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Consequences of Smoking
A Regional Perspective

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“Geography is destiny,” a refrain commonly heard among anthropologist, is often echoed by health care researchers—and with good reason: An individual’s behavior, with all the attendant consequences, often reflects the norms and opportunities in his or her community.

In this analysis, community norms pertaining to cigarette smoking—and the subsequent health effects—are the focus.

As a recent New England Journal of Medicine article reminds us, “At a time when all eyes are focused on health care reform, escalating medical costs and childhood obesity, cigarette smoking remains by far the most common cause of preventable death and disability in the United States.”¹ We would only add that cigarette smoking is also one of the most common causes of preventable medical care and the associated health care costs.

ABSTRACT

Focusing on those ages 25 and older, we identified areas within the state with significantly high or low percents of individuals who currently smoke some days or every day.

We then profiled each of those areas in terms of their hospitalization and mortality rates for conditions known to be related to tobacco use. Hospitalization and mortality rates for lung cancer, COPD, coronary artery disease and smoking-attributable conditions in aggregate were generally high in the high smoking regions and low in the low smoking ones. Excess costs for smoking-attributable hospitalizations in these high-smoking areas were as high as \$29,000 per 1,000 persons.

The findings indicate that in addition to the increased mortality and morbidity associated with tobacco use, there is also a very real price to pay in health care services. Additionally, the methods used in this analysis may assist in targeting tobacco cessation and prevention interventions to those communities most at-risk.

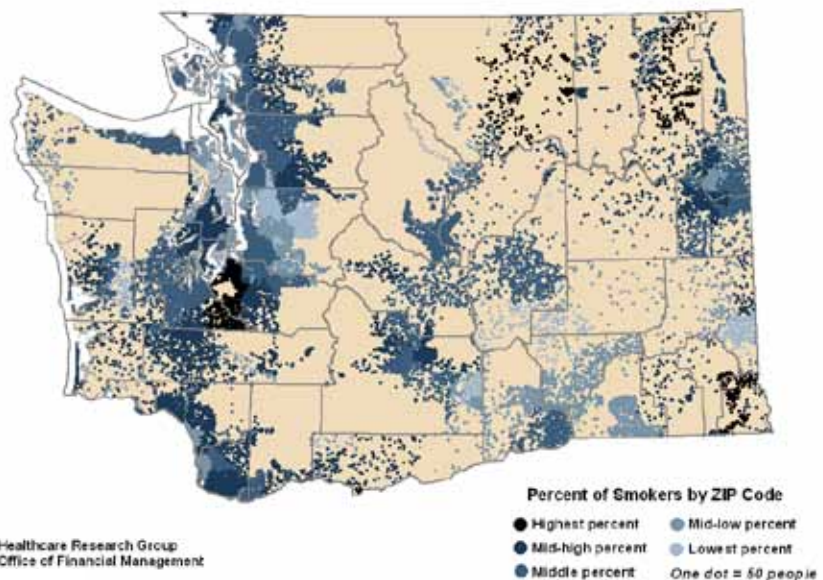
Identifying the distribution of smokers and at-risk areas

The general distribution of smokers, derived from Behavioral Risk Factor Surveillance System (BRFSS) data for 2005 through 2009 combined, suggests appreciable variation in the percent of smokers seen across the state. (See Figure 1)

These data, assessed at the ZIP code level of residence for each respondent were, when necessary, smoothed using a weighted median-based algorithm.²

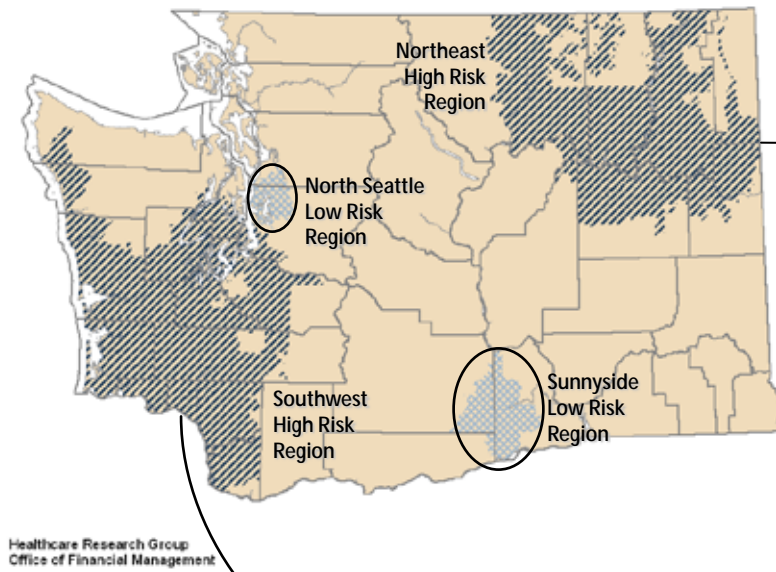
They show relatively low smoking rates in the central and northern Puget Sound regions and in the central southeast environs. They also show relatively high rates in the south Puget Sound and southwest coastal regions, and in the northeast and southeast corners of state.

Figure 1
Currently smokes some days or every day, ages 25 and older
Dot-plot of percent smokers by ZIP code area, BRFSS 2005-2009



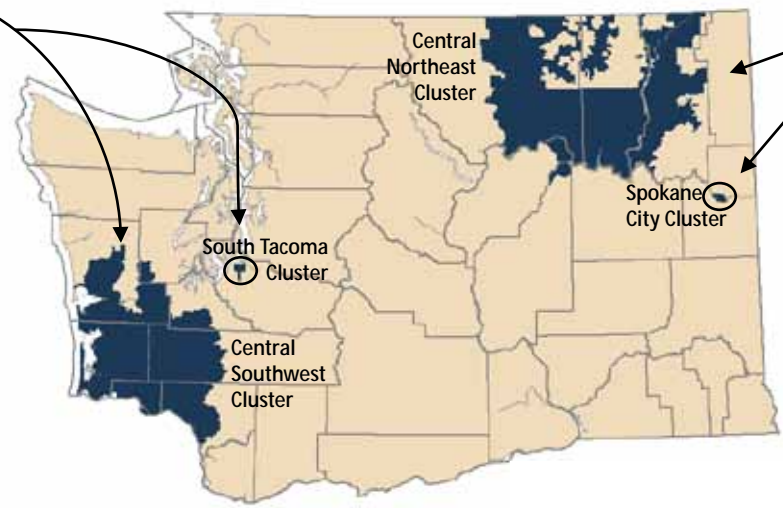
These same BRFSS data were also analyzed through the spatial scan statistic,³ and areas with smoking rates significantly higher or lower than the statewide rate ($p \leq 0.05$) were identified. In this process, regions at high-risk or low-risk for smoking were identified in the eastern and western sides of the state, and, within each of the high-smoking regions, “hot spots” or clusters of high-smoking sub-regions were also identified (see Figures 2 & 3).

Figure 2
Currently smokes some days or every day, ages 25 and older
 High- and low-risk regions, BRFSS 2005-2009



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Figure 3
Currently smokes some days or every day, ages 25 and older
 High-risk clusters within the Northeast & Southwest high-risk regions, BRFSS 2005-2009



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In total, eight high- and low-smoking areas were identified through this process: As seen in Figure 2, there are two low-smoking regions labeled *North Seattle* and *Sunnyside*, and two high-smoking regions, labeled *Southwest* and *Northeast*. And, as seen in Figure 3, there are two high-smoking clusters in the Southwest region, labeled *South Tacoma* and *Central Southwest*, and two high-smoking clusters in the Northeast region, labeled *Central Northeast* and *Spokane City*. These eight areas form the foundation for the analysis that follows.

In Figure 4, the percent of respondents who reported smoking some days or every day is shown for each of those eight areas. Included, too, are the 95% confidence intervals for those percents. Also shown, as a solid horizontal line, is the statewide percent of smokers, with that percent's 95% confidence intervals indicated by the two dashed lines. All of the percents and rates for each of the areas assessed in this analysis are presented in this manner throughout the report and are included in tabular form in the Appendix.

