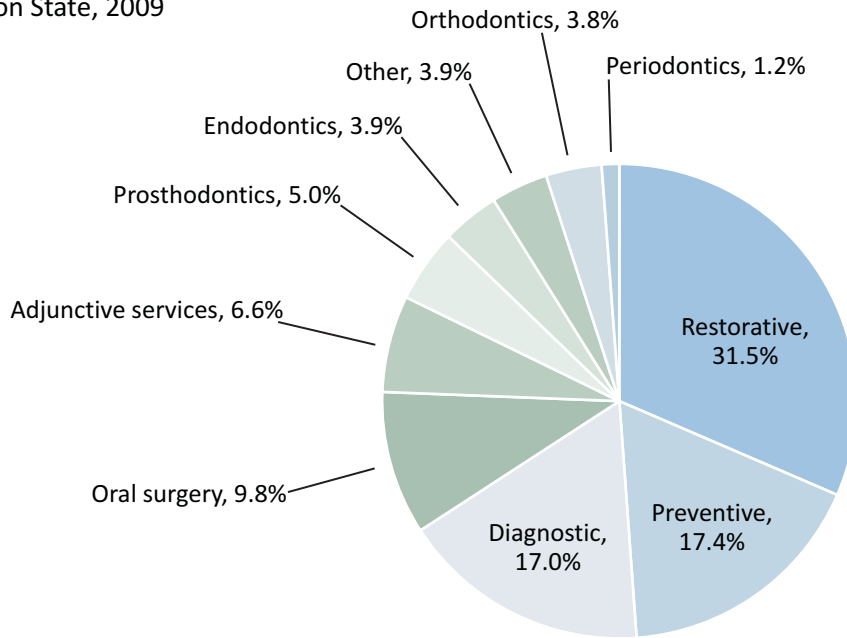
Age Group	Spokane County							
	Eligible Members	Dental Users	Percent of Users	Per Member Per Year	Per User Per Year	Per Member Per Month	Per User Per Month	Total Payment
All Ages	105,825	46,227	43.7%	\$163.58	\$374.47	\$13.63	\$31.21	\$17,310,617
21+ Years	43,246	12,437	28.8%	\$110.21	\$383.22	\$9.18	\$31.93	\$4,766,096
0-20 Years	62,579	33,790	54.0%	\$200.46	\$371.25	\$16.70	\$30.94	\$12,544,522
0-5 Years	23,794	11,944	50.2%	\$162.92	\$324.57	\$13.58	\$27.05	\$3,876,620

Age Group	Washington State					
	Percent of Users	Per Member Per Year	Per User Per Year	Per Member Per Month	Per User Per Month	Total Payment
All Ages	40.0%	\$134.28	\$335.62	\$11.19	\$27.97	\$17,310,617
21+ Years	26.4%	\$93.31	\$353.33	\$7.78	\$29.44	\$4,766,096
0-20 Years	48.3%	\$159.26	\$329.72	\$13.27	\$27.48	\$12,544,522
0-5 Years	42.8%	\$139.12	\$324.99	\$11.59	\$27.08	\$3,876,620

Source: Washington State Department of Social and Health Services, Health and Recovery Services Administration. http://hrsa.dshs.wa.gov/dentalproviders/dental_data.htm

FIGURE 1

Percent of Medicaid Dental Payment
Washington State, 2009



Source: Washington State Department of Social and Health Services

TABLE 2

Medicaid Population, Dental Services, Utilization and Cost by Age Group
Washington State, 2009

Type of Service	All eligible		21+ years		0-20 years		0-5 Years	
	Percent of Payment	Percent of Members	Percent of Payment	Percent of Members	Percent of Payment	Percent of Members	Percent of Payment	Percent of Members
Diagnostic	17.0%	92.4%	14.0%	90.3%	18.0%	93.1%	16.2%	91.2%
Preventive	17.4%	76.8%	4.3%	36.3%	22.1%	90.4%	24.3%	92.7%
Restorative	31.5%	38.0%	22.6%	37.4%	34.7%	38.2%	41.4%	24.6%
Endodontics	3.9%	4.3%	5.9%	6.2%	3.1%	3.7%	0.3%	1.0%
Periodontics	1.2%	4.9%	4.3%	18.9%	0.1%	0.2%	0.0%	0.0%
Prosthodontics, removable	5.0%	2.6%	19.0%	10.2%	0.0%	0.0%	0.0%	0.0%
Maxillofacial prosthetics	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Implant services	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Prosthodontics, fixed	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Oral surgery	9.8%	17.8%	18.3%	31.4%	6.7%	13.2%	2.4%	5.9%
Orthodontics	3.8%	0.9%	10.0%	0.0%	5.2%	1.2%	0.0%	0.0%
Adjunctive general services	6.6%	18.3%	7.7%	15.7%	6.2%	19.2%	9.3%	22.0%
Other	3.9%	10.9%	3.8%	2.3%	3.9%	13.8%	6.1%	36.7%
Total	100.0%		100.0%		100.0%		100.0%	

Source: Washington State Department of Social and Health Services

Emergency Department Use

Dentists are trained specifically to care for individuals with oral health complaints. These complaints arise from either the decay process or from a traumatic injury. However, some individuals seek care at the emergency department (ED) of a hospital for a variety of reasons, such as not having a personal dentist, inability to get an appointment, or it is after business hours.

In Spokane County, the number of ED visits for a dental-related diagnosis significantly increased over the last five years from 2,183 visits in 2005 to 4,676 in 2009. When accounting for the increase in population over time, the rate of ED usage increased 18% each year (OR=1.18, p<0.001). Dental-related diagnoses included diseases of hard tissues of teeth, diseases of pulp and periapical tissues, gingival and periodontal diseases, temporomandibular joint disorders, and broken teeth. The majority of ED visits for a dental-related complaint were due to oral disease (86.0%), compared to 21.3% of visits for broken teeth. A small percentage (7.3%) had a diagnosis of both oral disease and a broken tooth.

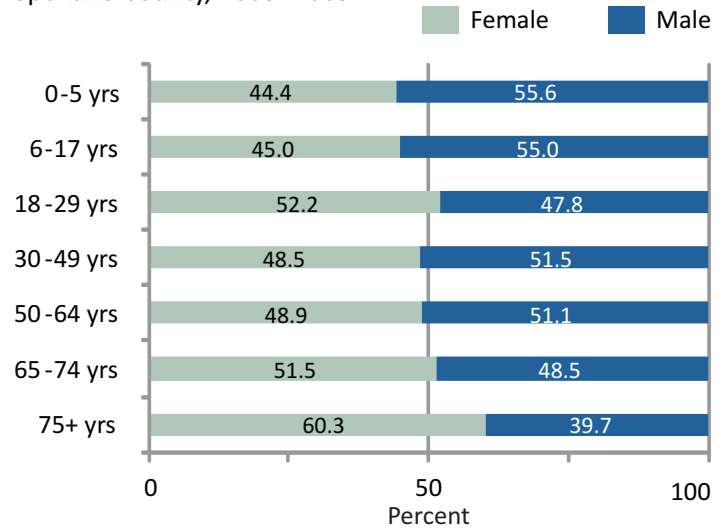
Young adults (18-29 years) had the highest utilization rate for an ED visit for an oral health complaint (Table 3). This was true for both an oral disease and a broken tooth diagnosis. More than half of ED visits for oral health were among individuals with government insurance, such as Medicaid and Medicare. One in three visitors were uninsured. A higher proportion of young males went to the ED compared to young females, and a higher proportion of older females went to the ED compared to older males, though overall utilization was the same for both males and females.(Figure 2).

More than half (54.9%) of the ED visits were single occurrences in the five-year period. Yet the remainder of visits represented individuals who went to the ED multiple times in the five-year period for an oral health complaint. Approximately one in four visits (26.4%) was an individual who went three or more times to the ED. Those with three or more visits were more likely to have government insurance (59.5%; OR=1.4, p<0.001) and less likely to be uninsured (29.7%; OR=0.86, p<0.001).

The average charge for an ED visit with a dental complaint was \$778. Some visits were more than \$100,000, but generally were complicated cases such as trauma from an assault or motor vehicle crash. Total charges during the five-year period were \$14.2 million. The total cost per year increased as the number of cases per year increased: \$1.6 million in 2005, \$2.1 million in 2006, \$3.1 million in 2007, \$3.3 million in 2008, and \$4.1 million in 2009.

FIGURE 2

ED Visits for an Oral Health Complaint by Age and Sex
Spokane County, 2005–2009



Source: INHS Meditech System

TABLE 3

ED Utilization Rate by Age
Spokane County, 2005-2009

	Total oral-related visits	Visits for oral disease	Visits for broken tooth	Uninsured	Government insurance
	Rate per 100,000			Percent	
<6 years	205.0	116.6	87.8	3.5	71.5
6-17 years	266.8	175.4	95.6	6.1	75.0
18-29 years	1991.4	1716.4	427.2	38.0	49.9
30-49 years	1233.9	606.4	232.9	34.3	51.4
50-64 years	264.5	234.3	40.1	16.7	53.3
65-74 years	96.3	76.0	20.2	0.7	89.1
75+ years	95.9	70.0	25.2	0.7	95.7
All Ages	807.1	557.6	171.4	32.2	53.2

Source: INHS Meditech System

DENTAL STATUS

There are multiple risk factors for dental cavities. At any point in time, an individual may be at one place in a continuum of risk based on the risk factors. Over time, the place in the continuum may shift as the risk factors change. Population-based risk factors for increased cavities include those with a low socioeconomic status, not seeking regular dental care, not having dental insurance, or not having access to dental services. Individual risk factors include a history of having a high number of cavities among siblings or caregivers, gum recession that exposes the tooth root, high levels of bacteria that cause cavities, an impaired ability to perform oral hygiene, decreased saliva, wearing orthodontic or prosthodontic appliances, and poor dietary practices that provide an environment for cavity formation.¹⁸

Dental Visits

The American Dental Association recommends that individuals visit the dentist at least two times per year. Children should begin seeing a dentist by their first birthday. Dental checkups allow the dentist to clean the teeth, identify any oral health problems, and provide education on improving or maintaining good oral health.

Among adults in Spokane County in 2008, three in four had visited the dentist in the last year. The proportion in Spokane County was similar to that in Washington State. The likelihood of having visited the dentist in the last year increased as education level increased. Individuals with less than a high school education were the least likely to have seen a dentist in the last year (<HS – reference; HS/GED – OR=2.4, p=0.03; Some College – OR=3.3, p=0.004; College Grad – OR=10.6, p<0.001). Adults living at or below 185% of FPL were more than three times less likely to have visited a dentist in the last year when

compared to adults above 185% FPL (OR=0.31, p<0.001) (Figure 3). There was no significant difference in having visited the dentist in the last year by age group or sex.¹⁹

Nearly three in four Spokane County youth in grades 8, 10, and 12 had visited the dentist in the last year. However, approximately 8% of youth had never seen a dentist. Time since last dental visit was similar in Spokane County and Washington State. The percentage of youth never having been to a dentist decreased as grade level increased (OR=0.89, p=0.001). Male youth were significantly less likely than female youth to have seen a dentist in the last year (OR=0.77, p<0.001) and more likely to have never seen a dentist (OR=1.41, p=0.002) (Figure 4).²⁰

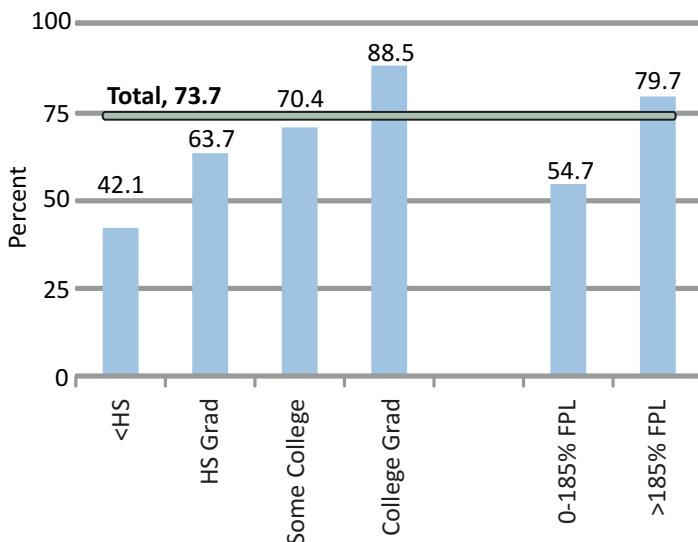
Non-White youth were less likely to have visited the dentist in the last year compared to White youth (White – reference; Black – OR=0.57, p=0.002; NAAN – OR=0.60, p=0.005; API – OR=0.68, p=0.014). Black and Native American/Alaska Native youth were nearly two times more likely than White youth to have never visited the dentist. There was no difference between Asian/Pacific Islander youth and White youth in having never visited the dentist (White – reference; Black – OR=1.82, p=0.03; NAAN – OR=1.82, p=0.03; API – OR=1.44, p=0.17) (Figure 4).²¹

Teeth Removed Because of Decay

Nearly one in three adults in Spokane County in 2008 had lost one or more teeth due to decay. This excludes losing teeth for orthodontia or from an injury. Five percent of adults had lost all their teeth. Dentition loss in Spokane County was similar to that in Washington State. The likelihood of having lost teeth due to decay increased as age increased (18-34 – reference; 35-54 – OR=2.5, p<0.001; 55+ – OR=8.6, p<0.001). Adults living at or

FIGURE 3

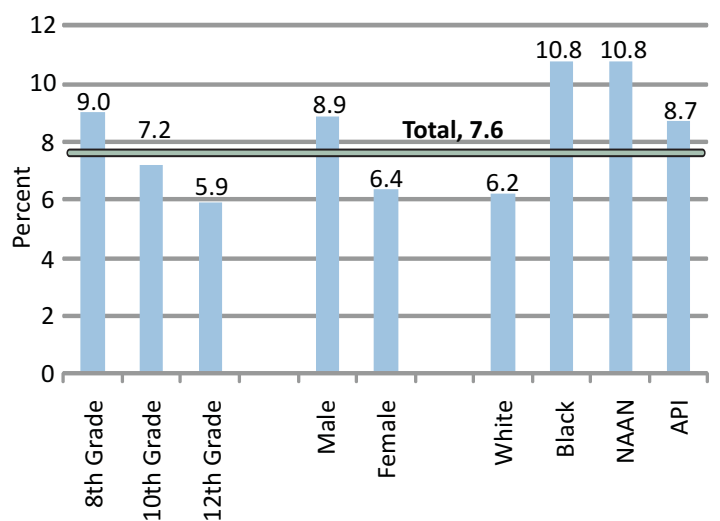
Dental Visit in the Last Year by Demographic Factors
Spokane County Adults, 2008



Source: BRFSS

FIGURE 4

Never Visited a Dentist by Demographic Factors
Spokane County Youth, 2008



Source: Healthy Youth Survey

below 185% FPL were two times more likely to have lost teeth due to decay than adults with higher incomes (OR=2.1, $p<0.001$). Adults with a high school education or less were more likely to have lost teeth due to decay than adults with some education beyond high school (<HS – reference; HS/GED – OR=0.54, $p=0.16$; Some College – OR=0.33, $p=0.01$; College Grad – OR=0.18, $p<0.001$) (Figure 6).²²

Dental Insurance

Previous studies indicated that individuals with dental insurance are more likely to use dental services and have better oral health.^{23, 24, 25} Children younger than 18 years of age were more likely to have had a preventive dental care visit if they had dental insurance.²⁶ Dental insurance is oftentimes a benefit provided through an employer.

In Spokane County, two in three adults had dental insurance. The proportion was similar in Spokane County (69.8%) and Washington State (66.9%). There was no significant difference between males and females. Adults 35-54 years of age were more likely to have dental insurance than younger (18-34 years) or older (55+ years) adults (18-34 – reference; 35-54 – OR=2.2, $p=0.04$; 55+ – OR=0.81, $p=0.57$). Adults living at or below 185% FPL were nearly three times less likely to have dental insurance (OR=0.34, $p=0.002$). The likelihood of having dental insurance

increased as education level increased (OR=1.5, $p=0.004$) (<HS – reference; HS/GED – OR=1.41, $p=0.54$; some college – OR=2.59, $p=0.079$; college grad – OR=3.21, $p=0.03$) (Figure 5).²⁷