Looking at Figure 4, we see that the percent of smokers in the high-smoking Southwest and Northeast regions are higher than the percent seen statewide, while the percent of smokers in the low-smoking North Seattle and Sunnyside regions are lower than the state's rate. These differences, and all others noted, are statistically significant with $p \leq 0.05$.

Within the Southwest region, the percent of smokers in South Tacoma and Central Southwest clusters well exceed the state's rate, as do the two clusters in the Northeast region: Spokane City and Central Northeast. The percent of smokers in these four clusters also exceed the percents in the regions they come from.

Key findings – Inpatient hospitalization rates and mortality rates

CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD)

The National Heart Lung and Blood Institute states, "Most cases of COPD occur as a result of long-term exposure to lung irritants... [and] the most common irritant that causes COPD is cigarette smoke."⁴ In that context, we assessed the hospitalization rates—based upon inpatient days spent in the hospital—for chronic obstructive pulmonary disease (COPD) for each of the eight regions.

While the average age at diagnosis is fifty-three,⁵ as with all rates shown in this report, the COPD hospitalization rates are age-adjusted to the 2000 US standard population. They are also based upon the ZIP code of the patient's residence, not where the hospitalization occurred.

Looking at these COPD hospitalization rates in Figure 5, it is striking—and telling—how they essentially mirror the smoking rates seen in Figure 4. Here we see that the rates in both of the high-smoking regions and in all four of the high-smoking clusters are higher than the statewide rate, while those in the two low-smoking regions are lower.

Hospitalizations for COPD have also been identified as one of fourteen prevention quality indicators (PQI) by the Agency for Healthcare and Quality Research (AHRQ).⁶ PQI's, in general, are conditions that may require inpatient care if they are not properly addressed in an ambulatory care

Figure 4
Currently smokes some days or every day, ages 25 and older
Percentages in high and low risk regions and in clusters within high risk regions
BRFSS 2005-2009

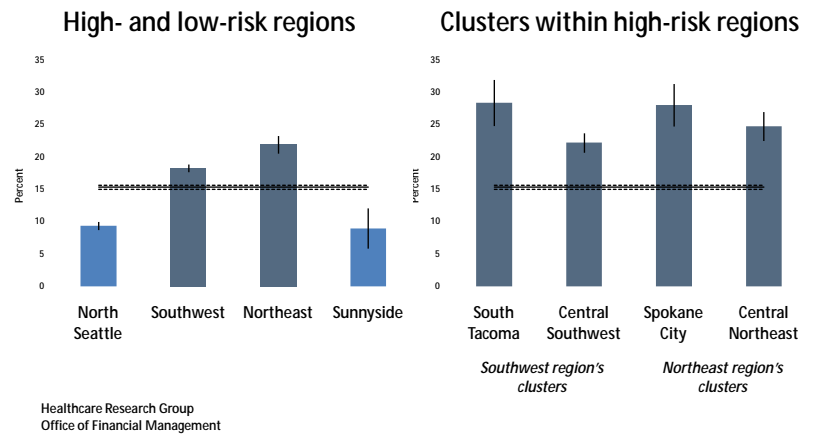
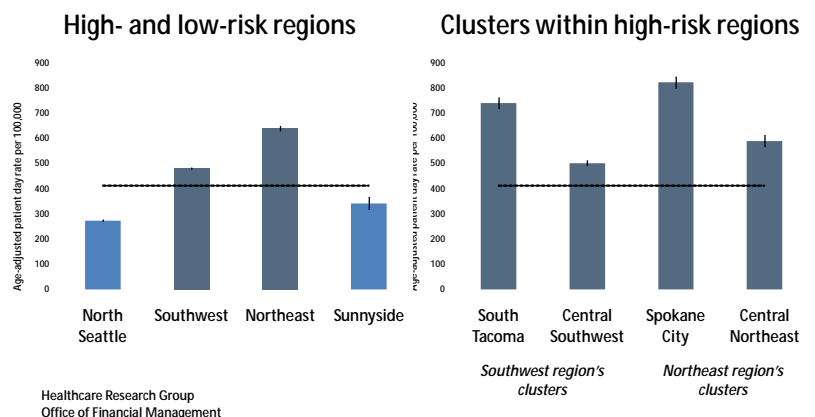


Figure 5
COPD age-adjusted patient day rates
Rates in high and low risk regions and in clusters within high risk regions
WA and OR inpatient hospital discharge data 2005-2009



setting such as a physician office or clinic. Often they are thought of as potentially preventable causes of hospitalization, and typically are associated with lack of access to primary care services due to a lack of insurance coverage.

As Figure 6 suggests, there is a good degree of concordance between COPD hospitalization rates and a lack of health care coverage, but that association is not consistent, particularly in the low-smoking Sunnyside region. In that area, while the lack insurance coverage is high, the hospitalizations rate for COPD is low.

This is likely the case because, while economic access through insurance coverage does play a role in potentially preventable, and hence excess, COPD hospitalizations,⁷ tobacco use is the primary underlying cause for this condition. In fact, for that reason, smoking status is often used to risk-adjust COPD hospitalization rates when assessing preventable hospitalizations or PQI indicators.⁸

In short, while some portion of the excess hospitalizations seen in the high smoking regions and clusters may be attributable to the lack of insurance coverage, smoking likely remains the primary underlying risk factor.

That being said, Figure 6 may help explain our findings related to COPD mortality rates shown in Figure 7. Here we see, as expected, that the mortality rates in both of the high-smoking regions and all four of the high-smoking clusters are higher than the statewide rate.

However, the COPD mortality rate in the low-smoking Sunnyside region does not significantly differ from the statewide rate. Perhaps the lack of health care coverage in this region may play some role in explaining why their mortality rate is not lower.

CORONARY ARTERY DISEASE (CAD)

Cigarette smoking causes atherosclerosis, the underlying cause of coronary artery disease (CAD) which is the leading cause of heart attacks.⁹ As seen in Figure 8, the CAD hospitalization rates in each of the high-smoking regions and clusters are higher than the statewide rate.

Figure 6
No health care coverage of any kind, ages 25 to 64
Percentages in high and low risk regions and in clusters within high risk regions
BRFSS 2005-2009

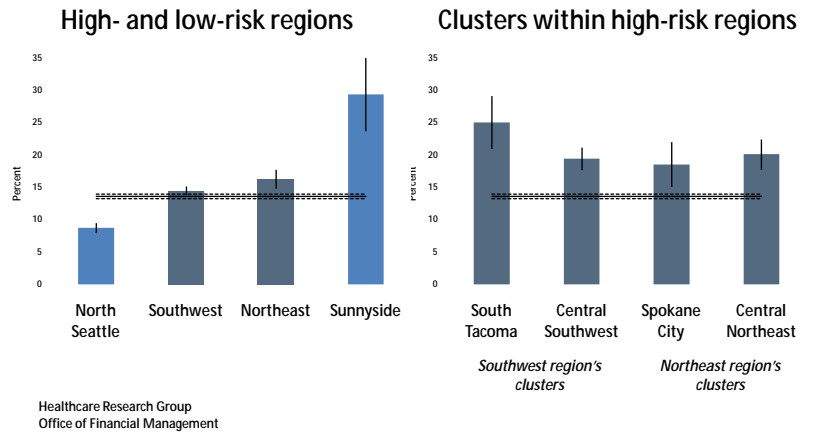


Figure 7
COPD age-adjusted mortality rates
Rates in high and low risk regions and in clusters within high risk regions
WA death data 2005-2009