FIGURE 5
Has Dental Insurance
Spokane County Adults, 2008

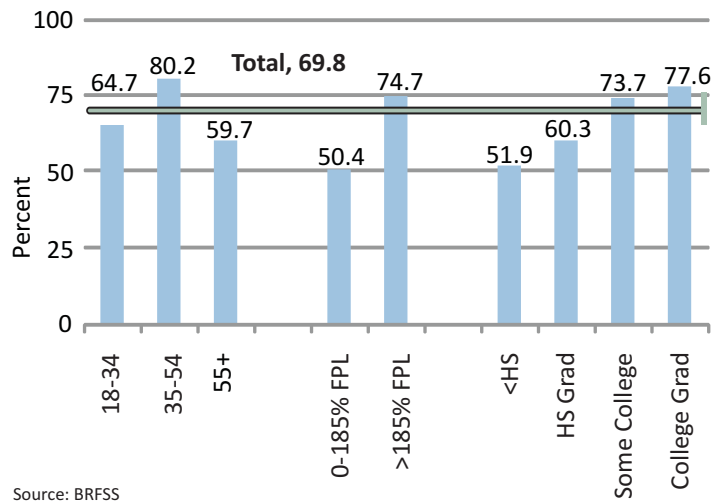
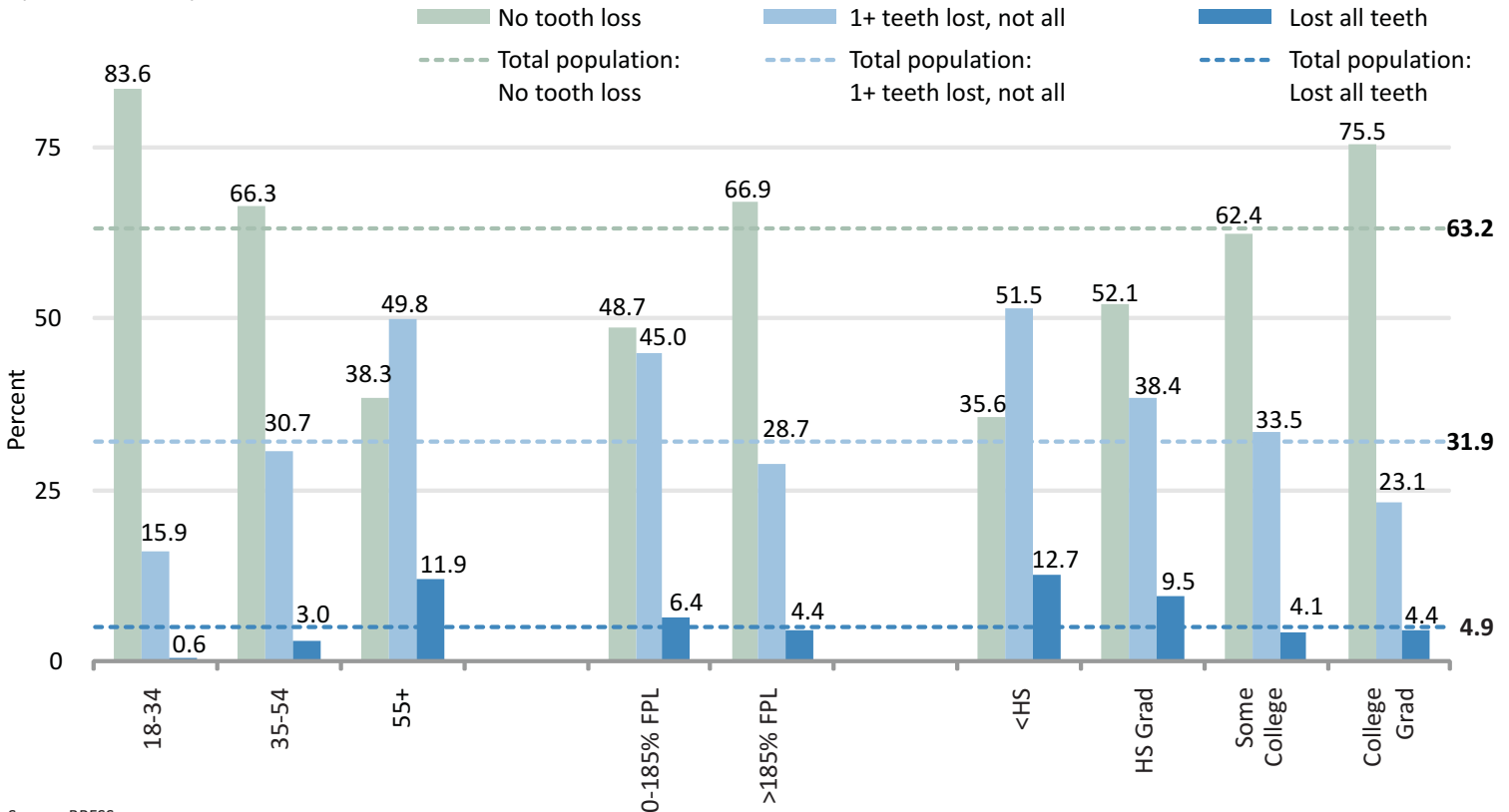


FIGURE 6
Tooth Loss by Age and Demographic Factors
Spokane County Adults, 2008



SPECIAL POPULATIONS

Early Cavities

In Spokane County in 2005, three out of five children in second and third grade had experienced dental decay. From 2000 to 2005, the prevalence of cavities or a history of decay significantly increased from 49.4% to 62.0%. This proportion likely underestimates the prevalence since the screening is only visual and does not use x-rays to identify early decay or decay between teeth. The proportion of children in Spokane County with a history of cavities was similar to that in Washington State in 2005.²⁸

In 2010, second grade children were not included in the survey. The proportion of children in third grade having cavities or a history of decay decreased in Spokane County to 57.2%, but the decrease was not statistically significant. One in five children (21.0%) had rampant cavities, which is seven or more cavities and/or fillings. Less than one in 10 third grade children in Spokane County had untreated decay in 2010 (8.8%, 95% CI 7.2-10.7), which was significantly lower than the proportion of second and third grade children in 2005 (14.7%, 95% CI 12.6-17.2). Among children with a history of cavities, 23.2% had decay in a permanent tooth and 15.3% had untreated decay. Low-income children, defined as being eligible for free or reduced school lunch, were nearly three times more likely to have experienced dental decay than were higher-income children (OR=2.7, $p<0.001$); cavities were present in 68.2% of low-income children and 44.5% of higher-income children. Non-White and Hispanic children were nearly two times more likely to have experienced dental decay (OR=1.8, $p=0.001$); 68.2% of minority children and 55.0% of White children had cavities.²⁹

Comparatively, approximately one in five fewer children in kindergarten had cavities (39.9%). The difference in decay experience between low-income and higher-income children in kindergarten was even greater than that seen in the third grade (55.9% and 25.3%, respectively; OR=3.7, $p<0.001$). The difference between Whites and non-Whites and Hispanics was similar in kindergarten as it was in third grade (37.5% and 52.7%, respectively; OR=1.8, $p=0.001$).³⁰

Sealants

Sealants provide a barrier on the chewing surface of teeth to help prevent dental decay. Nationally, the proportion of young children (6-11 years of age) with sealants increased from 21.7% in 1988-1994 to 30.5% in 1999-2004.³¹ Among third grade children in Spokane County in 2010, 60.1% had sealants. Low-income children were 1.5 times less likely to have sealants than higher-income children (55.8% and 65.3%, respectively; OR=0.67, $p=0.002$). Non-White and Hispanic children were 1.4 times less likely to have sealants than White children (52.8% and 61.5%, respectively; OR=0.70, $p=0.03$).³²

Pregnant Women

Women are likely to experience changes in their oral health during pregnancy. Increases in hormones—estrogen and progesterone—affect the way gum tissue reacts to plaque. If plaque is not removed it can cause gingivitis; red, swollen, tender gums that are more likely to bleed. These changes may begin as early as the second month of pregnancy. In some women, gingivitis may progress to periodontitis, a more serious oral infection.

Early research suggested there is an increased risk for preterm birth or low-birth weight among women with periodontitis. Periodontitis can increase the risk of transient bacteremia (bacteria intermittently entering the blood stream). Bacteria reaching the uterus triggers the production of prostaglandins, which are chemicals suspected of inducing preterm labor. Further research has shown conflicting results. A recent report by the California Dental Association describes how some studies show a positive relationship between periodontal disease and poor birth outcomes, while other studies did not show a relationship.³³

It is recommended that pregnant women visit the dentist in the second trimester for a cleaning and to monitor changes in their oral health. Another appointment may be scheduled early in the third trimester if necessary. The best time for non-emergent dental procedures is during the fourth to sixth month of pregnancy. Elective procedures should be postponed until after delivery.^{34,35} In Spokane County, 55.6% (+/- 10%) of women reported they visited the dentist while they were pregnant. Statewide, the proportion was similar (52.5%, +/-2%).³⁶

Spokane Regional Health District partnered with the March of Dimes in a two-year project called Treatment, Education, and Resources for Mothers (TERM). The TERM project was administered among Washington State Department of Social and Health Services (DSHS) First Steps clients. First Steps helped low-income pregnant women access health and social services, including a public health nurse to perform an assessment and provide education and counseling to help clients have a healthy pregnancy. The TERM project allowed nurses to provide clients with a free oral health kit that included a toothbrush, toothpaste, floss, educational materials, a disposable dental mirror used for a screening, a three-minute timer to encourage longer brushing, and a mirror cling as a reminder to brush and floss. If the nurse suspected the client had gum disease, she was referred to a participating dental clinic. The clinic determined if the client had periodontitis and treated her. Within this population, 99% of those who were examined at the dental clinic were diagnosed with some form of periodontitis ranging from mild to severe.

As part of the TERM project, clients completed a survey of oral health habits that included questions addressing brushing, flossing, accessing dental care, and knowledge of oral hygiene. Surveys were completed both upon entering the project and upon leaving the project.

At the start of the project, the majority of clients reported they brushed their teeth (93.6%). However, only 34.2% reported they brushed their teeth twice a day as recommended and only 15.3% reported they brushed their teeth for three or more minutes. Only 10.4% reported they always used some way to time how long they brushed. Flossing of teeth was considerably less likely to be reported on the pre-survey, with only 19.2% reporting that they regularly flossed their teeth and 57.1% reporting that they sometimes flossed their teeth. Close to one-quarter of the First Steps clients (23.7%) reported they did not floss their teeth at all. Of those who reported they flossed or sometimes flossed, the vast majority (79.7%) reported they flossed four or less times a week. The majority of First Steps clients (76.0%) reported it had been over a year since they had their teeth cleaned, and (63.1%) reported it had been over a year since they had been to a dentist or dental clinic for any reason.

At the end of the project, participants were significantly more likely to report they brushed their teeth in the morning after eating breakfast, brushed three minutes or longer, and used some method to time their brushing. Participants were significantly more likely than expected to report the toothbrush was less than three months old. One of the most striking changes seen in client's oral health habits was around the use of dental floss. Clients were significantly more likely than expected to say that they flossed their teeth after the project and the frequency of reported dental floss use increased significantly. Additionally, significantly more participants than expected understood that they could minimize transmission of bacteria to their infant and partner; and had knowledge of the link between periodontal disease and health. Table 4 shows the percentage of responses from the pre- and post-survey.



Access to Baby & Child Dentistry (ABCD) screenings – 2003. Spokane Regional Health District's Oral Health Program

TABLE 4

Responses to Pre- and Post- Survey for the Treatment, Education, and Resources for Mothers (TERM) Project 2004-2005

	Pre %	Post %	Sig.
Brushing			
Brush after breakfast?			
Yes	39.6	41.4	
Yes, sometimes	41.4	47.7	
No	18.9	10.8	*
Brush before bed?			
Yes	47.1	48.0	
Yes, sometimes	41.3	44.8	
No	11.7	7.2	
Time spent brushing?			
1 min or less	21.0	13.1	
>1 min to <3 min	66.7	68.3	
3 min or more	12.3	18.6	*
Timed their brushing?			
Yes	8.1	16.7	
Yes, sometimes	9.0	28.1	
No	83.0	55.2	***
Have own toothbrush?			
Yes, I have my own	99.1	100.0	
No, I share	0.5	0.0	
No, I don't have one	0.5	0.0	
Age of toothbrush?			
< 3 months	64.8	74.2	
3-6 months	26.9	23.5	
> 6 months	8.3	2.3	**
Flossing			
Floss teeth?			
Yes	18.9	34.1	
Yes, sometimes	59.0	55.2	
No	22.1	10.8	***
Frequency of flossing?			
< 1 times per week	34.2	14.5	
1 or 2 times per week	27.5	28.0	
3 or 4 times per week	20.2	32.5	
5 or 6 times per week	8.3	16.0	
7 times or more/week	9.8	9.0	***
Knowledge			
Cavities can be prevented?			
True	97.3	97.7	
False	0.9	0.9	
I don't know	1.8	1.4	
Pass germs to partner			
True	30.0	60.9	
False	16.6	8.2	
I don't know	53.4	30.9	***
Pass germs to baby?			
True	40.5	66.2	
False	17.1	11.3	
I don't know	42.3	22.5	***
Link to heart disease			
True	23.4	52.7	
False	11.7	12.6	
I don't know	64.9	34.7	***
Link to pre-term LBW			
True		58.4	
False		14.2	
I don't know		27.4	NC

Source: SRHD *p ≤ 0.05. **p ≤ 0.01. ***p ≤ 0.001. NC No comparison

Seniors

The oral health needs of seniors have changed over time due to improved treatment options. As a result, older adults are retaining more teeth longer.³⁷ Factors that impact the oral health of seniors include: most seniors have health insurance through Medicare, but there is not a dental benefits component; seniors may take multiple medications and have a dry mouth; and they may have physical limitations that could affect their daily care and access to a dental office. Older adults with fewer teeth may experience discomfort and embarrassment when eating and thus limit their social contacts. Additionally, difficulty chewing or eating limits food choices, which affects nutritional status.³⁸

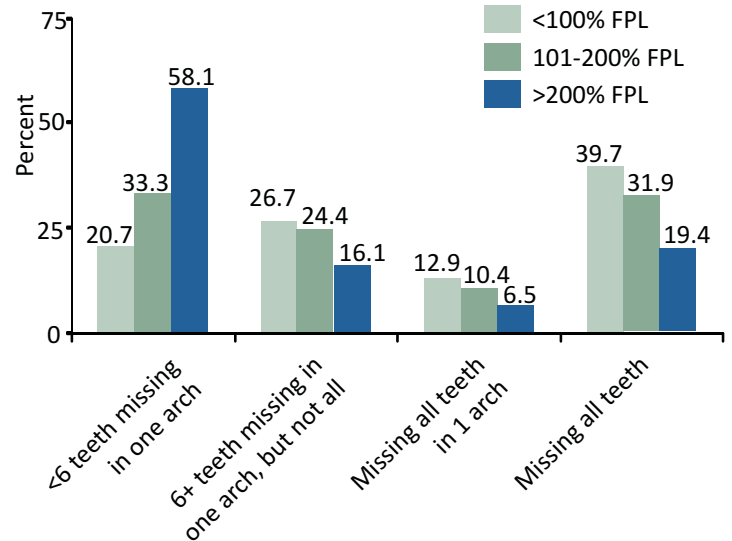
In 2006, Spokane Regional Health District administered an oral health and health history assessment among Spokane County seniors 65 years of age or older. The following information about the oral health of seniors is from that assessment, which included a questionnaire and a non-invasive screening of the mouth.³⁹

One-third of seniors were missing all of their teeth (33.3%), one-third were missing fewer than six teeth in either their upper or lower arch (31.7%). Of the remaining one-third, 23.9% were missing six or more teeth in one arch, but not all of them and 11.1% were missing all teeth in one arch. According to a geriatric dentist, missing six or more teeth in one arch is typically when people begin to have problems eating. Existing dentition was associated with poverty level ($p < 0.001$). Tooth retention increased as income increased (Figure 7). There was no difference for existing dentition by age group (65-74, 75-84, 85+) or gender.

More than half of seniors had a removable appliance (56.3%). Most individuals who were missing all teeth in one or both arches had a full arch denture. Only 5.9% of seniors who were missing all their teeth did not have both a complete maxillary and mandibular denture. Even fewer, 2.9%, of those missing all teeth in only one arch did not have a denture. Almost all of the seniors who were missing all teeth in only one arch were missing their maxillary teeth (94.1%). Among those who were missing six or more teeth in one arch and were not missing all teeth in the other arch, 53.4% did not have a removable appliance.

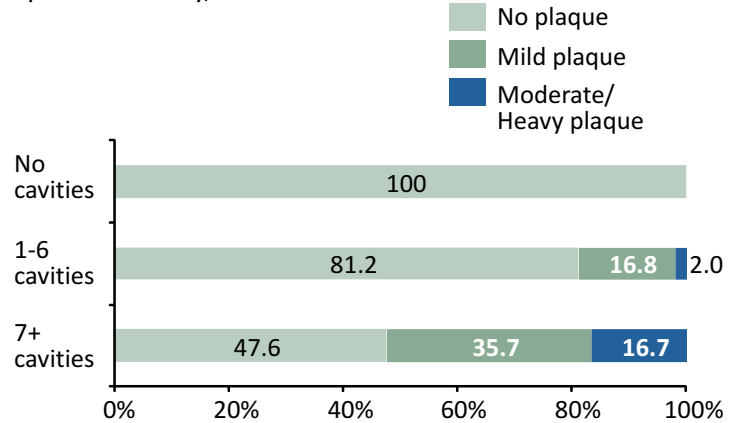
Of those with teeth, most had no untreated cavities (75%) and only 5% had seven or more untreated cavities. This proportion likely underestimates the prevalence since the screening is only visual and does not use x-rays to identify early decay or decay between teeth. Few participants had no plaque (5.4%) and most had mild plaque (74.0%). There was no significant difference in the level of plaque by age group. The number of untreated cavities was significantly associated with the level of plaque ($p < 0.001$) (Figure 8). Most individuals had no obvious problems requiring urgent treatment (93.3%).

FIGURE 7
Dentition Status by Poverty Level
Spokane County, 2006



Source: SRHD

FIGURE 8
Untreated Decay by Plaque Level
Spokane County, 2006



Source: SRHD

Half of seniors had not seen a dentist for any reason in the last year. There was a significant difference by dentition status. The proportion visiting a dentist in the last year decreased as dentition loss increased (OR=0.37, p<0.001). Similarly, the proportion that had not seen a dentist in five or more years increased as dentition loss increased (OR=3.4, p<0.001) (Figure 9). There was no significant difference by age group or poverty level.