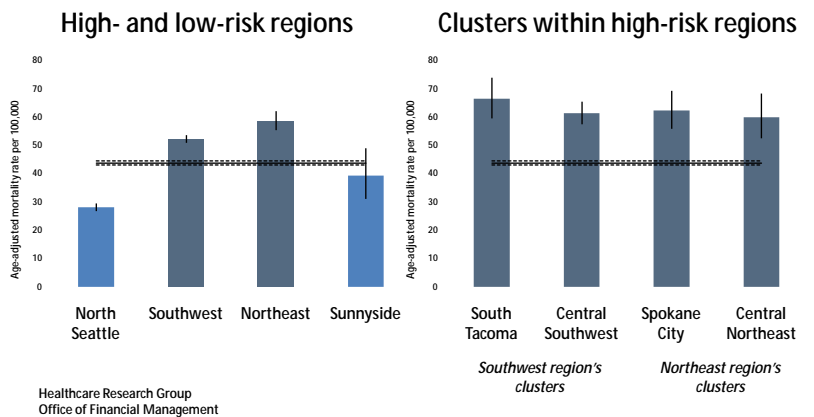
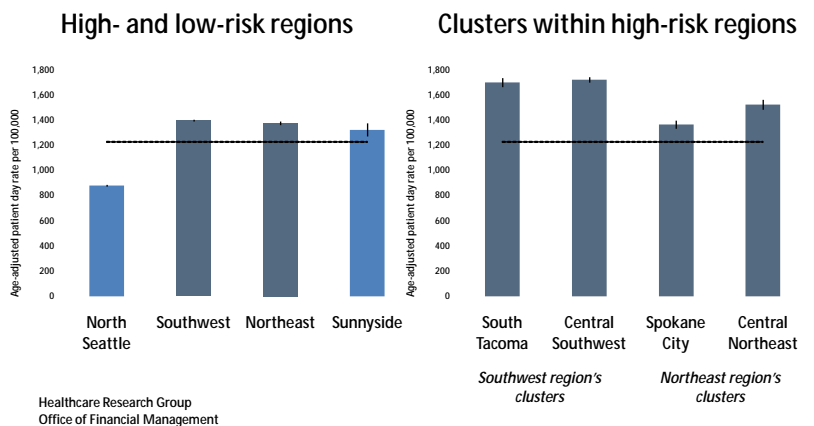


Figure 8
Coronary artery disease age-adjusted patient day rates
Rates in high and low risk regions and in clusters within high risk regions
WA and OR inpatient hospital discharge data 2005-2009



But in the low-smoking Sunnyside region, the CAD hospitalization rate is also above the statewide rate. Why would that be?

Again, the lack of insurance in that region may play some role since, as 2005 Robert Wood Johnson report notes,¹⁰ uninsured individuals with heart disease are less apt than those with insurance to visit a health care provider making them less apt to receive preventive care such as blood pressure and cholesterol lowering therapies.

However, there is another more likely risk factor for CAD present in this region—obesity. (See Figure 9) Not only does obesity indirectly increase the risk for CAD by its association with hypertension, high cholesterol and diabetes, but long-term studies also indicate that it is independently associated with CAD.¹¹

Thus, it seems likely that the high level of obesity in the Sunnyside region underlies the high CAD hospitalization rate, and that perhaps this is further compounded by the lack of insurance coverage in the area.

Similarly, when looking at the CAD mortality rates in Figure 10, we see that this pattern persists: High mortality rates relative to the state in all of the high-smoking regions and cluster areas—and in the low-smoking, but high-obesity, Sunnyside region.

Of course, it should be noted that the obesity levels together with smoking levels seen in both of the high-smoking regions and in three of the four high-smoking clusters, most likely contribute independently and collectively to the high CAD hospitalization and mortality rates in those areas.

LUNG CANCER

The hospitalization rates for the condition most closely associated with cigarette smoking, lung cancer, were assessed next.

Cigarette smoking is the leading cause of lung cancer,¹² and as we see in Figure 11, the hospitalization rates for lung cancer within the high-smoking regions and clusters are higher than the statewide rate, while those in the low-smoking regions are lower.

Figure 9
Obese (BMI >= 30), ages 25 and older
Percentages in high and low risk regions and in clusters within high risk regions
BRFSS 2005-2009

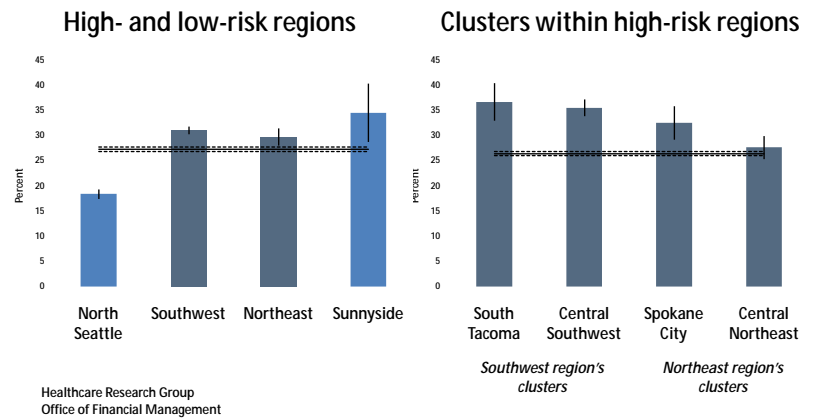


Figure 10
Coronary Artery Disease age-adjusted mortality rates
Rates in high and low risk regions and in clusters within high risk regions
WA death data 2005-2009

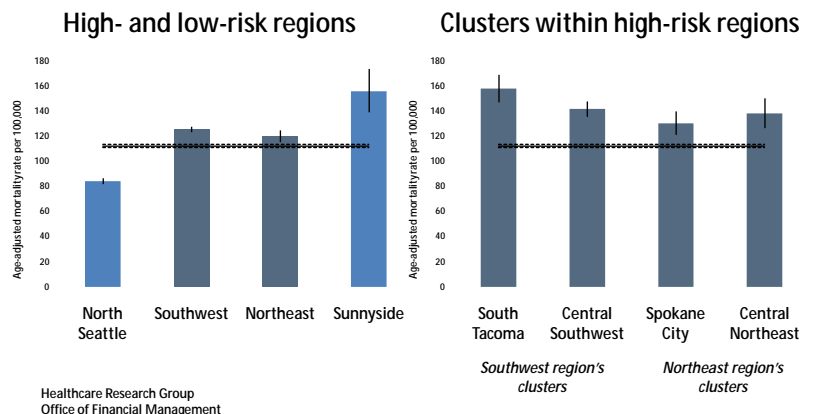
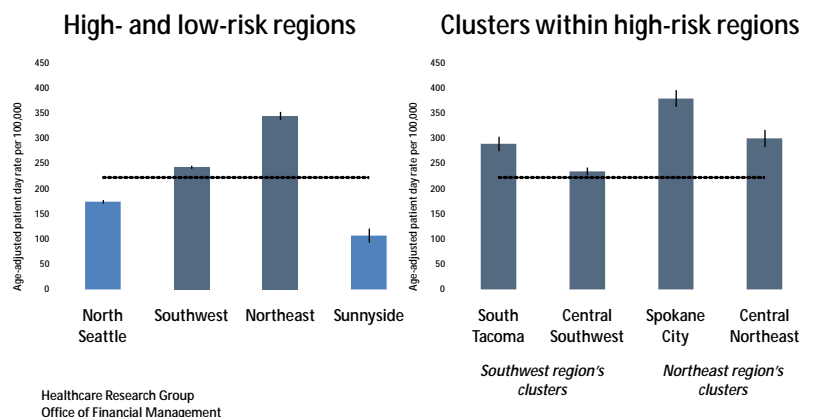


Figure 11
Lung cancer age-adjusted patient day rates
Rates in high and low risk regions and in clusters within high risk regions
WA and OR inpatient hospital discharge data 2005-2009



However, when we look at the mortality rates in Figure 12, a somewhat different pattern emerges.

First, the rates in the low-smoking Sunnyside region are, surprisingly, *not* significantly lower than the statewide rate.

This may be, in part, an artifact of “small numbers” with subsequent wide confidence intervals around the rate. However, the lack of health care insurance coverage in this region may also be a factor.

While the overall five-year survival rate for lung cancer is about 15%, cases diagnosed at the earliest stage have a 57% survival rate while those diagnosed at late stage have less than a 2% survival rate.¹³

Using Washington State Cancer Registry (WSCR) data, we found that within the Sunnyside region, 71% of the lung cancer cases are diagnosed at late stage, while statewide, and in the remaining three regions, only 61% of the lung cancer cases are late stage.

Thus, it is possible that this region’s lack of coverage may, in part, account for patients more often presenting with late stage and, hence, less curable disease.

Second, and even more surprising, is the mortality rate for the Central Northeast cluster within the Northeast region. Why would this high-smoking cluster, with a high lung cancer hospitalization rate, have a mortality rate that is essentially the same as the statewide rate?

One might initially speculate that the area’s high rate of lung cancer hospitalizations could account for its lower-than-expected lung cancer mortality rate, believing that “aggressive therapies” might be saving lives. To assess this supposition, we again used WSCR data, this time to calculate the rates of newly diagnosed lung cancer cases; these are called *incidence rates*.

As seen in Figure 13, the incidence rates are, in general, high in the high-smoking areas and low in the low-smoking ones, with one notable exception: The Central Northeast cluster. The incidence rate there is essentially the same as the statewide rate, just as its mortality rate was. The Central Northeast cluster’s relatively low mortality rate, therefore, seems quite simply to be a function of its relatively low rate of newly diagnosed lung cancer cases.

While “aggressive therapies” does not seem to explain why this high-smoking cluster has lung cancer mortality and incidence rates that are no higher than the statewide rate, another possibility exists: smoking rate time trends.

The latency period for lung cancer is long, generally between thirty and forty years¹⁴ depending upon the age of initiation and intensity of smoking, with the median age at diagnosis being seventy-one.¹⁵ It may be possible that the high smoking

Figure 12
Lung cancer age-adjusted mortality rates
Rates in high and low risk regions and in clusters within high risk regions
WA death data 2005-2009

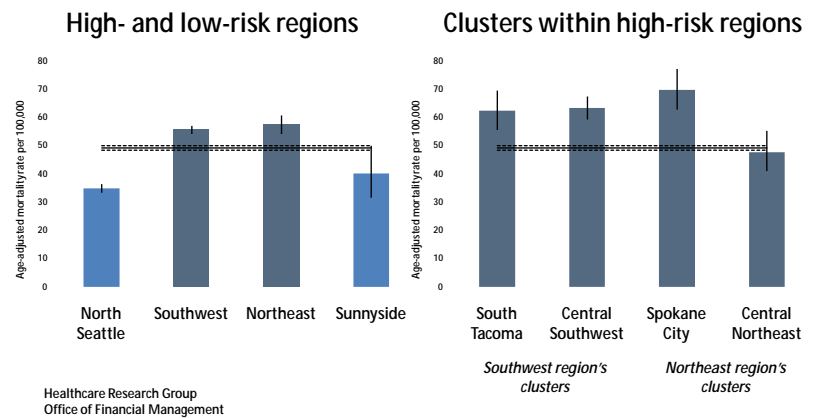
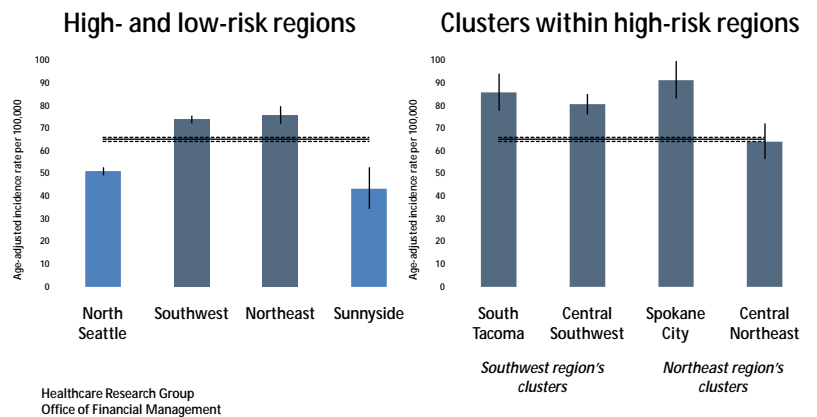


Figure 13
Lung cancer age-adjusted incidence rates
Rates in high and low risk regions and in clusters within high risk regions
WA Cancer registry data 2004-2008



rate in the Central Northeast cluster is a relatively recent phenomenon, with the rates over time on the rise, but not high long enough to appreciably affect the area’s current lung cancer incidence and mortality rates.

No significant trend, however, is seen for this area using BRFSS data from 2003 through 2009, and the sample size for years prior to 2003 is not large enough to allow us to look at a longer time period.

However, we do find that the regional pattern in *maternal smoking rates*, as seen in Figure 14, is remarkably concordant with the regional pattern for adult smoking shown in Figure 2. Taken from the Washington State Vital Statistics Annual Reports,¹⁶ these maps indicate that, except for the immediate Spokane City environs, the rest of the northeast corner of the state is not identified as a high maternal-smoking area until 2003.

Using these birth data to look farther back in time, as Figure 15 shows, we do find that in fact the maternal smoking rates in the Central Northeast cluster are significantly increasing from 1996 and onwards.¹⁷ The trends in the other clusters are either not significant or trending downward.

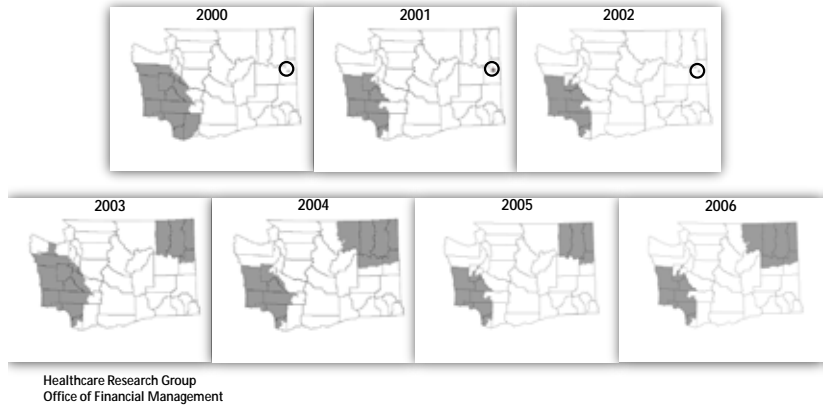
If the Central Northeast cluster’s maternal smoking rate trend is part of a broader overall trend, then it would help explain how that area could have a high smoking rate now, and also have lung cancer incidence and mortality rates that are not high—or, at least, not high yet.

Such a trend, though, would not explain why the lung cancer hospitalization rate in the Central Northeast cluster area is so high. Those reasons remain unclear.

Since we examined the maternal smoking trends in the high-smoking clusters, we also looked at the maternal smoking trends for the high- and low-smoking regions, as shown in Figure 16.

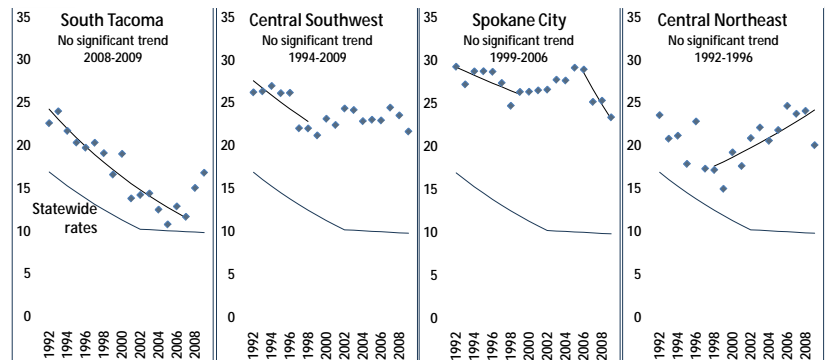
Here we see in the low-smoking regions consistently lower maternal smoking rates than those seen statewide, and the rates in those regions trending downwards.