The main reasons for the last dental visit were a routine check up or cleaning (42.6%) and dentures (29.3%). Of those who had not been to the dentist in the last year, the biggest reason was that they had no reason to go (either they had no problems or no teeth). Among those citing that reason, 78.3% were missing all of their teeth. The next most common reason was cost (23.8%).

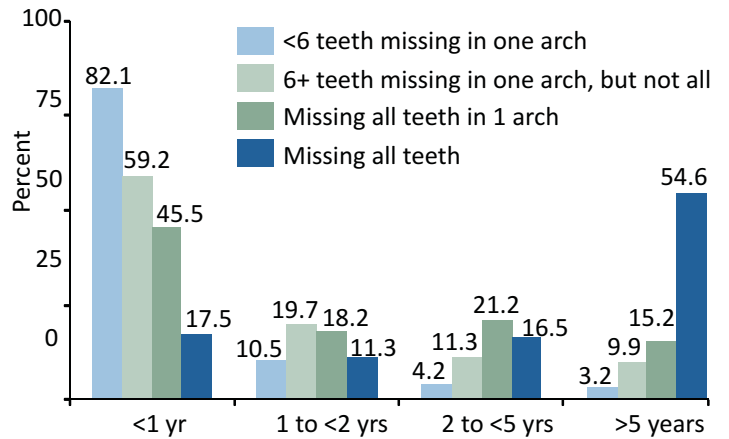
There were 22.1% of participants who had a dental problem in the last year and would have liked to have seen a dentist, but did not. Having an unmet dental need was significantly associated with poverty level (p=0.003) and existing dentition status (p=0.017) (Figure 10). There was no difference by age group.

More than one-third of seniors felt they were currently in need of dental or denture treatment (38.7%). Seniors reported significant differences, by age and dentition status, in their need for dental treatment. The need decreased as age increased (p<0.001) and was highest among individuals missing six or more teeth, but not missing all teeth (p=0.017) (Figure 11).



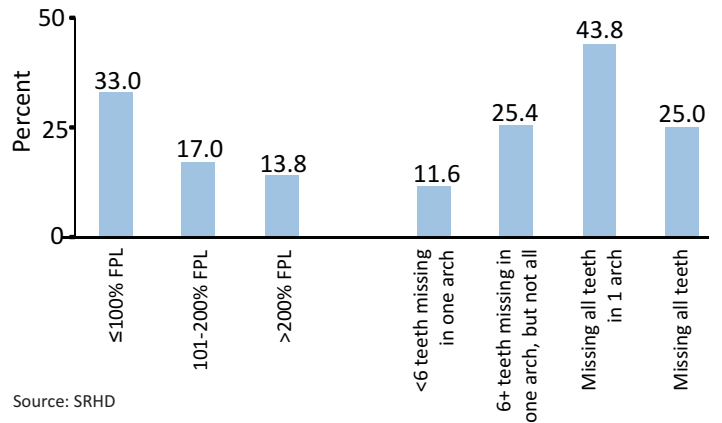
Spokane Senior Screenings – September 21, 2006. Provided at 15 locations – including senior housing, health fairs, nursing home, and community/senior centers. Screenings completed by: Joan Sheldon-Palelek volunteer RDH, and Ida Ovnecik, RDH, Spokane Regional Health District’s Oral Health Program

FIGURE 9
Time Since Last Dental Visit by Existing Dentition Status
Spokane County, 2006



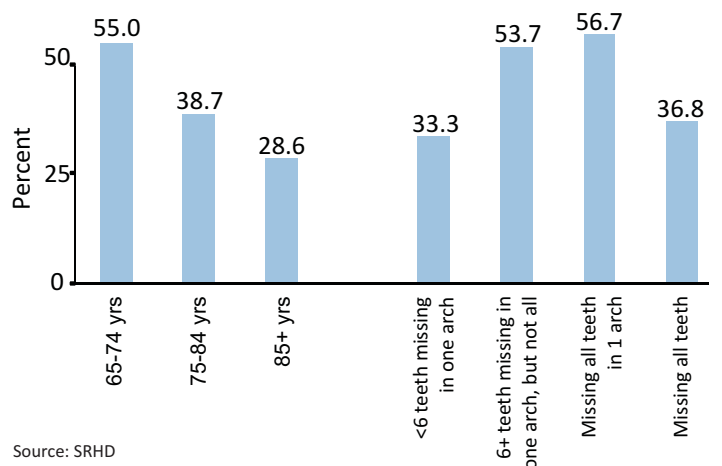
Source: SRHD

FIGURE 10
Unmet Dental Need by Poverty Level and Existing Dentition Status, Spokane County, 2006



Source: SRHD

FIGURE 11
Currently Need Dental Treatment by Age Group and Existing Dentition Status, Spokane County, 2006



Source: SRHD

Participants self-rated the appearance of their teeth. Rating the appearance of teeth as fair or poor increased with loss of dentition until losing all teeth (Figure 12). There was no difference for ratings of appearance by age group, poverty level, or current depression or other mental health issue.

One out of five seniors (19.7%) reported painful gums or teeth. The proportion of seniors reporting pain increased as dentition loss increased. Once all teeth were lost, seniors reporting pain decreased. There was no significant difference by age group or poverty level. As the appearance rating improved, the likelihood of having pain decreased (OR=0.44, p<0.001) (Figure 13). Individuals reporting current depression, anxiety, or other mental health problems were significantly more likely to have pain (OR=3.4, p<0.001).

One in three seniors had trouble biting or chewing food (32.4%). Having trouble biting or chewing increased as dentition decreased (OR=1.8, p<0.001). There was no significant difference by age group.

The proportion of the population over 65 years of age is increasing and will continue to increase over the years. Dental insurance is oftentimes offered through an employer. Once a senior retires, they will not have insurance and Medicare does not have a dental component. Also, some chronic health conditions and medication impact oral health status, which all affect the quality of life of an individual. As the community continues to age, there will be more people with less access due to lack of insurance and more risk factors for poor oral health.

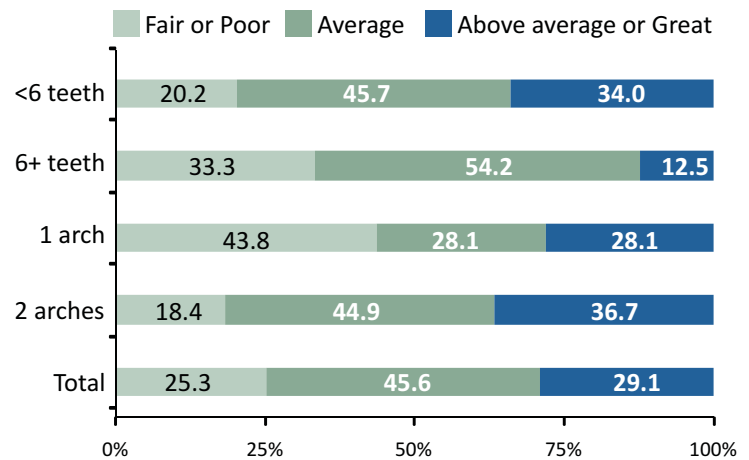
Special Needs

Individuals with special oral health needs are those with physical, medical, developmental, or cognitive conditions which limit their ability to receive routine dental care.⁴⁰ Unfortunately little information exists about the oral health status of these populations. However, it still warrants describing these other populations and oral health needs specific to their conditions.

An individual with a disability may have difficulty with mobility, self-care, communication, or self-control. Examples of disabilities that would require extra consideration by a dentist include use of a wheelchair, inability to hear or speak, or being autistic. A dentist would need to determine how to get a person into a position to be able to work in their mouth; they would have to find a method to communicate; and they would have to know how to keep a patient calm so they can treat them. In addition, an individual who has difficulty with self-care may be unable to comply with oral hygiene instruction. Caregivers who help with activities of daily living should include routine oral care.