Figure 14
High-risk maternal smoking regions
 Washington State Vital Statistics Annual Reports (2004-2006)
 Census tract derived at-risk regions from 2000-2006 birth certificate data



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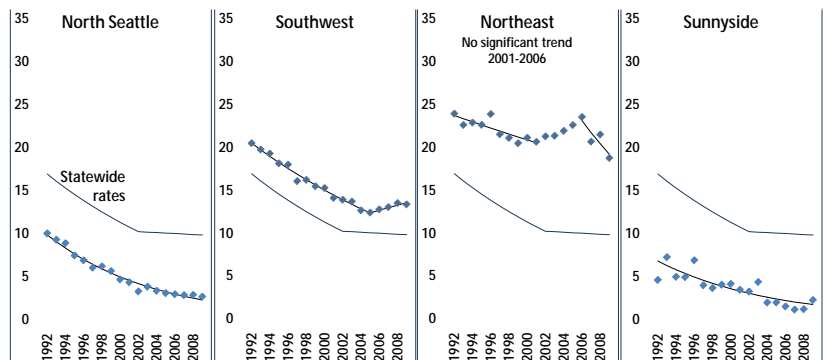
Figure 15
Maternal smoking trends within high-risk clusters
 Washington State Vital Statistics
 Joinpoint model derived trends from 1992-2009 birth certificate data



Southwest region's clusters
 Healthcare Research Group
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Northeast region's clusters

Figure 16
Maternal smoking trends within high- and low-risk regions
 Washington State Vital Statistics
 Joinpoint model derived trends from 1992-2009 birth certificate data



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In the high-smoking regions, the maternal smoking rates are consistently higher than the statewide rate, and the trends are more varied.

Within the Southwest region, the maternal smoking rates trend downwards from 1996 to 2005—but reverses course in 2005—with the rates trending upwards from then on.

Within the Northeast region, the maternal smoking rates trend downwards from 1996 to 2001; show no significant trend from 2001 to 2006; and then from 2006 on, they again trend downwards.

ALL SMOKING ATTRIBUTABLE CONDITIONS

While COPD, lung cancer and CAD are associated with tobacco use, the CDC has developed a set of attributable-risk fractions for all conditions associated with smoking.¹⁸ These include the three already assessed plus other cancers and cardiovascular and respiratory diseases. The smoking-attributable fractions by condition, age and sex are included in the Appendix.

Using these smoking-attributable fractions, Figure 17 shows the hospitalization rates for each area. As expected, rates are high in the high-smoking areas and low in the low-smoking ones.

In Figure 18, we use these same fractions to look at the mortality rates. Here we see high rates in the high-smoking regions and clusters, a low rate in the low-smoking North Seattle region, and, as we have seen before, a rate in the low-smoking Sunnyside region that is essentially the same as the state rate.

Although we cannot determine why this is the case for the Sunnyside region, the primary suspect, once again, may be the area’s lack of health care coverage, possibly combined with its high obesity rate.

Key findings – Inpatient hospitalization costs

While increased morbidity and premature mortality are, of course, our principle concern, the hospital care costs associated with these smoking-related conditions are of importance, too. Hospital *costs* are not, however, included in the inpatient discharge record, but the hospital *charges* are. We therefore converted those charges to “costs” using the AHRQ cost-to-charge ratios (CCR).¹⁹ These “costs” reflect our best estimate of the expenses incurred by the hospitals in providing care.

Using these CCR adjusted charges to estimate any excess hospital care costs in the high-smoking areas, or any savings in the low-smoking regions, we first estimated the “expected” number of patient days in each area; that is, the number of patient days that would be generated if the age-specific populations in each area were hospitalized at the same rate they are statewide.

Figure 17
Smoking-attributable* age-adjusted patient day rates
Rates in high and low risk regions and in clusters within high risk regions
WA and OR inpatient hospital discharge data 2005-2009
* Based upon the CDC’s SAMMEC smoking-attributable fractions by sex and age

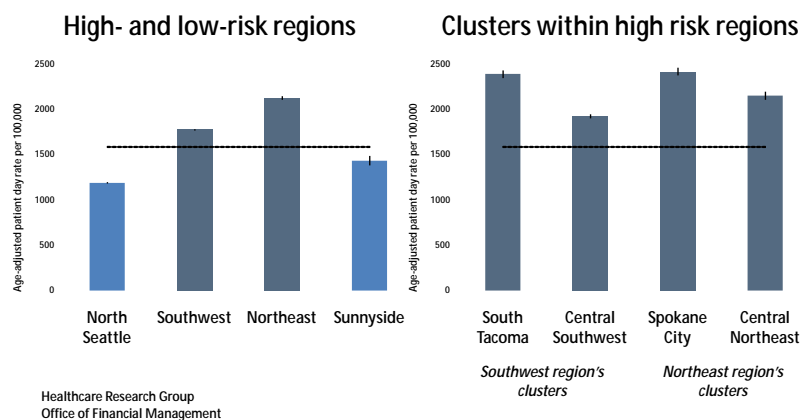
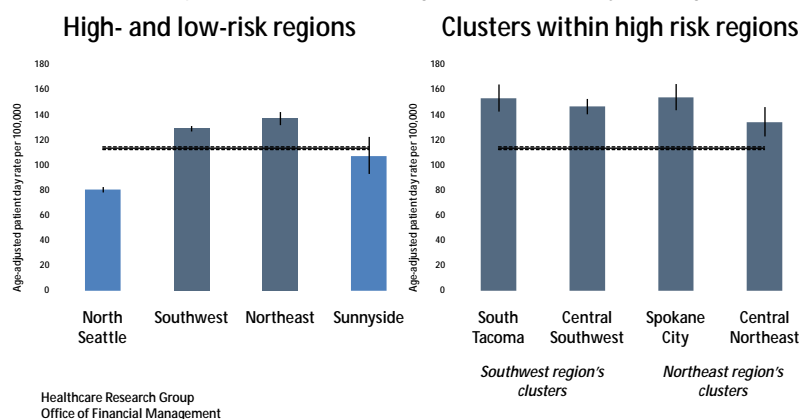


Figure 18
Smoking-attributable* age-adjusted mortality rates
Rates in high and low risk regions and in clusters within high risk regions
WA death data 2005-2009
* Based upon the CDC’s SAMMEC smoking-attributable fractions by sex and age



The areas' expected days were then multiplied by the statewide average cost per patient day, generating an "expected" cost. Similarly, the actual number of patient days in each area was also multiplied by the statewide average cost per day.

The differences between these costs and the expected costs were then divided by the region's or cluster's population, and converted to excess costs or savings per 1,000 adults.

Thus, as shown in Figure 19, for COPD hospitalizations, the savings in the low-smoking North Seattle and Sunnyside regions ranges between \$2,900 and \$1,200 per 1,000 adults living in those regions.

The excess costs in the high-smoking Southwest and Northeast regions ranges between \$1,500 and \$5,300 per 1,000 adults.

In the four high-smoking clusters, the excess costs for COPD hospitalizations equals \$6,300 per 1,000 adults in South Tacoma, \$2,400 in Central Southwest, \$8,300 in Spokane City, and \$4,400 the Central Northeast.

A slightly different picture emerges in looking at the excess costs and savings for CAD in Figure 20. Here we see appreciable savings in the North Seattle region, \$23,000 per 1,000 adults, but excess costs in the Sunnyside region of \$3,600 per 1,000. This excess cost for CAD hospitalizations is, as previously noted, likely due to the high obesity rate seen there.

The excess CAD costs in all of the high smoking areas are consistent with our expectations.

In the Southwest region those costs equal \$11,500 per 1,000 adults, while in the Northeast region they are \$10,400.

For the two clusters within the Southwest region, the excess CAD hospitalization cost per 1,000 adults equals \$28,400 in South Tacoma and \$39,300 in Central Southwest.

Figure 19
COPD hospitalization savings or excess costs
 Relative to expected costs per 1,000 adults by regions and cluster areas
 WA & OR hospital discharge data 2005-2009

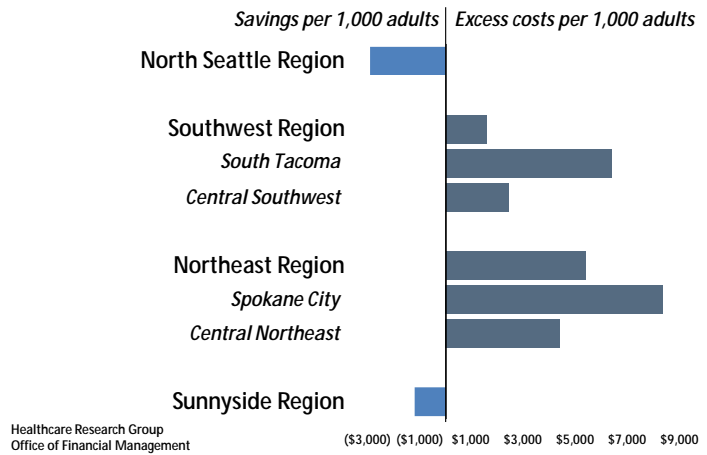


Figure 20
Coronary artery disease hospitalization savings or excess costs
 Relative to expected costs per 1,000 adults by regions and cluster areas
 WA & OR hospital discharge data 2005-2009

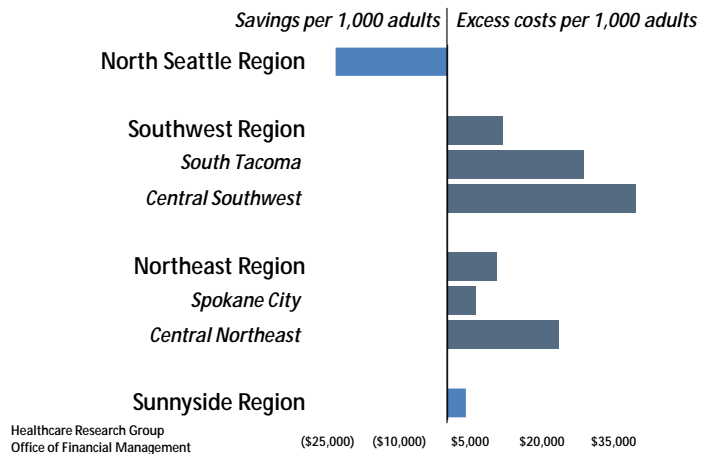
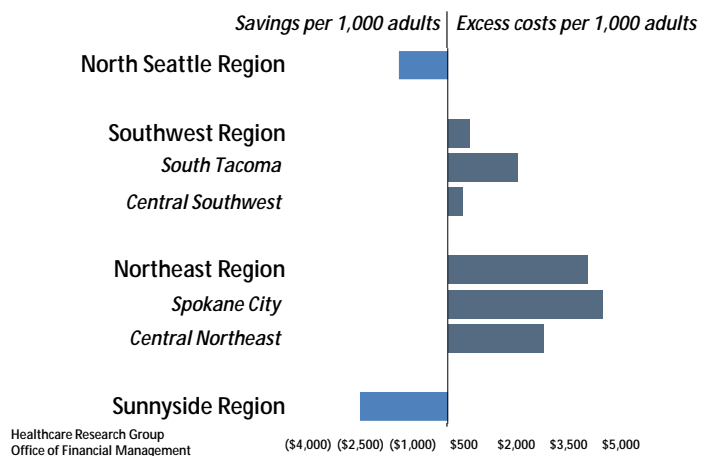


Figure 21
Lung cancer hospitalization savings or excess costs
 Relative to expected costs per 1,000 adults by regions and cluster areas
 WA & OR hospital discharge data 2005-2009



For the two clusters in the Northeast region, those excess costs equal \$6,000 in Spokane City and \$23,300 in Central Northeast.

For lung cancer, shown in Figure 21, we see, once again, savings in the low-smoking North Seattle and Sunnyside regions, \$1,400 and \$2,500 per 1,000 adults, respectively.

Conversely, in the high-smoking Southwest and Northeast regions, the excess lung cancer costs equal \$600 and \$4,000 per 1,000 adults.

In the high-smoking clusters within the Southwest region, excess costs for lung cancer hospitalizations range from a low of \$400 per 1,000 in the Central Southwest cluster, to a high of \$2,000 in South Tacoma.

In the high-smoking clusters within the Northeast region, those excess costs equal \$4,400 in Spokane City and \$2,700 in Central Northeast.

Finally, in Figure 22, we see the CDC’s smoking-attributable conditions in aggregate. Here, again, we find the usual pattern. In the two low-smoking regions, we see savings of \$15,000 and \$4,700 per 1,000 adults for the North Seattle and Sunnyside regions. In the two high-smoking regions, we see excess cost of \$7,500 per 1,000 adults in the Southwest region and \$22,300 in the Northeast region.

In the two clusters in the Southwest region, the excess cost per 1,000 adults is \$27,600 in South Tacoma, and \$15,200 in Central Southwest. In the two clusters in the Northeast region, those excess costs equal \$29,000 in Spokane City, and \$25,200 per 1,000 adults in Central Northeast.

Summary and conclusions

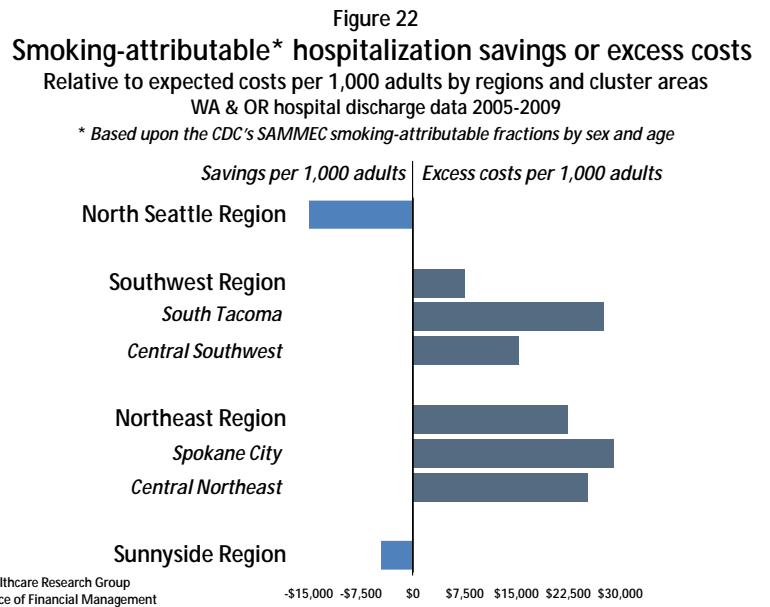
Having identified eight areas within the state with significantly high or low adult smoking rates relative to the state as a whole, we found that, for the most part, hospitalization and mortality rates for smoking-related conditions were high in the high-smoking areas and low in the low-smoking ones.

When rates differed from this pattern, we were, at times, able to identify some other risk factor that likely explained why. The high obesity rates in the low-smoking Sunnyside region, for instance, likely accounted for the high CAD hospitalization rates seen there. Similarly, that region’s low health care insurance coverage may be a factor underlying it’s higher than expected COPD, lung cancer and aggregate smoking-attributable mortality rates.

In other instances, for example the Central Northeast cluster where we saw high smoking and high lung cancer hospitalization rates together with lung cancer incidence and mortality rates that are about the same as the statewide rates, we proposed a possible explanation—an increasing smoking trend combined with a long latency period for lung cancer—but it is beyond the scope of available data to further verify that supposition.

We were also able to assess the inpatient hospitalization costs associated with each of the conditions examined. Here, too, for the most part, we found a pattern that fit our expectations: High per capita costs in high-smoking areas, and low costs in low-smoking ones.

The implications of this analysis may be broad. While much attention is focused on variations in the rates of medical procedures, this analysis suggests that the regional variations in behavioral patterns—specifically, smoking—may have an appreciable effect on health status and, consequently, on variations in health care service utilization and costs.



A secondary, and unexpected, finding suggests that the lack of insurance coverage in at least one region may potentially be offsetting the benefits of that area's low smoking rate. This region's high obesity rate also likely offsets the benefits of its low smoking rate.