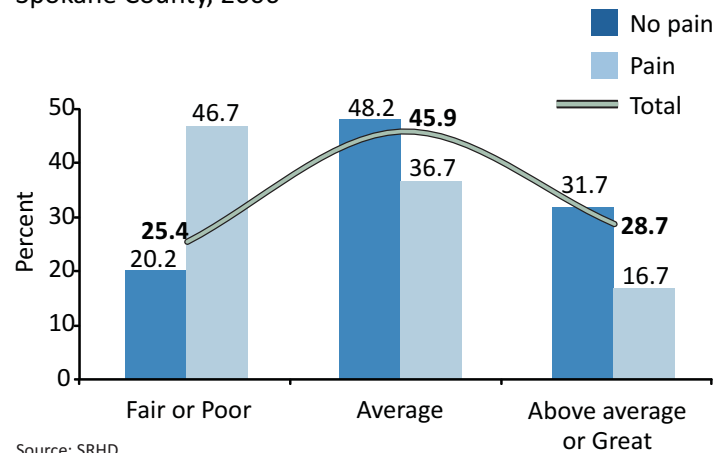
People who reside in long-term care facilities or nursing homes are generally in a condition where they are dependent on others to help with activities of daily living. In caring for medical needs of those individuals, oral health care may be overlooked. Recently, a definition of oral neglect among these vulnerable

FIGURE 12
Ratings of Teeth Appearance by Number of Teeth Lost
Spokane County, 2006



Source: SRHD

FIGURE 13
Ratings of Teeth Appearance by Painful Teeth or Gums
Spokane County, 2006



Source: SRHD

adults has been adopted. This definition provides a means for enforcing proper oral health care among the institutionalized elderly. Nursing homes that receive federal funds are required to provide proper oral care.⁴¹

Among older adults with special needs, four predictors were associated with tooth loss. They include the age of the individual, the number of decayed or broken teeth, the burden of anticholinergic medications, and physical mobility.⁴² Anticholinergic medications affect nerve impulses that control muscles. This class of medication is used in treating a variety of conditions such as gastrointestinal disorders, genitourinary disorders, respiratory disorders, Parkinson's disease, and some heart conditions.⁴³ A side-effect of anticholinergic medication is a dry mouth, which can cause dental decay, cause trouble with dentures, and may make it difficult to chew or swallow.⁴⁴

Tobacco Users

Tobacco use is a risk factor for cavities, oral cancer, periodontal disease, and other clinical oral health findings.⁴⁵ Smokers are also at a significantly increased risk for oral pain.⁴⁶ Among adults in Spokane County, smokers were two times less likely to have visited the dentist in the last year (OR=0.49, p<0.001) and were three times more likely to have lost teeth (OR=3.1, p<0.001).⁴⁷ Prevalence by smoking status is below.

- ♦ 61.1% of smokers and 76.3% of non-smokers visited the dentist in the last year.
- ♦ 41.7% of smokers and 67.6% of non-smokers had all their teeth.
- ♦ 12.8% of smokers and 3.2% of non-smokers had lost all their teeth.

Co-Morbidities

One's oral health status may impact or be impacted by other health conditions. The decay process involving bacteria can provide a site for initiation of opportunistic infection in individuals with weakened health conditions.

Mental Health

Individuals who are depressed or have other mental health conditions may have poor oral health due to a lack of interest in self-care. Saliva has an important role in oral health; medications used to treat depression can cause a dry mouth. Poor mental health among adults was defined as those who self-reported that their mental health was not good on 14 or more days in the last 30 days. Among adults in Spokane County, those with poor mental health were nearly two times less likely to have visited the dentist in the last year (OR=0.55, p=0.04) and

were more than two times as likely to have lost teeth (OR=2.26, p=0.002).⁴⁸ Prevalence by mental health status is below.

- ♦ 62.9% of adults with poor mental health and 75.4% of adults with good mental health visited the dentist in the last year.
- ♦ 45.9% of adults with poor mental health and 65.1% of adults with good mental health had all their teeth.
- ♦ 10.5% of adults with poor mental health and 4.2% of adults with good mental health had lost all their teeth.

Diabetes

Individuals with diabetes have difficulty responding to infection and as such are more susceptible to periodontal disease. A diabetic with periodontal disease has more difficulty managing their blood sugar. Research has shown a link between oral health and diabetes; the number of teeth is associated with a diagnosis of diabetes.⁴⁹ Among adults in Spokane County, those with diabetes were 2.8 times more likely to have lost teeth (OR=2.8, p<0.001). There was no significant difference between diabetics and non-diabetics in having seen the dentist in the last year.⁵⁰ Prevalence by diabetes status is below.

- ♦ 41.5% of diabetics and 64.9% of non-diabetics had all their teeth.
- ♦ 13.6% of diabetics and 4.2% of non-diabetics had lost all their teeth.

Heart Disease

Research has shown a link between oral health and heart disease; the number of teeth is related to cardiovascular disease.^{51, 52, 53} Heart disease, in this setting, is defined by whether or not an adult has had a myocardial infarction (MI). Among adults in Spokane County, those with a history of a myocardial infarction were two times less likely to have seen the dentist in the last year (OR= 0.52, p=0.03) and were six times more likely to have lost teeth (OR=5.9, p<0.001). After adjusting for age, the association between having lost teeth and a myocardial infarction was still statistically significant.⁵⁴ Prevalence by heart disease status is below.

- ♦ 60.1% of those who had a MI and 74.3% of those who had not had a MI visited the dentist in the last year.
- ♦ 21.0% of those who had a MI and 65.1% of those who had not had a MI had all their teeth.
- ♦ 17.7% of those who had a MI and 4.3% of those who had not had a MI had lost all their teeth.

Preventive Measures

Three factors necessary for development of cavities are the presence of: 1) an acidogenic oral bacteria, 2) sugars or fermentable carbohydrates from the diet, and 3) a susceptible tooth surface. Bacteria in plaque on teeth metabolize sugar or carbohydrate and produce an acid, which demineralizes the enamel of teeth. In order to prevent dental decay, the decay process must be interrupted.

The bacteria that causes dental decay are not evenly distributed throughout the population. Some people may have abundant bacteria and struggle with dental cavities even with good oral hygiene, while others may not have the bacteria and do not develop cavities regardless of their oral health habits. The bacteria can be transmitted from one person to another through saliva, such as sharing eating utensils. There are treatments that can decrease the amount of bacteria, but without maintenance of good oral hygiene, the bacteria may multiply.

Diets in the United States tend to be high in carbohydrates and refined sugars. This type of diet provides the necessary setting for cavities to occur.⁵⁵ Frequency of consumption also impacts the availability of sugars or carbohydrates for bacteria to metabolize. Individuals who snack throughout the day increase the availability of sugars and carbohydrates compared to individuals who eat regular meals. Drinks with sugar that are consumed consistently throughout the day also increase the availability of sugars.

Teeth that are more susceptible to decay have more grooves and pits. Back teeth, that have more grooves than smooth front teeth, are more likely to retain food debris in the chewing surface of these teeth, thus providing a necessary condition for dental decay.

Multiple prevention measures are available that disrupt the decay process for one or more of the necessary conditions. They include personal behaviors, use of oral health products, and dental treatment.

Knowledge

People make choices about their oral health every day, either through action or omission. Dependent individuals, such as a child or certain individuals who need assistance with daily care, must rely on others to make those choices. It is important that appropriate messages that promote healthy choices are given to the community regarding oral health. Opportunities for distribution of messaging are diverse as are the

potential recipients. They may include individuals, families, caregivers, service providers, and healthcare providers.

Oral Health Maintenance

Personal action is required for proper and effective oral health care. Some examples include regular visits to the dentist, brushing long enough, flossing, brushing after meals, and consuming an appropriate diet. Preventive therapies, such as using fluoride or sealants, are useful in aiding oral health care. When prevention fails, it is important to seek restorative care from a dentist to minimize the health impact of dental decay or gum disease.

Sealants

A sealant on the surface of the tooth provides a barrier to decay-causing bacteria. A sealant is a thin coating that adheres to the surface of the tooth. They are clear or white, which allows it to blend easily with the color of the tooth. Sealants are applied in early childhood and should be re-applied as the coating wears off. The cost of a dental sealant is approximately \$45.⁵⁶ Dental insurance generally covers this benefit for children and adults.

Fluoride

Fluoride in plaque and saliva decreases the demineralization of healthy enamel and promotes remineralization of enamel that has demineralized. Fluoride also inhibits the production of acid by the oral bacteria. Fluoride works primarily after teeth have erupted, which impacts adults as well as children. Benefits of fluoride are especially effective when small amounts of fluoride are consistently maintained in the mouth.⁵⁷

There are several methods for receiving fluoride. The first public water system to be fluoridated occurred in 1945. For areas without fluoridated public water, fluoride supplements were available beginning in the '60s. The first toothpaste with fluoride was available in 1964 and by the '90s, more than 90% of toothpaste contained fluoride. The combined use of receiving fluoride via different methods offers protection beyond only one method used alone.^{58, 59}

Public Water Fluoridation

While almost all water contains some fluoride, the levels can vary greatly. The optimal level of fluoride in water to reduce decay has been determined to be approximately one part per million (ppm).⁵⁹ Water with naturally occurring fluoride above this level may increase the risk for fluorosis. The concentration of naturally occurring fluoride in water below this level can be adjusted to raise the concentration to the optimal level for decay reduction. According to the Washington State Department of Health, Office of Drinking Water, Spokane County has two water systems that fluoridate their water, which serve 13,500 individuals. Fifteen smaller water systems in the county have naturally occurring fluoride at or above 0.6mg/L, which serve 1,100 individuals.