As the dollars for health care shrink relative to demand, and as health care reforms are being planned and implemented, we believe this analysis provides a means to better identify and, thus, better target those communities most at risk.

This report also suggests that some variation seen in the rates of hospital inpatient care may be driven by the underlying behavioral risk factors within each community. Such behavioral risk factors are typically best addressed through primary prevention and public health interventions.

¹Schroeder SA and Warner KE, Don't Forget Tobacco, *N Engl J Med* 2010; 363:201-204

²Hansen Simonson and Statistical Methodology and Applications Branch, NCI. Headbang software (surveillance.cancer.gov/headbang) version 3.0

³Bernoulli, Discrete Poisson and Continuous Poisson Models: Kulldorff M. *A spatial scan statistic. Communications in Statistics: Theory and Methods*, 26:1481-1496, 1997

⁴National Heart, Lung and Blood Institute, National Institutes of Health, U.S. Department of Health & Human Services, "What causes COPD?"

http://www.nhlbi.nih.gov/health/dci/Diseases/Copd/Copd_Causes.html Accessed June 1, 2011.

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Appendix – Data tables

Currently smokes some days or every day, ages 25 & older

Regions	Percent (95% CI)
North Seattle	9.4 (± 0.6)
Southwest	18.3 (± 0.6)
Northeast	22.0 (± 1.4)
Sunnyside	9.0 (± 3.1)
Clusters	
South Tacoma	28.4 (± 3.6)
Central Southwest	22.2 (± 1.5)
Spokane City	28.0 (± 3.3)
Central Northeast	24.8 (± 2.2)
Statewide total	15.3 (± 0.3)

BRFSS, 2005-2009

Has no health care coverage of any kind, ages 25 to 64

Regions	Percent (95% CI)
North Seattle	8.8 (± 0.8)
Southwest	14.5 (± 0.7)
Northeast	16.3 (± 1.4)
Sunnyside	29.4 (± 5.7)
Clusters	
South Tacoma	25.1 (± 4.1)
Central Southwest	19.4 (± 1.7)
Spokane City	18.6 (± 3.5)
Central Northeast	20.1 (± 2.3)
Statewide total	13.6 (± 0.4)

BRFSS, 2005-2009

Is obese (BMI >= 30), ages 25 & older

Regions	Percent (95% CI)
North Seattle	18.3 (± 0.8)
Southwest	28.9 (± 1.5)
Northeast	30.1 (± 0.7)
Sunnyside	35.0 (± 5)
Clusters	
South Tacoma	36.7 (± 3.7)
Central Southwest	35.6 (± 1.7)
Spokane City	32.5 (± 3.3)
Central Northeast	27.7 (± 2.3)
Statewide total	26.4 (± 0.4)

BRFSS, 2005-2009

COPD age-adjusted patient day rates, cost-to-charge ratio adjusted costs, and estimated excess costs or savings

Region	Annual Average		Age-adjusted patient day rate per 100,000 (95% CI)	Cost per day (CCR adjusted)	Expected		Normalized Annual costs***	Excess costs or savings per 1,000 persons
	Population	Patient days			Patient days*	Annual costs**		
North Seattle	1,234,568	3,399	274.3 (270.2, 278.5)	\$2,139	5,092	\$10,775,544	\$7,193,130	-\$2,902
Southwest	2,156,126	10,270	481.8 (477.6, 486.1)	\$2,362	8,684	\$18,375,085	\$21,731,320	\$1,557
Northeast	376,893	2,650	641.0 (630, 652)	\$1,709	1,699	\$3,595,570	\$5,606,977	\$5,337
Sunnyside	52,089	136	342.7 (317.2, 369.1)	\$1,897	166	\$351,147	\$288,622	-\$1,200
Cluster								
South Tacoma	117,402	773	741.0 (717.7, 764.7)	\$2,576	422	\$892,648	\$1,636,091	\$6,332
Central Southwest	251,925	1,551	502.5 (491.3, 513.9)	\$2,088	1268	\$2,682,639	\$3,281,916	\$2,379
Spokane City	104,927	872	823.3 (798.8, 848.1)	\$1,701	459	\$971,733	\$1,845,152	\$8,324
Central Northeast	66,254	475	591.0 (567.1, 615.4)	\$2,150	338	\$714,895	\$1,004,254	\$4,367
Statewide total	6,474,955	26,494	412.7 (410.4, 414.9)	\$2,116	n/a	n/a	\$56,061,304	n/a

* Based on statewide age-specific patient day rates

** Based on expected patient days and statewide cost per day

*** Based on actual patient days and statewide cost per day

WA & OR Inpatient Hospital Discharge data, 2005-2009

Coronary artery heart disease age-adjusted patient day rates, cost-to-charge ratio adjusted costs, and estimated excess costs or savings

Region	Annual Average		Age-adjusted patient day rate per 100,000 (95% CI)	Cost per day (CCR adjusted)	Expected		Normalized Annual costs***	Excess costs or savings per 1,000 persons
	Population	Patient days			Patient days*	Annual costs**		
North Seattle	1,234,568	11,106	882.9 (875.5, 890.4)	\$6,451	15,496	\$102,104,654	\$73,173,941	-\$23,434
Southwest	2,156,126	30,138	1,401.0 (1393.8, 1408.1)	\$7,381	26,366	\$173,724,817	\$198,578,273	\$11,527
Northeast	376,893	5,730	1,378.0 (1362, 1394.2)	\$6,045	5,138	\$33,851,347	\$37,753,210	\$10,353
Sunnyside	52,089	530	1,325.7 (1275.3, 1377)	\$4,653	499	\$3,289,446	\$3,490,811	\$3,866
Cluster								
South Tacoma	117,402	1,776	1,702.2 (1665.9, 1737.1)	\$8,294	1271	\$8,373,661	\$11,704,562	\$28,372
Central Southwest	251,925	5,323	1,722.2 (1616.8, 1657.7)	\$6,378	3819	\$25,163,432	\$35,071,518	\$39,329
Spokane City	104,927	1,469	1,367.7 (1336.2, 1399.6)	\$5,819	1374	\$9,051,672	\$9,680,445	\$5,992
Central Northeast	66,254	1,257	1,524.8 (1486.6, 1563.5)	\$5,812	1023	\$6,741,450	\$8,282,276	\$23,256
Statewide total	6,474,955	80,053	1,228.2 (1224.4, 1232.1)	\$6,589	n/a	n/a	\$527,464,355	n/a

* Based on statewide age-specific patient day rates

** Based on expected patient days and statewide cost per day

*** Based on actual patient days and statewide cost per day

WA & OR Inpatient Hospital Discharge data, 2005-2009

Lung cancer age-adjusted patient day rates, cost-to-charge ratio adjusted costs, and estimated excess costs or savings

Region	Annual Average		Age-adjusted patient day rate per 100,000 (95% CI)	Cost per day (CCR adjusted)	Expected		Normalized Annual costs***	Excess costs or savings per 1,000 persons
	Population	Patient days			Patient days*	Annual costs**		
North Seattle	1,234,568	2,138	174.5 (171.2, 177.9)	\$3,006	2,723	\$8,099,475	\$6,359,992	-\$1,409
Southwest	2,156,126	5,176	243.3 (240.3, 246.3)	\$3,317	4,734	\$14,081,041	\$15,398,439	\$611
Northeast	376,893	1,428	345.7 (337.7, 353.8)	\$2,229	919	\$2,732,555	\$4,247,332	\$4,019
Sunnyside	52,089	45	107.1 (93.4, 121.7)	\$2,235	89	\$265,033	\$133,268	-\$2,530
Cluster								
South Tacoma	117,402	306	289.7 (275.3, 304.5)	\$3,787	227	\$675,462	\$910,865	\$2,005
Central Southwest	251,925	725	234.9 (227.2, 242.7)	\$2,813	689	\$2,050,766	\$2,157,876	\$425
Spokane City	104,927	397	379.7 (363, 396.7)	\$2,259	241	\$716,177	\$1,181,566	\$4,435
Central Northeast	66,254	246	300.0 (283.2, 317.3)	\$2,522	185	\$551,101	\$732,976	\$2,745
Statewide total	6,474,955	14,287	223.0 (221.3, 224.6)	\$2,975	n/a	n/a	\$42,498,907	n/a

* Based on statewide age-specific patient day rates

** Based on expected patient days and statewide cost per day

*** Based on actual patient days and statewide cost per day

WA & OR Inpatient Hospital Discharge data, 2005-2009

Smoking-attributable† age-adjusted patient day rates, cost-to-charge ratio adjusted costs, and estimated excess costs or savings

Region	Annual Average		Age-adjusted patient day rate per 100,000 (95% CI)	Cost per day (CCR adjusted)	Expected		Normalized Annual costs***	Excess costs or savings per 1,000 persons
	Population	Patient days			Patient days*	Annual costs**		
North Seattle	1,234,568	15,270	1,191.5 (1182.9, 1200.1)	\$3,697	20,245	\$75,421,959	\$56,888,906	-\$15,012
Southwest	2,156,126	38,771	1,778.1 (1770.1, 1786.2)	\$4,065	34,459	\$128,376,420	\$144,444,491	\$7,452
Northeast	376,893	8,917	2,126.6 (2106.7, 2146.6)	\$3,110	6,659	\$24,808,058	\$33,221,390	\$22,323
Sunnyside	52,089	582	1,434.4 (1382.4, 1487.4)	\$2,932	648	\$2,412,462	\$2,169,967	-\$4,655
Cluster								
South Tacoma	117,402	2,518	2,392.5 (2350.6, 2434.7)	\$4,401	1649	\$6,144,814	\$9,379,443	\$27,552
Central Southwest	251,925	5,957	1,925.1 (1903, 1947.4)	\$3,666	4930	\$18,365,431	\$22,194,500	\$15,199
Spokane City	104,927	2,576	2,418.7 (2376.6, 2461.2)	\$2,960	1759	\$6,554,691	\$9,595,636	\$28,982
Central Northeast	66,254	1,774	2,153.1 (2107.6, 2199.1)	\$3,362	1326	\$4,939,401	\$6,609,687	\$25,210
Statewide total	6,474,955	104,490	1,585.9 (1581.5, 1590.2)	\$3,726	n/a	n/a	\$389,279,384	n/a

* Based on statewide age-specific patient day rates

** Based on expected patient days and statewide cost per day

*** Based on actual patient days and statewide cost per day

† Smoking-attributable fractions are based upon the CDC's SAMMEC model

WA & OR Inpatient Hospital Discharge data, 2005-2009

COPD age-adjusted mortality rates

<i>Regions</i>	Rate (95% CI)
North Seattle	28.2 (26.8, 29.5)
Southwest	52.4 (51, 53.8)
Northeast	58.8 (55.5, 62.2)
Sunnyside	39.3 (31.1, 49.1)
<i>Clusters</i>	
South Tacoma	66.5 (59.6, 74)
Central Southwest	61.4 (57.6, 65.5)
Spokane City	62.4 (56, 69.3)
Central Northeast	60.0 (52.6, 68.5)
<i>Statewide total</i>	43.8 (43.1, 44.6)

Vital Statistics - Deaths, 2005-2009

Coronary artery disease age-adjusted mortality rates

<i>Regions</i>	Rate (95% CI)
North Seattle	84.4 (82.2, 86.7)
Southwest	125.4 (123.3, 127.6)
Northeast	120.0 (115.4, 124.8)
Sunnyside	155.7 (139.1, 173.9)
<i>Clusters</i>	
South Tacoma	157.9 (147.3, 169)
Central Southwest	141.6 (135.8, 147.7)
Spokane City	130.2 (121.2, 139.8)
Central Northeast	138.0 (126.7, 150.3)
<i>Statewide total</i>	112.2 (111, 113.4)

Vital Statistics - Deaths, 2005-2009

Lung cancer age-adjusted mortality rates

<i>Regions</i>	Rate (95% CI)
North Seattle	34.9 (33.4, 36.5)
Southwest	55.6 (54.2, 57.1)
Northeast	57.4 (54.1, 60.8)
Sunnyside	40.1 (31.8, 50.1)
<i>Clusters</i>	
South Tacoma	62.3 (55.6, 69.6)
Central Southwest	63.3 (59.4, 67.5)
Spokane City	69.7 (62.8, 77.3)
Central Northeast	47.7 (41.2, 55.3)
<i>Statewide total</i>	49.2 (48.4, 50)

Vital Statistics - Deaths, 2005-2009

Smoking-attributable* age-adjusted mortality rates

<i>Regions</i>	Rate (95% CI)
North Seattle	80.6 (78.4, 82.9)
Southwest	129.1 (126.9, 131.3)
Northeast	137.2 (132.1, 142.3)
Sunnyside	107.2 (93.4, 122.6)
<i>Clusters</i>	
South Tacoma	153.3 (142.8, 164.4)
Central Southwest	146.7 (140.7, 152.9)
Spokane City	154.1 (143.9, 165)
Central Northeast	134.3 (123.2, 146.4)
<i>Statewide total</i>	113.5 (112.4, 114.7)

*SAMMEC

Vital Statistics - Deaths, 2005-2009

Lung cancer stage at diagnosis

<i>Regions</i>	Early	Late
North Seattle	1181 (38.6%)	1875 (61.4%)
Southwest	2959 (39.1%)	4612 (60.9%)
Northeast	600 (39.4%)	922 (60.6%)
Sunnyside	25 (29.1%)	61 (70.9%)
<i>Clusters</i>		
South Tacoma	148 (34.2%)	285 (65.8%)
Central Southwest	439 (36%)	782 (64%)
Spokane City	175 (36.5%)	304 (63.5%)
Central Northeast	100 (38.5%)	160 (61.5%)
<i>Statewide total</i>	7919 (39.2%)	12295 (60.8%)

WA St Cancer Registry, 2004-2008

Lung cancer age-adjusted incidence rates

<i>Regions</i>	Rate (95% CI)
North Seattle	51.2 (49.3, 53)
Southwest	74.0 (72.3, 75.7)
Northeast	76.0 (72.2, 79.9)
Sunnyside	43.3 (34.6, 53)
<i>Clusters</i>	
South Tacoma	85.9 (78, 94.3)
Central Southwest	80.8 (76.3, 85.4)
Spokane City	91.4 (83.3, 99.9)
Central Northeast	64.3 (56.6, 72.4)
<i>Statewide total</i>	65.2 (64.3, 66.1)

WA St Cancer Registry, 2004-2008

Mortality Smoking-Attributable Fractions by Sex and Age*

	Male		Female	
	35-64	65+	35-64	65+
Malignant Neoplasms				
Lip, Oral Cavity, Pharynx	73%	68%	52%	43%
Esophagus	69%	70%	63%	53%
Stomach	25%	25%	13%	12%
Pancreas	23%	16%	27%	22%
Larynx	81%	80%	77%	70%
Trachea, Lung, Bronchus	87%	86%	76%	68%
Cervix Uteri	-	-	13%	9%
Kidney and Renal Pelvis	36%	35%	6%	4%
Urinary Bladder	44%	44%	31%	28%
Acute Myeloid Leukemia	21%	20%	10%	11%
Cardiovascular Diseases				
Ischemic Heart Disease	35%	14%	32%	10%
Other Heart Disease	18%	16%	11%	8%
Cerebrovascular Disease	31%	7%	39%	5%
Atherosclerosis	28%	23%	14%	7%
Aortic Aneurysm	62%	61%	59%	46%
Other Arterial Disease	17%	9%	20%	12%
Respiratory Diseases				
Pneumonia, Influenza	21%	21%	20%	12%
Bronchitis, Emphysema	89%	90%	82%	81%
Chronic Airway Obstruction	79%	80%	79%	74%

* Among adults ages 35 and older

Smoking-Attributable Mortality, Morbidity, and Economic Costs (SAMMEC)