Research has shown that the most effective and efficient method for receiving fluoride is through fluoridating public water.⁶⁰ The estimated cost of water fluoridation was \$0.90 per person annually, adjusted for inflation to 2010.⁶¹ For every decayed dental surface repaired, the estimated cost in 2010 was \$5.89 for water fluoridation, but was \$77.31 for a restoration.⁶²

For the maximum benefit, people should receive frequent exposure to small amounts of fluoride. Since topical fluoride lasts 1-2 hours in the mouth, this can be accomplished through drinking fluoridated water and brushing with fluoride toothpaste twice daily. Fluoridated water is advantageous in that it can be passively received. It is available without having to deliberately seek it out, as with fluoride supplements. Adults 50 years of age or older benefit because they are more susceptible to root cavities. The older adult population is increasing, but also retaining more teeth. Root cavities among adults decreases as the fluoride concentration in public water increases. There is also no direct cost to the individual for receiving it through the public water system. This benefits individuals who cannot afford other sources of fluoride, do not seek regular dental care, and would otherwise be hard to reach through traditional approaches.^{63, 64, 65, 66}

Early studies in the impact of public water fluoridation showed a dramatic decrease in not only the number of cavities, but also the severity of the cavities. However, by the end of the 20th century, the use of other sources of fluoride, primarily toothpaste, had become

widespread. This positively impacted oral health in both areas with public water fluoridation and areas without fluoridated water.⁶⁷ Yet, public water fluoridation has a beneficial effect on prevention of cavities beyond that of other fluoride sources. A review of studies done after widespread use of fluoride toothpaste showed an increase in children who were cavity-free in areas with fluoridated water compared to areas without fluoridated water.⁶⁸ Additionally, public water fluoridation is a cost-effective method for equitably providing a preventive health measure to the community.

Toothpaste

Most toothpaste contains fluoride, which is proven to reduce cavities. Fluoride concentrations in the mouth after brushing decrease after 1-2 hours. Increased frequency of brushing with fluoride toothpaste can help maintain the fluoride concentration in the mouth. A reasonable recommendation from the American Dental Association is to brush twice daily. Fluoride in toothpaste does not require a prescription, is readily available, and relatively inexpensive. Due to the high amount of fluoride in toothpaste, it should not be swallowed. Children younger than six years of age should be supervised when brushing their teeth.⁶⁹ Parents of children younger than two to 2.5 years of age should consult with their dentist on using fluoride toothpaste.^{70,71} Estimating that an individual would use three tubes of toothpaste per year at a cost of \$4 per tube, the annually cost of toothpaste would be \$12.

Mouthrinse with Fluoride

Mouthrinse is a solution with concentrated fluoride intended for daily or weekly use. Daily-use mouthrinses are available over-the-counter and contain a lower concentration of fluoride than do the weekly-use mouthrinses. Solutions with a higher concentration of fluoride can be used weekly and have been used in supervised, school-based rinsing programs. Mouthrinses are intended for individuals six years of age or older. Research on the effectiveness of fluoride mouthrinses to reduce decay shows mixed results. Administrators of mouthrinse programs in schools estimate the cost at \$1.41 per child per year, adjusted for inflation to 2010,⁷² but they may not have included indirect costs.⁷³

Dietary Fluoride Supplements

Fluoride supplements come in the form of tablets, lozenges, or liquid. Supplemental fluoride is intended for children living in areas without optimally fluoridated water. All sources of dietary fluoride, such as naturally occurring fluoride in water at a sub-optimal level, should be considered in determining the dosage necessary. The American Dental Association maintains a fluoride supplement dosage schedule for children younger than 17 years of age based on age of the child and fluoride level exposure. A prescription is necessary to receive fluoride supplements.⁷⁴ In Spokane County, both physicians and dentists can prescribe fluoride supplements. The current cost of supplements is approximately \$10 per month with an annual cost of \$120.⁷⁵ Pharmacies within Yoke's Fresh Market stores will fill a fluoride prescription free of charge for children 12 years of age or younger.⁷⁶ Research on the effectiveness of fluoride supplements shows weak evidence in the reduction of decay in primary (or baby) teeth, but supports prevention of decay in permanent teeth.⁷⁷

Gel and Foam Fluoride

Fluoride is available in a gel or foam form. Lower concentration gels are available for daily home use and can be brushed on after brushing with toothpaste. A higher concentration form is professionally applied at a dental office. The usual recommended frequency of a professional application is every six months. Because of the length of time between treatments, there is little risk of side effects from fluoride gel that is professionally applied.⁷⁸

Varnish

A varnish uses a high concentration of fluoride that is painted onto the teeth where it adheres for several hours. It is easy and fast to apply. Recommendations are to apply a varnish every six months.⁷⁹ A varnish is useful in treatment of young children who cannot use a gel tray, and children are less likely to swallow fluoride from a varnish. A clinically applied fluoride varnish is more expensive than other fluoride modalities due to the cost of an office visit. This method would be more cost-effective if applied in conjunction with another office visit, such as a well-child visit; or applied by a trained staff member in a setting where many children are, such as a school.

Fluoride Concerns

Health impacts of public water fluoridation have been extensively studied by rigorous scientific methods since water fluoridation began. While the proper amount of fluoride helps prevent and control cavities, there is concern about enamel fluorosis. This condition causes changes in the opacity of the enamel. Fluorosis ranges from lacy, chalklike markings that are visually undetectable (very mild to mild) to more than half of the enamel being opaque white (moderate) to pitted and brittle enamel (severe). All forms of fluorosis are considered cosmetic and do not affect functionality.⁸⁰

Fluorosis has increased over time in areas with and without fluoridated public water. Children younger than 8 years of age may develop fluorosis, but toddlers are most at risk.^{81, 82} Once tooth development is complete, fluorosis does not occur. Front teeth development occurs up to 6 years of age. The United States Environmental Protection Agency (EPA) recommends monthly reporting from public water systems to maintain fluoride levels within specified guidelines. Since public water sources are monitored, most overexposure of fluoride occurs from dietary supplements or ingestion of toothpaste with fluoride.^{83, 84, 85, 86, 87} During 1999-2002, 2.5% of children and young adults nationally were found to have moderate or severe fluorosis.⁸⁸ A local estimate is unavailable.

Other concerns about fluoride include its toxicity and an increased risk for poor health conditions such as skeletal fluorosis, cancer, Down's syndrome, osteoporosis and bone fracture, and Alzheimer's disease. Fluoride can be toxic at high levels. However, fluoridated water and the fluoride supplement schedule keep ingested fluoride well within tolerable levels. Toothpaste contains a high-level of fluoride, but is only meant to be used in small portions and not ingested. Overexposure to fluoride occurs through inappropriate use of uncontrolled fluoride sources, such as eating toothpaste because it tastes good, swallowing toothpaste instead of spitting it out, or using too many supplements. There are warnings on toothpaste containers as a reminder to use it appropriately. Research linking public water fluoridation with adverse health outcomes is weak, inconclusive, or not supported.^{89, 90, 91, 92, 93, 94, 95}

ORAL HEALTH COMPARISON

In this section we compare the oral health status of residents of Spokane County to the residents of Snohomish County to present local differences within the state that impact oral health. Snohomish County was chosen as the comparison county because it was more similar to Spokane County in demographics than other counties. More than half of third grade children in Spokane County had at least one cavity in their primary teeth in 2010 (56.3%, 95% CI 53.3-59.3). In 2005 in Snohomish County, the same proportion (56%) of second and third graders had experienced dental decay.⁹⁶

Spokane County is largely non-fluoridated with only 3% of the county population receiving fluoridated water. In Snohomish County, 68% of the population receives fluoridated public water. With such a difference in the population receiving fluoride through water, it would be expected to find a difference in the prevalence of dental decay. This assumption is not supported by the prevalence of childhood cavities experience in the two counties, thus demonstrating the complexity of factors that influence oral health.

Other factors that have an impact on oral health status are socioeconomic status, access to dental services, and availability of preventive programs. There are differences between the two counties in each of these categories:

Socioeconomic Status

Spokane County had more poverty, but fewer minorities, non-English speakers, and those with less than a high school education.

Access

Spokane County has a better overall dentist-to-population ratio and has more dentists that accept Medicaid even though there are fewer people in Spokane County.

Programs

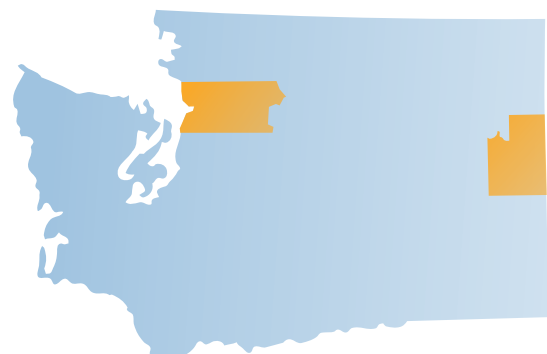
Spokane County has a fairly new school-based sealant program which is entering its third year of implementation and is currently only in a couple of schools. A higher proportion of young children in Spokane County who are eligible for dental services through Medicaid are actually using the benefit and seeing the dentist. A contributing factor in the higher proportion may be that Spokane County has a very active ABCD program. (Table 5)

This comparison demonstrates how even a broadly supported preventive health measure, public water fluoridation, can be mediated by additional factors. An analysis could not be accomplished to determine the contribution of each component on oral health status. The comparison also shows how complicated it can be to identify an approach that best impacts oral health in the community.

TABLE 5

Community Factors that Impact Oral Health

	Spokane County	Snohomish County
Population ⁹⁷	465,000	704,300
Socioeconomic Status (2006-2008) ⁹⁸		
Below 100% FPL	13.5%	7.8%
Non-White	9.4%	17.9%
Hispanic	3.9%	7.0%
Speaks lang. other than English at home	6.7%	16.1%
Less than a high school education	8.3%	15.5%
Access to Services (2009) ^{99, 100}		
Number of dentists	341	421
Number of dental hygienists	396	498
Dentist-Population ratio	1:1,364	1:1,673
Medicaid population using dental services		
0-5 years old	50.2%	38.5%
6-20 years old	56.3%	48.6%
21+ years old	28.8%	24.8%
Number of Medicaid dental providers	190	128
Average Medicaid clients per dental provider	243	315
Prevention		
Population with fluoridated water system ¹⁰¹	3%	68%
Number of safety net/comm. dental clinics	4	3
School-based sealant program	Yes	Yes
Local oral health coalition	Yes	Yes



Discussion

This paper explains the extent to which poor oral health affects the community, special needs of certain groups, and some factors that can either be beneficial or serve as barriers. Oral health should be recognized as a component of overall health, its impact to a community at large, and its negligence having negative economic, social, and personal effects.

Multiple factors influence oral health in a community. They include preventive measures, personal care, and treatment options. Public health actions, such as population-based fluoridation, sealant programs, or broad education can create an environment to help control oral decay. Individuals are responsible for daily maintenance and minimizing risk factors, such as smoking or poor dietary habits. Routine dental care and restorative procedures are necessary for good oral health, but use of these services are influenced by factors such as having insurance, the number of practicing dentists, affordability, and individuals committing to proper dental care.

Current strong recommendations of effective dental decay prevention include:

- ♦ Brushing and flossing daily
- ♦ Visiting a dentist every six months
- ♦ Community water fluoridation in all areas
- ♦ Using fluoride toothpaste for all people
- ♦ Having a school-based or school-linked sealant program
- ♦ Using fluoride mouth rinse, gel, and varnish for high risk individuals
- ♦ Taking fluoride supplements for children 6-16 years of age who are high risk

High-risk groups include those who have a low socioeconomic status, do not seek regular dental care, and are without dental insurance or access to care. There are also individual factors that increase risk, such as family history of dental decay, reduced salivary flow, inability to perform daily oral care, and wearing dental appliances. All forms of fluoride exposure and dental risk factors should be considered when deciding on preventive treatment.^{102, 103}

Fluoride is proven to alter the biological environment in which bacteria cause decay in teeth and is available in many distribution forms. In efforts to improve oral health, the public health system has long supported fluoridated public water as a prevention strategy. This distribution method is the least expensive for the community and individuals, reaching those who may not have access to other forms. Fluoride in public water must be monitored to maintain the proper concentration for the maximum benefit and least harm. Public water fluoridation is supported by organizations such as the American Dental Association, the American Academy of Pediatric Dentistry, the U.S. Centers for Disease Control and Prevention (CDC), the Washington State Department of Health (DOH), and the Spokane County Oral Health Coalition.

In addition to biological and personal influences, there are also community influences on oral health. Adoption of methods to improve oral health at the community level should consider factors such as greater access to care, availability of fluoride, and improved knowledge and awareness of oral health. Working at the community level provides an opportunity to reach many people, compared to working with individuals. An example of a community level project is school-based sealant programs, a strategy supported by the CDC.

While it may seem complex to address a population-based health issue, the task of public health is to monitor and improve conditions in the community so that the population is healthy. Public health activities have proven successful in improving the quality of life through organized efforts based on scientific and technical information. These efforts should consider an individual's responsibility for their actions along with the environment in which we live, work, and make decisions.¹⁰⁴ Possible public health actions to improve oral health should be identified. Any action that is taken should be supported by public health professionals, who seek to make the best decisions based on scientifically-proven information and community need; by community agencies who may be willing to provide support or participate in efforts; and by the community, since it is their health that will be impacted.

Opportunities

Information on a variety of topics related to oral health has been presented. Community members can use this information to identify opportunities that could improve oral health. Some possible actions are described below.

Encourage regular dental visits

People should be encouraged to visit their dentist regularly, even if they have few or no teeth. Survey results among seniors indicate that they may need more education about the benefits of visiting a dentist; such benefits might focus on the fact that the dentist can help maintain good functionality of full or partial dentures, as well as screen for oral cancers. In Spokane County, seniors are nearly three times more likely than adults 25-64 years of age to be diagnosed with oral or pharyngeal cancer (OR=2.75, <0.001).¹⁰⁵

Support programs such as ABCD and school-based sealants

Young children are experiencing a high rate of dental decay. The ABCD program is a cost-effective measure that helps young Medicaid children find a dentist that will accept them as a new patient. The program is designed for low-income children who are at increased risk for cavities. A school-based sealant program could also provide an opportunity for children to receive sealants in cases when they might otherwise not receive them. Washington State law allows a dental hygienist or dental assistant to apply sealants and fluoride varnish through a school-based sealant program.^{106, 107}

Support dental screenings in medical offices

During well-child visits, medical care providers increasingly provide preventive oral health services. Services may include an oral health screening, risk assessment, application of fluoride varnish, and a referral to a dentist. Medicaid reimburses primary care providers for applying fluoride varnish. Certified providers can also be reimbursed for providing oral screenings and family oral health education.¹⁰⁸

Encourage people with Medicaid to use their dental benefits

Less than half of Spokane County residents with Medicaid used dental services in 2009. The proportion was lower among adults (28.8%) and higher among children (54.0%). Individuals with Medicaid should be made aware of their dental benefit and encouraged to use it. While it can be challenging to find a dentist that accepts Medicaid insurance, there are resources available to help people find a dentist. Spokane Regional Health District has partnered with dentists in the community through the ABCD program to help low-income children receive dental services. A referral list of dental practices that accept low-income individuals is also available on the health district's website, www.srhhd.org.

Support new "Project Dental Access"

The Spokane District Dental Society Foundation is working on developing a Project Dental Access program to provide dental care for low-income and uninsured residents of Spokane County. Volunteer dentists will provide the care. If funding is available, the service will begin in the fall of 2010. They will collaborate with Project Access, a local primary care access program, to screen

residents for eligibility. This project could help address the issue of seniors who do not have dental insurance through Medicare and cannot afford supplemental insurance or self-paying for treatment.

Encourage pregnant women to improve their oral care

The majority of pregnant women begin prenatal care in their first trimester of pregnancy. Education on the benefits of oral health and a few simple supplies can improve the oral health habits of pregnant women. Health care professionals providing prenatal care have an opportunity to encourage this population to improve their oral health. Since cavities are a communicable disease that can be passed from mother to infant, improved oral health of the mother may passively affect the oral health of their child.

Provide effective education and communication

Education about the importance of oral health, the need among specific populations, and gaps in services are important for policy makers. They have an important job in ensuring a community has the appropriate services to make it healthy, safe, and thriving. As such, they must balance many issues in their decision process; one of which is oral health. Without adequate knowledge of oral health needs, the topic will not receive attention.¹⁰⁹

Communication concerning the oral health needs of the community, resources, and recommendations increase the knowledge of both the dental community and the community at large. Local and state dental societies and organizations working to improve oral health should continue to partner in their efforts and give consistent messages. An example is that the Spokane County Oral Health Coalition openly supports the DOH statement supporting public water fluoridation. The coalition is developing an official statement on public water fluoridation. This will allow community members to know what is supported by public health and other experts in the field within their own community.

Consider implementing public water fluoridation

As described in the preventive measures section, public water fluoridation is an equitable and cost-effective action that provides oral health benefits beyond that of other fluoride products. It can easily reach populations who would likely benefit the most: children and seniors. The process of fluoridating public water will depend on the water system. Some areas have a large centralized water system, while other areas have smaller water districts. Communities will have to consider the cost of implementing public water fluoridation, as the requirements may vary based on the structure of the water system, while also weighing the health benefits of such a change. Washington state law, Revised Code of Washington (RCW) 57.08.012 states "A water district by a majority vote of its board of commissioners may fluoridate the water supply system of the water district. The commissioners may cause the proposition of fluoridation of the water supply to be submitted to the electors of the water district at any general election or special election to be called for the purpose of voting on the proposition. The proposition must be approved by a majority of the electors voting on the proposition to become effective."

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